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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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CONTENTS OF VOL. VIII.

[FOURTH SERIES.]

NUMBER XLIII.

NUMBER XLIV.

NUMBER XLVI.

NUMBER XLVII.

NUMBER XLVIII.

PLATES IN VOL. VIII.

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. 43. JULY 1871.

I.—*A Description of two new* Calcispongiæ, *to which is added Confirmation of* Prof. James-Clark's *Discovery of the True Form of the Sponge-cell (Animal), and an Account of the Polype-like Pore-area of* Cliona corallinoides *contrasted with* Prof. E. Häckel's *View on the Relationship of the Sponges to the Corals.* By H. J. Carter, F.R.S. &c.

[Plates I. & II.]

In the following paper I propose to describe and illustrate two new calcareous Sponges from this locality (Budleigh-Salterton, Devon), one of which will form the type of a new genus, and the other, although before noticed, has not been properly recognized; also to confirm Prof. James-Clark's discovery of the true form of the sponge-cell in *Leucosolenia botryoides*, Bk., by recent observations and experiments on the structure of *Grantia compressa*; further, to describe and illustrate the polype-like pore-area of *Cliona corallinoides*, Hancock, for the purpose of contrasting it with the views of Prof. E. Häckel on the organization of Sponges and their relationship to the Corals; to which are added a few remarks on the groundwork or basis of his proposed classification of the Calcispongiæ.

Trichogypsia villosa, nov. gen. et sp.
Pl. I. figs. 1–4.

Massive, sessile, depressed, greyish or greenish white; base subelliptical. Surface uneven, rough, ridged, villous (Pl. I.

fig. 2), presenting a single vent at one end of the ellipse (fig. 2, *a*), about midway between the border and the centre, at the bottom of an oval excavation, furnished internally with a circle of minor vents arranged round the large one (fig. 3). Pores scattered over the surface generally. Internal structure close, areolar, accompanied by the branching excretory canal-system. Spicules of one form only (fig. 4), viz. linear, sinuous, fusiform, spino-tuberculate at the extremities, especially the outer one, which is most attenuated, the internal one being obtuse and less tuberculated; arranged more or less perpendicularly, so as to present a villous surface. Size of spicule averaging 32-1800ths of an inch long by 1-1800th of an inch broad. Size of specimen (fig. 1) 5-12ths of an inch long by 3-12ths broad, and 1-12th of an inch high.

Hab. Marine. Laminarian zone, in company with *Isodictya simulans*, Bk. (*Halichondria simulans*, Johnston).

Loc. Budleigh-Salterton, south coast of Devon.

Obs. I have only obtained one specimen of this sponge; it had grown upon the deciduous shell of a shark's egg, together with branching and inosculating *Isodictya simulans*, the whole of which had probably become entangled in the Laminarian zone, whence it had been torn off in a storm and cast upon the beach, where I found it about a year since.

It consists of a single individual, with one vent, growing flat upon the horny egg-shell, and is so far like *Leuconia nivea* that the vent branches off directly into the areolar parenchyma of the sponge; but its surface, instead of being depressed, flat, and smooth, is rather elevated and rough, or irregularly ridged, while the whole mass has the appearance of the pile on white velvet which, having been moistened with gum-water, has been allowed to dry in a ruffled state. How far this may be owing to the washing of the sea-water, I cannot say; but it is chiefly caused by the projection of the attenuated spinous ends of the sinuously straight spicules, which, arranged perpendicularly to the surface, give the latter its villous appearance. The colour is greyish or greenish white, of that tint which is perhaps the most common in the crystalline salts of lime—calc spar, gypsum, &c.

While, however, there is only one kind of spicule, and that linear, this Calcisponge further differs from all the others with which I am acquainted in possessing *no* triradiate or quadriradiate spicules.

It is necessary to make a new genus of it, for which, from its calcareous nature and hair-like appearance, I propose the name of "*Trichogypsia*," designating the species by the term "*villosa*," from its surface being somewhat like the pile on velvet, as above stated.

The spicule happens to be almost a facsimile of that which forms the tubercles and crust on the back of *Doris tuberculata*, and, like it as well as all the other calcareous spicules that I have met with in the Calcispongiæ, Foraminifera, Gorgoniidæ, Echinodermata, and compound tunicated animals, presents no central canal, but is solid throughout.

Leuconia Johnstonii, mihi.
Pl. I. figs. 5–12.

Massive, flat, sessile, lobulated, snow-white, each lobule having a single vent situated at the end of a more or less elongated, conical or rounded eminence (Pl. I. fig. 6). Surface smooth, covered with very large quadriradiate spicules (fig. 6, *c*). Vent circular, and surmounted by a crown of erect linear spicules (fig. 6, *a* and 7, *e*), or simple and bound down marginately by the spreading arms of the great quadriradiate spicules of the surface (fig. 6, *b*, and fig. 40, *b b b*, Pl. II.), leading into a cloacal cavity (fig. 7, *a*) which soon branches off into the excretory canal-system (fig. 7, *b b*). Pores scattered irregularly over the surface, in the dermal sarcode, chiefly opposite the interstices of the intercrossing subjacent spicular structure (fig. 9, *a*, *b*). Internally areolar for the most part, accompanied by the branching excretory canal-system (fig. 7, *d d d d*); areolar cavities opening into each other (8, *a*) and finally into the cloaca directly (fig. 7, *c c*) or indirectly into it through the branches of the excretory canal-system. Spicules of seven forms:—1, the largest, quadriradiate (fig. 10, *a*), one arm of which is directed internally (*c*), while the three others (*b b* & *d*), lying flat upon the surface (fig. 6, *c*), thus, nail-like, bind down the spicular structure; internal arm (*c*) much curved, projecting into the cloacal cavity, where it presents a formidable spur bent *towards* the vent (fig. 7, *f*); the junction of the radii marked by a transparent area, which is white or dark according to the direction of the light, and arises from the presence or junction of the internal or fourth arm, whereby this part often has the appearance of a pore (fig. 12); 2, triradiate (*g*), very much smaller than the last, but of different sizes, and forming, as in most calcareous sponges, the staple spicule of the mass; 3, thick, long, linear, smooth, inæquifusiform, slightly curved, larger at the proximal than at the distal end (*e*); 4, long, delicate, hair-like, straight (*f*); the last two are confined to the vent (fig. 7 *e*); 5, small quadriradiate (*i i'*), with one arm straight and long, two short and opposite or lateral, and the fourth forming a long curved spur directed forwards, which, as this spicule is chiefly confined to the cloacal surface, projects into the latter after the manner of the fourth arm of the large quadriradiate; 6, minute, fusiform, acerate, curved, spinous, presenting for the most part the appearance of one end having been broken off and again united, but in the opposite direction to the curve of the spicule generally (*k*, and fig. 11, *a*); 7, minute quadriradiate, with one short and three longer arms (*l*, and fig. 11, *b*), chiefly confined, with the two preceding ones, to the surface of the cloacal cavities, where they form a more or less dense layer, pierced only by the fourth or internal arm of the great quadriradiate and the openings of the excretory canal-system (fig. 7, *a*, *f*, *c*). These spicules, although they vary somewhat in size, are, on the average, as they are successively described, 100, 36, 62, 58, 10, 4, and 1½ 1800ths of an inch in their length and spreading respectively. Size of the specimen (fig. 5) about 9-12ths long, 6-12ths broad, and 1½-12ths of an inch high.

Hab. Under surface of the rocks, in company with most of the other siliceous and calcareous sponges here, about low-water mark, in the Laminarian zone. Not uncommon.

Loc. Budleigh-Salterton, south coast of Devon.

Obs. I have found several specimens of this sponge. In some the vents are ciliated, in others unciliated; that is, crowned with a row of erect linear spicules, or with none at all. Both kinds occur in the specimen from which the illustration is taken; and where the crown is absent or broken off, perhaps from the waves beating upon it twice a day at each falling of the tide, the margin is chiefly bound down by the arms of the great quadriradiate spicule of the surface.

It differs from *Leuconia nivea* in the vents being ciliated, in the great spicules of the surface being quadri- instead of triradiate, in the projection of the curved or fourth ray of the great quadriradiate spicule into the cloaca, in the presence of the dark area or point in the centre of the radii of the latter (fig. 12), which at once distinguishes it from *Leuconia nivea*, where there is no fourth ray to occasion this; in its lobulated form, where one-third or more of the individual sometimes projecting above the common level of the sponge entails a short cloacal cavity (fig. 7, *a*) before branching off into the excretory canal-system generally, while in *Leuconia nivea* the vent, being on the same plane as the rest of the surface, which is flat, branches off *immediately* into this canal-system.

Thus in *Leuconia Johnstonii* we have a form midway between *Grantia ciliata* and *Leuconia nivea*.

After having described *Leuconia nivea* and its large triradiate spicules, Dr. Johnston concludes with the following paragraph:—

"Mr. M'Colla has furnished me with a variety from the Irish coast that merits to be distinguished. The sponge rises up in compressed sinuous leaf-like lobes, which are united together so as to form a lobulated crust nearly an inch in thickness, with a circular osculum on every projecting angle (pl. 20. fig. 6). Were we to imagine that a cluster of *Grantia compressa* had grown so close as to press against each other, and the various specimens to have coalesced into one mass, we would have a correct idea of this variety. That it is, however, no variety of *G. compressa*, is proved by the difference of its texture as well as by the form of the spicula." (Brit. Spong. 1842, p. 183.)

I need hardly add, after this quotation, that Dr. Johnston was acquainted with the species which I have now the pleasure to dedicate to his respected memory; nor, on the other hand, need I allude further to Dr. Bowerbank's description of *Leuconia nivea* (Brit. Spong. 1866, vol. ii. p. 36) than to state that, as he has changed Johnston's name of *Grantia nivea* to *Leuconia nivea*, so he has lost sight of or ignored this classical writer's description of the true *Grantia nivea*, and replaced it by an imperfect one of his "variety."

That, however, Johnston's "variety" is entitled to a distinct appellation, the above description will show.

As the great quadriradiate spicule of the surface of *Leuconia Johnstonii* is but a larger form of that which is common to the cloacal surface alone of most of the calcareous sponges, I have given an illustration of that which is found in *Grantia ciliata* as a type specimen (Pl. II. fig. 32). It will be observed that one ray is straight (*b*), while two others are more or less curved and opposite to each other (*a a*); this is the common form of the *tri*radiate spicule; and it is in the straight ray alone that a trace of the central or axial canal common to the siliceous spicule is seen (*c*), which trace, however, is here the central canal filled up with a cylinder of the same material as the spicule, so that, in fact, there is no canal at all. The fourth ray (*d*) projects at about right angles to the other three, and sometimes is a little excentric—that is, arises from the straight ray at a little distance from its union with the two curved ones. This ray is also curved forwards (that is, *towards* thevent), and in this way projects into and forms the armature of the cloaca: it would have been opposite, probably, if the current had been so, and hence is one of the *structural* evidences of an aboriginal excretory stream.

What is remarkable, however, in *Leuconia Johnstonii* is, that this spicule is so large that its fourth ray not only projects in a formidable manner into the cloaca (Pl. II. fig. 40, *c c*), but its three other rays bind down the rest of the spicular structure on the surface at the same time (Pl. I. fig. 6, *c*). It is therefore as much a surface- as a cloacal spicule; while, in all the other calcareous sponges that I have seen, it (that is, the quadriradiate) is almost entirely confined to the cloacal surface. The two other quadriradiate spicules are also chiefly confined to the inner surface of the cloaca here as well as in *Leuconia nivea*, where, with the minute spinous spicule, they also chiefly form the lining of the excretory canals; but the great spur of the great quadriradiate spicule of *Leuconia Johnstonii* is, of course, absent.

Confirmation of Prof. James-Clark's *Discovery of the "Collar" round the Cilium of the Sponge-cell.*

In the October Number of the 'Annals' for last year my paper on the "Ultimate Structure of the Marine Sponges" was published (vol. vi. p. 329), at the end of which (p. 341) are the following paragraphs:—

"I have only now to add a word or two, in conclusion, on the real nature of the animal of the Sponges abstractedly.

"The only naturalist, to my knowledge, who has turned his attention directly to this all-important point connected with them is Prof. H. James-Clark, of Boston, to whose valuable memoir on the subject, entitled, "Spongiæ ciliatæ or Infusoria flagellata" (Mem. Bost. Soc. Nat. Hist. vol. i. pt. 3, pls. 9 & 10, read June 20, 1866; reprinted in the 'Annals,' vol. i. p. 133, Feb. 1868) I have alluded at the commencement of this paper.

"The object of Prof. James-Clark is to prove that the monociliated sponge-cell is a distinct flagellated infusorium, possessing an oral and an anal orifice respectively, in close approximation, at the bottom of a funnel-shaped retractile expansion which surrounds the base of the cilium, and also a nucleus and two contracting vesicles; further, that this flagellated infusorium is in no sense whatever related to the Rhizopoda; and that it is an aggregation or colony of such Infusoria which produces the 'true ciliated *Spongiæ*.'

"I cannot altogether endorse Prof. James-Clark's views, as I have stated (Annals, Sept. 1869, vol. iv. p. 196), nor do I desire to dispute his conclusions here."

It is with great pleasure that I *can* now endorse them—that is, that I am now able to confirm all that Prof. James-Clark has stated of the flagellated sponge-cell in the valuable memoir to which I have referred.

For two months past *Grantia compressa* has been growing in clusters on branches of the delicate little seaweed called *Callithamnion roseum*, which fringes the overhanging edges and under surfaces of the rocks here, about midway between high- and low-water mark, where it is left uncovered by the water for some hours twice a day.

Thinking, therefore, from its hardiness, that it might serve to confirm Prof. James-Clark's observations on *Leucosolenia botryoides* (*l. c.*), I, about six weeks since, brought home some branches of the *Callithamnion* bearing specimens of *Grantia compressa*, which were put into salt water on the spot; and the day after, as these sponges were still living, I tore up some pieces and placed them under the microscope, with $\frac{1}{4}$-of-an-inch compound power for observation, when, much to my gratification, I witnessed exactly what Prof. James-Clark had described, as may be seen by reference to the four groups of figures (13–16 in Pl. I.) which were then made from them. I also saw immediately that the "ear-like points or spines" on the monociliated sponge-cell of *Spongilla*, which may be found fully described and figured in the 'Annals' (Jan. 1859, vol. iii. p. 14 &c., pl. 1. figs. 12, 13, 14) were, as Prof. James-Clark had suspected (footnote, p. 21, *loc. cit.*), "the right and left profiles of a membranous cylindrical collar."

Feeling satisfied that Prof. James-Clark was right in his interpretation of this form of sponge-cell, and having, by experiments on *Spongilla*, as may be seen in my figures (*l. c.*), showed that, when immersed in a solution of indigo, the sponge-cells with "ear-like points" became more or less filled with it, I, of course, thought that the sponge-cells of *Grantia compressa* might do the same, when it would become satisfactorily evident that the same kind of ciliated sponge-cell existed in both the siliceous and calcareous sponges.

Accordingly, about a fortnight since, I took a branch of *Callithamnion roseum* on which there was a cluster of *Grantia compressa*, and, having placed it, as before, in sea-water on the spot, brought it home, rubbed down a little indigo, also in sea-water, and put the cluster into it.

After about an hour, all the specimens of *Grantia compressa* became of a dark-blue colour; and on cutting out a minute portion of one and tearing it to pieces, still in sea-water, the fragments were thus placed under the microscope, on a glass slide under a glass cover, when, equally to my gratification, I found the collared monociliated cells more or less filled with indigo, and in active vitality (Pl. II. fig. 30).

Next the cluster was placed in clean sea-water, and a stream of indigo was observed to be gradually flowing from the vent of each specimen respectively.

The cluster was then immersed in spirit and water; and after a few hours another minute portion, having been cut out from one of the specimens, was torn to pieces in like manner to the foregoing, and placed under the microscope, when the cell again was distinctly seen, although dead, with its cilium straight and, of course, motionless, the collar partially retracted, and the body more or less filled with indigo (Pl. II. fig. 31).

Thus it was proved that in the siliceous sponges (*Spongilla*) and in the calcareous sponges (*Grantia compressa*) the same form of monociliated sponge-cell exists, which will, in both instances, take in indigo when supplied with it under the circumstances above mentioned.

Further, it follows that, as these cells do take in *crude* material, they are as much the animals of the sponge as the little Ascidians are the animals of the compound Tunicata,—ex. gr. *Botryllus polycyclus* (Pl. II. fig. 41), where the Ascidians are imbedded in circular groups (*b*) in a common tough gelatinous mass (*a*), each Ascidian having an oral orifice on the surface for the reception of food &c. (*c*), and an anal orifice which empties itself interiorly (*d*) into a common cloaca (*e*), finally opening by a circular hole, also on the surface, in the centre of each group (*f*).

Thus satisfied that this monociliated cell existed in both classes of sponges, viz. in *Spongilla* and in *Grantia compressa*, I sought for it also in living specimens of *Grantia ciliata*, *Leuconia nivea*, and *Clathrina sulphurea*, where it was equally well represented.

I then tried the siliceous sponges, viz. *Isodictya simulans*, *Hymeniacidon plumosa*, *Microciona atrosanguinea*, *Cliona celata*, &c., and might have gone further; but the fact of the sponge-cell being only half the size in the siliceous (viz. 1-6000th of an inch in diameter) that it is in the calcareous sponges precluded my seeing any thing more than the cilia. Of all these sponges that I have examined, the common *Isodictya simulans* seems to be the hardiest and best fitted for this purpose; but all that I can state respecting my examination of it amounts only to fancying that I saw the collar round the base of the cilium in profile.

However, as, when my eyes were younger, I had determined it in *Spongilla* in the way mentioned (*l. c.*), that is sufficient to establish its existence in at least one of the siliceous sponges.

As the monociliated cell in *Grantia compressa* somewhat differs from that represented in Prof. James-Clark's figure of it in *Leucosolenia botryoides* (*l. c.* pl. 9. [pl. 6, 'Annals,' vol. i.] fig. 41), it is desirable that I should describe it more particularly; but, before doing so, I would premise that Prof. James-Clark's memoir, although headed "Spongiæ ciliatæ &c.," is chiefly on flagellated Infusoria—four new genera of which, viz. *Bicosœca*, *Codonœca*, *Codosiga*, and *Salpingœca*, including six species, partly freshwater and partly marine, growing separately or in groups on stalks, and all possessing the "collar" characterizing the sponge-cell, he has described and illustrated in detail, before that of *Leucosolenia botryoides*. Hence he not only gives the sponge-cell, but several other minute monociliated and collared monadine organisms almost identical with it, which live respectively in the sea and in fresh water—whereby his observations on the form and habits of the sponge-cell are confirmed by totally independent evidence.

I do not know that any one has published an account of the same kind of monadine infusoria; but now that I am aware of what they are, and have seen them in the sponge, I remember to have frequently seen such organisms as are represented by Prof. James-Clark under the name of *Salpingœca amphoridium* (figs. 37, *a–d*, pl. 9, *l. c.*) on the filaments of *Spirogyra* or *Cladophora* at Bombay, and have them *figured* in several parts of my journal, beginning as far back as "April 15th, 1855" (Pl. II. fig. 42); but at that time my microscopic power was too low to see them properly, and therefore, as often as I met with them, they were so far disregarded. Hence it is probable that when Prof. James-Clark's discoveries become better known (which, like all valuable communications of the kind, may be too far in advance to be recognized in the lifetime of the author) these Infusoria may be often noticed; indeed I hardly despair now of seeing some of them one day myself, especially the freshwater *Codosiga pulcherrima*, which can be "readily recognized under as low a magnifying-power as two hundred diameters" (*l. c.* p. 10).

Returning, then, to *Grantia compressa*, so far as the sponge-cell alone goes, *it* is the same as that of *Leucosolenia botryoides*, viz. globular in form, composed of a plastic exterior, enclosing granuliferous mucus or protoplasm, a nucleus and contracting vesicles, besides, perhaps, other organs at present unknown (Pl. I. fig. 13, *a*), having at one part a non-granular portion, which is extensible (*b*). This part, which we will call the "rostrum," is polymorphic and protrusible, as in *Difflugia*, and frequently assumes different shapes, but especially a cylindrical one rounded at the free end, from the summit of which convexity the cilium (*d*) proceeds, and from around its base a funnel-shaped delicate film like a fringe or frill, which, with Prof. James-Clark, we shall call the "collar" (*c*).

Although the rostrum is not represented in Prof. James-

Clark's figures of the sponge-cell of *Leucosolenia botryoides*, it is figured and described in his *Codosiga pulcherrima* (*l. c.* p. 10, pl. 9. [pl. 5, 'Annals,' 1868, vol. i.] figs. 8, 9, 25, 27, &c.).

Further, it should be stated that both the cell and its appendages are all polymorphic, or, at all events, the latter and non-granular portions of the protoplasm; so that, while the appendages may assume an infinitude of shapes and transformations, the globularity of the cell for the most part remains stationary. (For a description of the different forms of the sponge-cell assumed under polymorphism, and figured in the illustrations, see *infrà*, "Explanation of the Plates," figs. 13–31, inclusively.)

How the *crude* fragments of food are introduced into the sponge-cell is still so far questionable, that, as yet, it has only been *inferred*.

In the 'Annals' for July 1857 (vol. xx. p. 29, pl. 1. fig. 10) I described and figured what appeared to me to be the process in a sponge-cell of *Spongilla* attached by a pseudopod to the watch-glass, similar to that which I have seen twice, and figured, in *Grantia compressa* (Pl. II. figs. 20, 21); and there (that is, as represented in the figure *l. c.* 10), the particles seemed to be hurled back upon the cell by the cilium, described in my own words at the time as "caught up (by apparently adhering to it, or by a process thrown out by it, as in *Actinophrys sol* (*b*)) and rapidly passed into its interior."

Respecting these observations, Prof. James-Clark states (*l. c.* p. 1),—"Strangely enough, though, as it seems to me now, he [Carter] does not look upon the intussusception of the particles as a genuine process of swallowing, like that which obtains among the ciliated Infusoria." "It is plain, therefore, that he does not believe that the 'sponge-cells' are endowed with a *mouth*; and moreover, if I am not mistaken, he attributes to any part of the 'cell' the faculty of engulfing food."

Now here is the only point at issue between us; and on this depends whether we shall regard the sponge-cells as "Infusoria flagellata," after Prof. James-Clark's view, or as Rhizopoda (like *Amœba*) after my own and that of others.

It should be understood, however, that by any part of the sponge-cell "engulfing food" I mean any pseudopodial prolongation or exserted process of the protoplasm; for it is not improbable that in the Rhizopoda the surface-layer does not cover the *pseudopodium*, but, by its elasticity and yielding nature, allows the transparent and prehensile material of the interior to be protruded for the capture of food &c., and then withdrawn within the rent, which afterwards closes over it;

hence the primary globular or rounded form of *Amœba* in the passive state.

Be this as it may, Prof. James-Clark states, respecting the sponge-cell of *Leucosolenia botryoides* (*l. c.* p. 22), that "the mouth is the only organ which has not been actually observed, although its position has been inferred, not only from the otherwise similar structure of the monad of this creature to that of *Codosiga* (§ 6), but because currents of floating particles are constantly whirled in by the flagella and made to impinge upon the area within the collar."

As regards *Codosiga pulcherrima* and *Salpingœca gracilis*, the intelligent author adds (*l. c.* p. 15):—"The *mouth*, we are obliged to presume, as we did in regard to *Codosiga*, lies somewhere about the base of the flagellum. Abundant digestive vacuoles were observed, as well as loose particles of food, in various parts of the body; but at no time were we so fortunate as to see the introception of nutritive material or the ejection of fæcal matter." And of *Salpingœca* it is stated (p. 11), "the position of the *anus*, which, as I have already suggested, may possibly be coincident with the mouth, is easily determined, even to the narrowest limits, as the fæcal matter is discharged in large, highly refractile pellets (fig. 24[a], *d*) close to the base of the flagellum."

Such is the only evidence we possess of the existence of *distinct* oral and anal orifices respectively within the collar of the sponge-cell of *Leucosolenia botryoides*; and so long as the collar of the sponge-cell is present with the cilium, all particles of food may go into and out of the body through the collar; but as every part of the sponge-cell is polymorphic, and may put forth pseudopodia from one part in particular (Pl. II. figs. 22, 23, 24), like *Difflugia*, or from any part of the body (Pl. I. figs. 14, *b* & 16, *a*), like *Amœba*, so it seems to me that we may infer that these pseudopodia may have, under such conditions, the power of introcepting particles of food at any point, which, while the cilium is unretracted and in full motion, may be thrown back upon the body towards its base only, and there introcepted, as I delineated in 1857 (*l. c.*).

This, then, would at one time make the sponge-cell a flagellated infusorium, and at another a rhizopod; but being compounded of the two, it is certainly neither, but an organism *sui generis*—in short, the sponge-cell.

On some occasions, too, the pseudopodial prolongation appears to become a pointed organ of suction like the tentacular prolongations from *Podophrya fixa* and *Acineta*, when it may seize and penetrate the body of another infusorium for the purpose of extracting its nutritive contents. (Indeed it is probably by the intercellular protoplasm, to which I shall allude hereafter, that the Sponges, like the Myxogastres, chiefly excavate and work (how?) their way through hard bodies.) This tentacular form of pseudopodium, which is characteristic of the *Acinetina*, I have also witnessed twice, in two cells of *Grantia compressa*, viz. one where the collar had partly become transformed into a pseudopodial extension and had caught an unciliated monadine cell (Pl. II. fig. 17), and the other where the margin of the collar itself had seized a monociliated one (fig. 18). As these two instances presented themselves during a very short and limited examination of the sponge-cells of *Grantia compressa* in the way above stated, it is not improbable that they are of very frequent occurrence. At the same time it should be remembered that many phenomena of this kind are witnessed under the glass cover, from the Infusoria being brought so closely together, which might not occur so frequently in their natural element, where they are unconfined and have plenty of room to avoid each other.

As an instance of a Rhizopod being able to put forth vibratile cilia at one time, and replace them by pseudopodial tentacles at another, I, long since, described and figured *Podophrya fixa* in the 'Annals' (vol. xv. p. 287, pl. 12. fig. 10).

To this it may be added that Prof. James-Clark in no part states that any of his collared flagellated Infusoria possess a polymorphic power over the whole body like the sponge-cell.

Nevertheless this sagacious observer states (p. 20), regarding "the theory of Carter as to the alliance of Sponges with Rhizopods," "my firm conviction" is "that the true ciliated *Spongiæ* are not *Rhizopoda* in any sense whatever, nor even closely related to them, but are genuine compound *flagellate Protozoa*, and are most intimately allied to such genera as *Monas*, *Bicosœca*, *Codonœca*, *Codosiga*, and *Salpingœca*."

Thus having stated our views respectively on this point, I must leave the reader to judge for himself.

Contracting vesicles and a nucleus are common to all the sponge-cells, and the former common to the protoplasm to which I have just alluded, viz. that which binds them and the whole elements of which the sponge is composed together. The latter is figured and described in one of my earliest papers on *Spongilla* (Annals, Aug. 1849, vol. iv. pp. 86–91, pl. 4. fig. 2), wherein it is stated, at p. 81, that, "when the fleshy mass is examined by the aid of a microscope, it is found to be composed of a number of cells imbedded in and held together by an intercellular substance," and, at p. 91, that "it (this substance) is extended into digital prolongations precisely similar to those of the protean, which in progression or in polymorphism throws out parts of its cell in this way," and that in it "may be observed hyaline vesicles of different sizes contracting and dilating themselves as in the protean." I quote these portions to show that this intercellular protoplasm was described upwards of twenty years since.

Another phenomenon witnessed by Prof. James-Clark was the duplicative division ("fissigemmation") of *Codosiga pulcherrima* (pl. 9. figs. 13–21, p. 13), which he patiently watched and has as fully delineated and described. To this also I would direct attention, because I have figured a group of stoloniferous sponge-cells from *Grantia compressa* which bear the appearance of having been produced in a similar way (Pl. II. fig. 19).

But the variety of forms which these sponge-cells may assume, from their polymorphic power, is infinite; and, considering the number I have figured from two or three comparatively short examinations (Pls. I. & II. figs. 13–31) it will be easily understood that to attempt to delineate all would be endless.

Another question now arises, as to how and where these sponge-cells are grouped in the sponge-structure.

Here, again, I must refer the reader to the description and figure of these cells *en groupe* in my paper on "the Ultimate Structure of *Spongilla*" (Annals, July 1857, vol. xx. p. 26, pl. 1. fig. 5), where it will be observed that in this sponge they form *spherical aggregations*, each of which presents a large circular transparent area (aperture?), which is capable of being closed or expanded as required; and to this aggregation I have given the name of "ampullaceous sac." These groups are situated in the areolar cavities, which are accompanied by the excretory canal-system; and the sponge-cells of which they are composed seize the particles of food as they are whirled in through the pores of the investing dermal sarcode, and retain them as long as may be necessary, after which the undigested parts find themselves in the excretory canals.

It is very easy to ascertain the form of the groups, because the monociliated cells of which they are composed are the *only* cells which take in the carmine or indigo, and hence their shape and position are readily recognized with the microscope through the semitransparent substance of the young *Spongilla*.

It must be remembered that in all these instances the parts were viewed *in situ* in the watch-glass where the young *Spongilla* was grown, with the object-glass *under* water and with *no* glass cover.

Although it is easy to determine the form of the groups of sponge-cells in *Spongilla*, it is not so easy to see by what channels the particles of colouring-matter are *immediately* taken into them, or to see how they or the ingesta get from the cells into the excretory canals; for the cilia of the sponge-cells are in the *interior* of the ampullaceous sac, where they may be seen vibrating through the transparent circular area (aperture?). In my latest observations it seemed to me that the particles got into the sponge-cells of the ampullaceous sac through several different channels and holes, perhaps, in the latter, and that the discharged portions passed into the excretory canals through the transparent aperture; but of this I am not certain, and must now leave others to determine it.

The same kind of ampullaceous sac may be seen in many of the marine siliceous sponges, of which perhaps *Isodictya simulans* affords the best example. It has been figured by Schmidt under the name of "Wimperkorb" from *Reniera aqueductus* &c. (Suppl. Spong. Adriat. 1864, p. 13, t. 1. fig. 17); but this author does not allude to my description and figure of it in the 'Annals' for 1857, although the feeding of *Spongilla* with carmine by Lieberkühn and myself is noticed.

Thus the peculiar grouping of the sponge-cells in *Spongilla* and many of the marine sponges has been ascertained.

But in the Calcispongiæ they seem to cover the whole surface of the sarcode which lines the areolar cavities of the parenchyma (Pl. I. fig. 8, and Pl. II. fig. 29), with the exception, of course, of their incurrent and excurrent apertures, the latter of which, where there is no system of excurrent canals, finally open by large orifices *directly* into the cloaca.

So far as structure goes, *Grantia ciliata* does not differ, in the form of its areolar cavities and the absence of the excretory canal-system, from *Cliona celata*, in which, as my figure seems to show, the sponge-cells are still grouped in a spherical form (Pl. II. fig. 38).

It therefore remains for future observation to determine how the sponge-cells are grouped, generally and respectively, both in the siliceous and calcareous sponges.

Cliona corallinoides (Hancock in Ann. Nat. Hist. April 1867, vol. xix. p. 238, pl. 7. fig. 3). Pl. II. figs. 33–37.

Next to the sponge-cells, perhaps the most interesting organ is the dermal sarcode; for this, as I have before shown (Ult. Struct. of *Spongilla*) literally commands the openings on the surface. It can either extemporize them in any part, or close them, as required—a process which, of course, is very slowly effected, on account of the amœboid nature of the sarcode; so that, on death occurring suddenly (that is, where the sarcode has not become putrid and passed into dissolution, and there has been no time for closing by reflex action) these apertures remain. Hence in dried specimens, where the dermal sarcode is not destroyed, they remain visible.

There are two kinds of openings, viz. the pores and the vents—the inhalant and exhalant apertures.

Directing our attention to the former first, we find them averaging about a 1000th of an inch in diameter,—either scattered generally over the dermal sarcode opposite the interstices of the subjacent spicular structure, as in the Esperiadæ, *Halichondria panicea*, Johnston, &c., and the Calcispongiæ; or confined to circular areas in juxtaposition, as in *Raphyrus Griffithsii*, Bk. (*Cliona celata?*), *Raphiophora patera*, Gray, or Neptune's Cup, *Pachymatisma*, &c.; or to circular areas separated from each other and raised on cylindrical heads, as in *Grayella cyathophora*, Cart., *Cliona corallinoides*, Hancock, &c.

Of these the Clionidæ, including *Raphyrus* and *Raphiophora* (see "Mém. sur le Genre *Potérion*," par P. Harting, Soc. des Arts et des Sci. d'Utrecht, 1870, pl. 4. figs. 7 & 12), present examples of a division of the sponge-structure in the pore-areas resembling the tentacular head of a polype; but as this is merely a resemblance, and my object in introducing the subject of the openings in the sarcode of the Spongiadæ is more especially to show this, I shall take *Cliona corallinoides* alone (Pl. II. fig. 33) for description and illustration, as affording the nearest resemblance of this kind that I have met with.

This sponge (like *Raphyrus Griffithsii* and the great Neptune's Cup, together with the diminutive *Grantia ciliata* and its like among the calcareous sponges) possesses *no branched* system of excretory canals like most of the other sponges, but consists merely of an areolar structure (Pl. II. figs. 33 & 36, *a a*) which, burrowing between the layers of univalve and bivalve shells, forms for itself therein similar excavations, which open into each other by efferent (fig. 36, *c c c*) and afferent apertures, finally communicating with the exterior by distinct heads (figs. 33, *a*, *b*, & 36, *b*) here and there, most of which are simple pore-areas (fig. 34), while the rest present a combination of vent and pores (fig. 35) or a single large vent only. *Cliona corallinoides* not only excavates shells, but the sandstone rock too of this locality, where it shelters itself under the florid expansions of *Melobesia lichenoides*, which goes on growing (that is, spreading in all directions), while the

Cliona every here and there makes holes through this crust or thalloid frond for its pore-areæ or vents as required.

Of course, therefore, these "holes" are occupied by a longer or shorter cylindrical prolongation of the sponge (fig. 36, *b*) in proportion to the thickness of the crust, which thus presents as many heads; so that when the shell is dissolved off by acid, these heads project here and there above the general surface of the sponge (Pl. II. fig. 33, *a*, *b*).

It may be assumed that this way of reaching the exterior necessitates a cylindrical extension of this kind; but *Grayella cyathophora*, which is an allied species, possesses it, together *with* a branched system of excretory canals, although freely spreading *over* the surface of the rocky object on which it may be growing.

Each portion, too, in *Cliona corallinoides* has, for the most part, its peculiar spicule. Thus the pin-like, slightly curved, and fusiform one with oval head (fig. 37, *a*) is almost entirely confined to the cylindrical head-like extensions of the sponge, and the tentacle-like prolongations of the pore-area, where their points project outwardly (fig. 35, *f*), while the minute sinuous spinous spicule (*c*, *d*) for the most part fills up the interstices between the latter, and the curved, acerate, spinous spicule (*b*), which is not more than a quarter the length of the pin-like one, is confined to the areolar structure of the interior. These spicules, as they are described, average about 83, 2–3½, and 21 6000ths of an inch in length respectively.

When we examine the heads or free ends of the cylindrical prolongations, they are found to be of different sizes, to present an irregularly round or elliptical margin (fig. 34, *a a a*), and within this a variable number of tentacle-like prolongations of the sponge-structure (*b b b*) charged with the pin-like spicule, and webbed together by the dermal sarcode (*c*), in which there is a variable number of pores (*d*), chiefly situated between the prolongations. In the dried state all this is on a level with the margin of the pore-area, if not a little depressed, with the pointed ends of the pin-like spicules uncovered and bristling in all directions (fig. 35, *f*); but in the living state it rises much above the margin, into a convexity, when the dermal sarcode entirely covers and conceals the spicules.

At this time, inhalant currents may be seen to pass in through the *pore-openings*.

Our illustration presents about thirty of these tentacle-like prolongations, of different lengths (Pl. II. fig. 34, *b b b*), and is nearly a facsimile of the mounted dried one from which it has been taken, and in which the dermal web-like sarcode (*c*) with its pores (*d*), as delineated, still remain.

Let us now turn our attention to the vent or larger aperture of the dermal sarcode, which here, as well as in *Pachymatisma Johnstonia*, Bk., is more or less constricted or covered (*i. e.* commanded) by a diaphragm of the dermal sarcode, in like manner as the pores, although in the latter both vent and pore-area are themselves solidly fixed by the masonry of the little siliceous balls of which the crust of *Pachymatisma* is composed. By this means (that is, by the dermal sarcode) the vent also may be opened or closed when required, in all the sponges, as I have long since shown in the young *Spongilla* (Ult. Struct. Spong. *l. c.*).

In *Cliona corallinoides* the whole area of the head (figs. 33, *a*, 36, *b*) is not always given up to the vent, but allows the latter to occupy its centre (fig. 35, *c*), while the circumference still presents the tentacle-like prolongations (*b b b*) and pores of the dermal sarcode between them (*d*); so that the head is composed of the two organs, *so far* in combination.

It is a common occurrence for the pores in most sponges to be seen close to the border of the great vent; but as the latter is only the opening at the end of the canal of the excretory system, the pores, although close to its border, do not necessarily communicate *directly* with it, but are in connexion with the areolar parenchyma beneath, which is thus *outside* and surrounds this canal or aperture.

Hence, for convenience, I have taken the same head for illustrating the vent that has been drawn from the pore-area alone (fig. 34), and have placed a large circular aperture in the centre for this purpose (fig. 35, *a*), after which it will not be difficult for the reader to supply the other and, perhaps, more common form, where the vent *alone* occupies the whole of the head (fig. 33, *b*). I have also in this figure inserted the bristling arrangement of the ends of the pin-like spicules as seen in the dried state (fig. 35, *f*), which has been omitted in the former, also for convenience.

Thus, however much like the polype-head the pore-area may be, the tentacle-like prolongations can only be considered to bear a remote resemblance to the tentacles of a polype; and thus also we read in Prof. P. Harting's valuable memoir on *Poterion*, or "Neptune's Cup" (where the pore-area is similar in structure to that of *Cliona corallinoides*, and the internal mass in like manner composed of areolar cavities only, without *canal*-system):—"Peut-être MM. Häckel et Miklucho-Maclay verront-ils dans ces plis rayonnants [in the pore-area] une confirmation de leurs idées sur les affinités des éponges avec les polypes. Quant à moi, je ne crois pas que ces plis puissent être comparés à aucune partie du corps d'une polype, soit aux bras, soit aux plis mésentériaux. C'est une simple analogie de forme, rien de plus." (Mém. pub. par la Soc. des Arts et des Sci. d'Utrecht, pp. 11 & 12, pl. 4. fig. 12 &c.)

As regards homology and adaptation, it is manifest that if the pores are to be considered the homologues of the ends of the gastro-ventricular canals of an *Actinia*, which are said to open on its surface, then their tentacle-like structure cannot be considered homologous with the tentacles round the mouth of the *Actinia* or polype.

Then, as regards the function of the vent and the excretory system of canals generally, it is the rule, and not the exception, for the current to pass outwards, and *vice versâ*. Indeed the structural arrangement in all sponges about the vent proves this; and where the opposite takes place, it seems to me to be occasioned by abnormal conditions, similar, perhaps, to what Dr. Bowerbank has stated to occur on such occasions. ("Ult. Struct. Marine Sponges," Annals, Oct. 1870, vol. vi. p. 331.)

In all sponges which are living and active, the inhalant and exhalant functions of the pores and vents respectively may be easily seen by placing a little colouring-matter in the water which surrounds them, when the process will be found to be almost invariable.

For the development of the seed-like body of *Spongilla* and the spicule, see 'Annals,' 1848, vol. i. p. 305; *ib.* 1849, vol. iv. p. 82 &c.; *ib.* 1857, vol. xx. p. 26; and *ib.* 1859, vol. iii. p. 334, respectively, wherein I am pleased to observe that much has been confirmed by Prof. Häckel's observations on the calcareous sponges, to which I shall presently allude more particularly.

Lastly, I have given an illustration of a group of *Botryllus polycyclus* (Pl. II. fig. 41), to show how the Ascidians of which it is composed have each its separate branchial aperture (*c*), for aëration and nutrition, on the surface of the gelatinous mass (*a*) in which they are imbedded, and its anal orifice (*d*) internally, extended into a common receptacle or cloacal cavity (*e*), which finally also opens externally on the same surface, for the discharge of the fæcal contents of the little community generally (*f*), there being a great many communities of the same kind imbedded in the same flat and spreading, tough, gelatinous or albuminous mass.

Now here we cannot help seeing that the gelatinous mass is at least analogous to the sponge-structure (indeed in the little white incrusting species *Leptoclinum gelatinosum* it is also densely charged with globular radiated calcareous bodies (spicules) similar to some of the siliceous ones of the Geodidæ, and presenting *en masse* such a white colour that it may be easily mistaken for a calcareous sponge,—that the branchial opening in the gelatinous mass, if not homologous with, is certainly analogous to the pore in the Spongiadæ, and the common cloacal cavity and fæcal orifice are respectively analogous to the excretory canal-system and vent, also in the sponges, while the plurality of communities or "systems" correspond to the individual divisions of the sponge termed by Prof. Häckel "persons."

Then, too, there is a network of canals in the gelatinous structure which may be the homologue of the gastroventricular canals in *Actinia* and the cœnosarc of the coral-polypes, especially for supplying nourishment and sustaining the vitality of these parts.

Prof. E. Häckel's *Views.*

It seems to me imperative on all those who would write anything on the Spongiadæ, and especially on the Calcispongiæ, to notice what has lately been put forth by one of the highest authorities on the Protozoa of the present day. I, of course, allude to the paper "On the Organization of Sponges and their Relationship to the Corals," to which is appended a "Prodromus of a System of Calcareous Sponges," by Prof. E. Häckel (Jenaische Zeitschrift, B. v. pp. 207–254; translated by W. S. Dallas, F.L.S., in the 'Annals,' Jan. 1870, vol. v. pp. 1 *et seqq.*).

In this paper, at p. 11 (translation), we find the following statement:—

"Miklucho has already shown that in a great many sponges the mouth or osculum by no means permits only the outflow, but also the inflow of water. I have repeatedly convinced myself, by my own observations, of the correctness of this assertion. Consequently the mouth in many sponges, just as in the corals, serves for both the reception and expulsion of the water and the nutritive constituents contained in it."

And at p. 6,—"I start with the following general proposition:—The sponges are most nearly allied to the corals of all organisms."

At p. 9:—"I do not, like most authors, regard the characteristic canal-system of sponges as something quite specific and peculiar to this class, an arrangement *sui generis*, but share in the opinion of Leuckart and Miklucho, that it is essentially *homologous with the cœlenteric vascular system* or gastrovascular apparatus of the Corals and Hydromedusæ—in fact, of all the Acalephæ or nettle-animals. Indeed I am so thoroughly convinced of this homology that I (with Miklucho) designate the largest cavity into which that canal-system is dilated in the sponge-body, and which is usually called the excurrent tube or flue (*caminus*) as the *stomach*, or digestive cavity, and its outer orifice, which is usually called the excurrent orifice or osculum, as the buccal orifice or mouth."

As may be perceived from these quotations, Häckel's views of the organization of the Spongiadæ (which also form the basis of his classification of the Calcispongiæ) do not accord with the facts which I have stated. Hence, our premises being different, it is useless to raise any argument against his hypothesis: the *facts* must speak for themselves.

But, as regards the inflow of the water into the osculum or vent, which, as before stated, is only occasional, abnormal, and not the rule but the exception (for even Häckel observes, at p. 10, that it is "generally (but not always!) the case"), no one well acquainted with the habits of the sponge would expect to see any thing but an exhalant current from this orifice.

Relative to this, Häckel adds, at p. 11:—"The difference in the direction of the current of water which is usually admitted in the two classes is a matter of perfect indifference in this close *morphological* comparison. Even if this difference was really constant, general, and thoroughgoing, it would not be capable of invalidating our notion of the homology of the canal-system in the body of the sponge and coral."

The necessitous adaptation, however, of the vent in the sponge to an inflow instead of an outflow of water is only temporary, and, not being constant, seems to me of no value in establishing an homology.

Thus, neither the prehensile extremity of the elephant's trunk nor that of the spider monkey's tail can make these two organs homologous with each other, or with the finger, although all three are used for similar purposes and in a similar way. Again, although a human being may be nourished through the rectum, it does not make the latter homologous with the stomach; neither does the casual inflow of the water through the vent of the sponge make this aperture homologous with the mouth of an *Actinia*; while in all these instances it seems to me more essential to know what their respective functions may be than their homologies, albeit the latter, when based on facts and not fancies, are equally essential as the basis of true classification. It is not difficult to assume that a spider monkey should have a tail, but it is much more useful in natural history to know how it differs from tails in general. Diversity concerns us more than unity, fact more than theory. It is right to know what the form of a brick is, but it is of more consequence to know what structures a combination of them may produce. A mansion and a monument are not necessarily allied because they are both built of brick, nor is the sponge allied to the coral because both may have originated from the same kind of ovum in a similar way. It is the differentiation of their respective structures afterwards that is of most importance to the naturalist; and it is precisely on this point that Häckel and myself differ. One would make the sponges go along with the corals, and the other in the direction of the compound tunicated animals.

But although our premises being different precludes my arguing against Häckel's hypothesis, there are other points in his interesting paper which do appear to me to be directly assailable.

Thus at p. 8 he states:—"That the essential agreement in the internal organization of sponges and corals, their actual homology, has hitherto been for the most part overlooked is due, among other things, to the fact that the most accurate anatomical investigations of recent times (especially those of Lieberkühn) took their start from the best-known and most common forms of sponges—viz. the freshwater sponge (*Spongilla*), which belongs to the group of the true siliceous sponges, and the common sponge (*Euspongia*), belonging to the group of horny sponges. But these very two forms of sponges differ in many respects considerably from the original and typical structure of the entire class, have been in many ways modified and retromorphosed by adaptation to special conditions of existence, and therefore easily lead to erroneous conceptions, especially as their investigation is comparatively difficult.

"On the other hand, among all the sponges, no group appears better fitted to shed full light upon the typical organization and the true relations of affinity of the whole class than the legion of the Calcispongiæ."

This recalls to mind the old story in Mavor's 'Spelling-Book' of the town in danger, when, the different artisans meeting together for a council of defence, the shoemaker stated that "there was nothing like leather." The same, however, may be stated of what I myself am about to assert, which is, that there is nothing like *Spongilla* for the purpose of studying sponge-development.

As a medallist in the classes of comparative anatomy (under Prof. R. E. Grant) and of human anatomy at University College in 1836–37, as a practical and experimental observer of *Spongilla* in its *living* state, for many years, when it grew in the tanks close to my door at Bombay, and as a practical and experimental observer, for the last two years, on the marine sponges, both siliceous and calcareous, also in their *living* state, I think it might be assumed at least that, both by early education and subsequent opportunities, I ought to be qualified to give an opinion in this matter.

Now, for the most part, all marine sponges (save the *Clionidæ*, which may be in deciduous shells) begin to perish within forty-eight hours after they have been taken from their natural habitat, although their attachment to the piece of rock on which they may be growing remains uninjured; and even if they survive a little this period, they are voraciously devoured by the crustaceans which may be confined with them—just as in all similar and serial microscopical inquiries, whether free or confined, the minute crustaceans are thus the most defeating agents. With the putridity or dissolution of the sponge comes a development of infusoria; and if, under such circumstances, *one* Vibrio is seen to pass across the field, the microscopist may as well give up all further research into the phenomena of the *living* sponge.

On the other hand, if the seed-like body be taken from a living piece of *Spongilla* and placed in a watch-glass with water, it may be kept under a quarter-of-an-inch compound power until the young *Spongilla* issuing from it has gone through all its phases of development from its first appearance to its full completion, which may be seen both elementarily and collectively; while during this time, having a plurality of seed-like bodies growing in different watch-glasses, the experiment of feeding the young *Spongilla* with carmine or indigo, which soon points out, by its colour, the position and grouping of the sponge-cells, together with the passage of the particles in through the pores of the dermal sarcode, thence to the ampullaceous sacs, and then the discharge of the ingesta through the excretory canal-system—all may be deliberately watched under the same microscopic power, with so little difficulty and yet so accurately that there is no merit whatever in recording observations of the whole process. It was in this way that I obtained the data published in my paper "On the Ultimate Structure of *Spongilla*," confirmed by similar observations on large pieces of *Spongilla* taken directly from the tank; and to this paper I must refer the reader for all further information on the subject.

Latterly I have had nothing but the marine sponges to examine and experimentalize on, especially the calcareous ones; and I cannot help thinking that if Prof. Häckel had had the same opportunities that I have had of studying the development of *Spongilla*, he would not have given a preference to the Calcispongiæ for this purpose.

It is remarkable that Häckel, with the exception of stating at p. 111 that "the simple and extremely significant fact that the reproductive cells are produced, by division of labour, from the nutrient vibratile cells of the entoderm or vegetative germ-lamella applies to the sponges equally with the Acalephs," never once alludes to the *organs of nutrition*, by which the sponge-structure is built up and sustained. Such an omission could never have occurred with an observant, sagacious mind like his, ardent in the pursuit of truth, had he added to his indefatigable researches on the calcareous sponges a study of the development of *Spongilla*, such as I have described, or even had he experimented after a like manner on the *living* calcareous sponges.

Häckel observes, at p. 9, that the calcareous sponges to which he has given the names of *Clistosyca* and *Cophosyca*, which do not possess an excretory opening, are probably to be regarded as retromorphosed forms, related to the others as the Cestode worms to the Trematoda. At p. 10, that "the part played" by the cutaneous pores, which, in the corals, are the peripheral extremities of the cœlenteric vascular system, "is, unfortunately, as good as unknown;" yet with these he homologizes the pores of the sponge. At p. 116, the petaloid arrangement of the vents in *Axinella polypoides*, Sdt. (Spong. Adriatic. 1862, t. vi. f. 4) is regarded by Häckel as antimeral or homologous with the segmental divisions of a coral-polype; and therefore he sets these sponges down as "true Radiata;" while, in the following paragraph, the fringes round the vents in *Osculina polystomella* (2nd Suppl. Spong. Adriat. t. i.) are regarded as "incipient tentacles"—after which Häckel observes that whether this be right or wrong, it is of "less importance," because the tentacles are "almost wanting" in *Antipathes*. But considering that these fringed apertures were neither drawn nor ever seen by Schmidt himself, and that, as I have shown in *Cliona corallinoides*, they belong more to the pore-areas than to the vents, they can hardly be homologized with the tentacles of an *Actinia*.

At p. 116 it is also stated that "the conditions of *stock-formation* or *cormogeny* are exactly the same in the corals and the sponges." True; but the Compound Tunicated animals and the Polyzoa, &c. &c. are grouped together in a similar manner—in "systems."

Among the calcareous sponges which Häckel tells us he found at Naples, and preserved in spirit, we read, at p. 12, were some "microscopically small, but yet perfectly developed (*i. e.* ovigerous)" ones, "in which there are actually no traces of cutaneous pores" (and no spicules; at least none are mentioned in the "classification"). The entire body consisted of an "elongate rounded sac (stomach), with a single opening (mouth) on that extremity of the body which is opposite to the point of attachment." For this sponge Häckel has proposed the name of *Prosycum.* Indeed this is the starting-point or base of his Classification of the Calcispongiæ; and, of course, the absence of cutaneous pores makes its cavity a *stomach*, for there is no evidence of any other means by which nourishment could be obtained.

But is this not slender evidence to go upon, viz. the examination of a microscopic object preserved in spirit? If examined in the living state, might it not, like the young *Spongilla* (for it could hardly be much smaller) have possessed amœboid sponge-cells which might have enclosed particles of food on the outside of the sac, and discharged the ingesta into the so-called stomach, just as in *Clathrina sulphurea*, where the walls of the tubular structure are so thin that its areolar structure, beset with sponge-cells, can hardly be distinguished.

Of course I allude to these points for the purpose of eliciting truth, which no one desires more than Prof. Häckel.

As regards the development of the so-called ovum, it is stated, at p. 12, that the excretory canal commences "by a small central cavity (stomach)," which "extends, and, breaking through at one pole of the longitudinal axis, acquires an aperture, the mouth;" and at p. 114, that the "pores are simple breaches in the parenchyma, which perforate both layers of the body-wall (ectoderm and entoderm)." The first stage represents his *Prosycum*, and the second, where the pores are added, his *Olynthus.* In his *Clistolynthus* the mouth is closed up "by retromorphosis." Where the mouth is closed, the nourishment *must*, of course, come through the *pores*, and not through the so-called stomach.

Such are Häckel's views; and his classification of the Calcareous Sponges is carried out upon them *in extenso.* His theory that the vent of the sponge is the mouth, and the large excretory canal the stomach, is the *principium et fons* of all.

But how can this be maintained, when it has been proved that the greater part of the Sponge consists of flagellated Rhizopoda which take in *crude* material for nutrition, and probably supply the necessary elements of sexual generation?

EXPLANATION OF THE PLATES.

Plate I.

Fig. 1. *Trichogypsia villosa*, n. g. et sp., outline of, natural size.

Fig. 2. The same, magnified two diameters: *a*, vent.

Fig. 3. The same, vent more magnified, to show disposition of oscules opening into it.

Fig. 4. The same, spicule of, linear, slightly sinuous, inæquifusiform, spino-tuberculated at the ends. Size 1-60th of an inch long by 1-1000th broad. Scale 1-24th to 1-6000th of an inch.

Fig. 5. *Leuconia Johnstonii*, n. sp., outline of, natural size.

Fig. 6. The same, magnified 2 diameters: *a*, ciliated vents; *b*, unciliated vents; *c*, large quadriradiate spicule of the surface, relatively magnified.

Fig. 7. The same, diagram of vertical section of upper third or cloacal extremity: *a*, cloaca branching off into *b b*, excretory canals; *c c*, excretory apertures; *d d d d*, parietes of cloaca, consisting chiefly of areolar cells; *e*, ciliated crown of vent; *f*, internal or cloacal arms of great quadriradiate spicule.

For the arrangement of the spicules round the *un*ciliated vent see fig. 40, Pl. II.

Fig. 8. The same, diagram of areolar cells of parietes of cloaca, much magnified, showing large and small apertures in them: *a a*, efferent apertures.

Fig. 9. The same, diagram of a portion of the surface, much magnified, to show the dermal sarcode (*a*), and its pore-openings (*b*).

Fig. 10. The same; *a*–*f*, all the spicules relatively magnified, viz. on the scale of 1-24th to 1-1800th of an inch: *a*, large quadriradiate spicule of surface; *b b*, curved arms; *c*, internal arm; *d*, straight arm foreshortened, presenting the central canal line; *e*, large, thick, slightly curved, inæquiacerate spicule of the ciliated crown of vent; *f*, thin, straight, cylindrical one of the same; *g*, triradiate, staple spicule of the skeleton, of various sizes, showing the curved and straight arms respectively, the latter (*h*) bearing the trace of the central canal; *i*, small quadriradiate of the interior, front view; *i'*, lateral view, showing the curved arm, which projects into the cloacal cavity and excretory canals, in company with *k*, minute fusiform spicule, and *l*, still more minute quadriradiate spicule with one short arm.

Fig. 11. The same, minute spicules more, but relatively, magnified, on the scale of 1-12th to 1-6000th of an inch: *a*, curved fusiform spinous spicule, for the most part characterized by one extremity presenting the appearance of having been fractured towards the point and reunited in the opposite direction to the general curvature of the shaft; *b*, quadriradiate spicule, showing its short arm &c.

Fig. 12. The same, dark or transparent area (according to the direction of the light) at the union of the four arms of the great quadriradiate spicule of the surface, arising from the presence of the fourth arm, which thus distinguishes at once this species from *Leucosolenia nivea*. Scale 1-24th to 1-1800th of an inch.

Fig. 13. *Grantia compressa*. Sponge-cells relatively magnified, on the scale of 1-12th to 1-6000th of an inch, showing:—*a*, cell containing granular mucus or protoplasm, nucleus, and contracting vesicles; *b*, rostrum; *c*, collar or frill; *d*, cilium—all polymorphic; *e*, another common form; *f*, a form where the whole cell nearly appears to have become transformed into the rostrum; *g*, conical form of the same, where the rostrum presents a pointed elongation in the centre, with flat top; *h*, similar form, showing the contracting vesicle, *i*.

Fig. 14. The same, group of sponge-cells, part of which show the rostrum in different degrees of protrusion, apparently without the collar, but with the cilium; *g*, sponge-cell with rostrum, collar, and cilium retracted, and pseudopodia alone put forth.

Fig. 15. The same, group of sponge-cells showing the rostrum in different degrees of protrusion (*b*), and the collar only seen in *a a*.

Fig. 16. The same, five sponge-cells, of which three present the collar &c., and the other two (*a*) the pseudopodia only.

Plate II.

Fig. 17. *Grantia compressa.* Sponge-cell with collar transformed into tentacular pseudopodia, one of which bears a monad on its point, *a*.

Fig. 18. The same, sponge-cell with monociliated cell (*a*) seized by the margin of the collar.

Fig. 19. The same, group of sponge-cells with collar and cilium respectively, which appear to have undergone duplicative division, on stolons of sarcode.

Fig. 20. The same, sponge-cell with a single pseudopodium extended laterally from the fundus and attached to the glass (*a*), round which it was propelled by the cilium in a circle represented by the arrows, *b*.

Fig. 21. The same, sponge-cell (*a*) similarly attached to a group.

Fig. 22. The same, collar transformed into pseudopodia, cilium remaining.

Fig. 23. *Clathrina sulphurea*, sponge-cell of; rostrum and collar transformed into pseudopodia, cilium remaining.

Fig. 24. *Leuconia nivea*, sponge-cell of; rostrum partly, and collar and cilium wholly, transformed into pseudopodia.

Fig. 25. *Grantia compressa.* Sponge-cell with rostrum, collar, and cilium; presenting pseudopodia at the fundus of the cell.

Fig. 26. *Clathrina sulphurea*, sponge-cell of; rostrum and collar retracted, and cilium also becoming retracted by thickening at the base.

Fig. 27. *Grantia ciliata.* Sponge-cell with rostrum, collar, and cilium; the collar very faint.

Fig. 28. *Leuconia nivea.* Sponge-cell with rostrum, collar, and cilium; the rostrum beaded upon its anterior edge, and the collar very faint.

Fig. 29. *Grantia compressa.* Group of sponge-cells which had assumed a round or elliptical form, with their cilia rapidly vibrating in the interior. Common.

Fig. 30. The same, two living sponge-cells after their bodies had become more or less filled with indigo, presenting rostrum, collar, and cilium in motion.

Fig. 31. The same, specimen of the same after the sponge had been immersed in spirit and water.

Fig. 32. *Grantia ciliata.* Quadriradiate spicule, magnified, on the scale of 1-24th to 1-6000th of an inch, common to the internal surface of the cloaca in most of the calcareous sponges; showing:—*a a*, the two arms, which are generally more or less curved; *b*, the straight arm, which generally presents a trace of axial canal (this is the common form of the *tri*radiate in this sponge

&c.); *d*, the fourth arm, which is curved *towards* the orifice of the cloaca *in situ*, and often joins the straight arm at a little distance from its union with the other two.

***Fig.* 33.** *Cliona corallinoides*, Hancock (Ann. Nat. Hist.), portion of, after having been dissolved out of the deciduous shell of *Cardium edule*, and dried; magnified 2 diameters: *a a*, pore-heads; *b*, vent.

***Fig.* 34.** The same, pore-head in the midst of a thalloid expansion of *Melobesia lichenoides*, beneath which the sponge had grown; taken from a dry-mounted specimen; magnified, on the scale of 1-48 to 1-1800th of an inch; natural size about 1-24th of an inch in diameter: *a a a*, border of the pore-area; *b b b*, tentacle-like prolongations of the sponge-structure, bristling, in the dried state, with the pointed ends of the pin-like spicules, and united together by the dermal sarcode, *c*, which fills up all the interstices, with the exception of the pore-openings, *d*.

***Fig.* 35.** The same, pore-area with vent in the centre, combined, but not communicating with each other: *a a a*, border of area; *b b b*, tentacle-like prolongations of the sponge-structure, bristling, in the dried state, with the ends of the pin-like spicules, and united together by the dermal sarcode, *c*, which fills up all the interstices but the pore-openings, *d*, and the vent, *e*; *f*, the pin-like spicules, which are omitted in the foregoing figure for convenience.

***Fig.* 36.** The same, diagram of vertical section of the pore-head and a portion of the areolar structure of the body, magnified, to show the absence of the excretory canal-system, whose function is supplied by the large efferent apertures, *c c c*, in the areolar cavities, *a a*; *b*, pore-head.

***Fig.* 37.** The same; all the different spicules relatively magnified, on the scale of 1-24th to 1-6000th of an inch: *a*, pin-like spicule of the pore-head; *b*, spinous curved acerate spicule of the areolar structure; *c*, minute tortuous spined spicules of the pore-area: *d*, the same, more magnified.

***Fig.* 38.** *Cliona celata*; ampullaceous sac of sponge-cells, showing the cilia vibrating internally ("Wimperkorb" of Schmidt); showing also the relative size of the sponge-cells compared with those of *Grantia compressa* in fig. 29, which are magnified to the same scale, viz. 1-12th to 1-6000th of an inch.

***Fig.* 39.** The same, reproductive or ovi-cell, to show its relative size when compared with the sponge-cells in fig. 38: *a*, nucleus.

***Fig.* 40.** *Leuconia Johnstonii.* Unciliated mouth of cloaca, much magnified, to show arrangement of the arms of the great quadriradiate spicules of the surface: *a*, vent; *b b b*, quadriradiate spicules; *c c*, their fourth arm projecting into the cloaca.

***Fig.* 41.** *Botryllus polycyclus.* Fragment of gelatinous mass showing a group of Ascidians, magnified; arranged round a common cloaca: *a*, integument; *b*, Ascidians; *c*, branchial orifice; *d*, anal orifice; *e*, common cloacal chamber; *f*, its vent.

***Fig.* 42.** Bell-shaped colourless infusorium, common on *Cladophora* in the freshwater tanks of Bombay. Cell about 1-7466th of an inch in diameter; total length about 1-1600th of an inch. Sessile, separate, in groups. Copied from a drawing in my journal, made in March 1857; to compare with Prof. James-Clark's figures of *Salpingœca amphoridium* (*l. c.* pl. 9. fig. 37).

II.—*Notes on Sylviads.*
By the Rev. H. B. Tristram, LL.D., F.R.S.

The observations of my correspondent and indefatigable ornithological friend, Mr. W. E. Brooks, C.E., have long been especially devoted to the Sylviad group as represented in India. I transmitted to him, to assist him in comparison, various specimens of European Sylviadæ from different localities. Mr. Brooks has drawn my attention to some peculiarities and variations in the specimens of *Phyllopneuste rufa* and *Ph. trochilus*, and suggested that there must be two species confounded under the name of *Ph. rufa*. I have, in consequence of my friend's remarks, gone very carefully through the group, examining the large series in the collection of Mr. Gurney, as well as my own and several others, and especially the Cambridge collection, which includes the type of Mr. Strickland's *Phyllopneuste brevirostris*. This specimen I have examined with the utmost care, and compared it with all my Holy-Land specimens. I observe, by its label, that Mr. Strickland seems latterly to have rejected his own species, and classed it as *Ph. rufa*. The examination, however, of a large series from the Holy Land forces me to the conclusion that there exist in Syria and Asia two distinct and cognate forms, side by side, each possessing certain recognizable diagnostics.

1. *Phyllopneuste brevirostris*, Strickl. — Long. tot. 4·75, al. 2·4, caud. 2·15, tars. ·75, rostr. a rict. ·4. Tarsi dark, as in *Ph. rufa*; but whereas in *Ph. rufa* the second wing-primary is equal to the seventh, in *Ph. brevirostris* it is shorter, and generally less than the eighth primary. This may seem a trifling diagnosis; but it holds good in all the specimens I obtained (about fifteen) in Palestine, and I never found the like elsewhere.

2. *Phyllopneuste rufa* (Lath.).—This species is still more abundant in winter in Syria than the former. I still possess of the number I collected nine specimens, all agreeing precisely with English, German, Algerian, and Greek examples. I found it in the same localities as the former species, which, after all, may be looked upon as a large race of *P. rufa*, with rounder wings. I find no difficulty in discriminating the two.

3. *Phyllopneuste trochilus*, L.—The range of our common willow-wren extends into Syria and Asia Minor, without exhibiting variations greater than in English specimens, though, of course, it is there only a winter visitant. It is also extremely common in Algeria and in the oases of the Sahara in winter.

4. I possess from Algeria and the Sahara four specimens

out of above a dozen, the remainder of which have been long since distributed, which do not correspond with the ordinary Algerian or British specimens, and which are decidedly larger than *Ph. trochilus*. They correspond in all proportions and specific characters, except that the second primary is relatively shorter than in *P. trochilus*, and is only barely the length of the sixth, which it always exceeds in the common species. This is evidently the bird mistaken by Temminck (Man. d'Orn. iii. p. 150) for the *Sylvia icterina* of Vieillot, a bird with a depressed bill, belonging to the *Hippolais* group. This bird, besides its larger size, has proportionally a much stronger and larger bill than the willow-wren. As Temminck's name cannot stand, I propose to designate it

Phyllopneuste major.

Long. tot. 5·3, al. 2·7, caud. 2·3, tarsi ·75, rostr. a rict. ·5. *Hab.* Southern Mediterranean coasts.

I am still prepared to acquiesce in its rejection, but think it well to notice it, as being undoubtedly the bird intended by Temminck when he described *S. icterina*.

III.—*Notes on New-Zealand Eared Seals.* By Dr. Hector, F.R.S.&c.

On the 13th of February last, during the visit of H.M.S. 'Clio' to Milford Sound, on the west coast of the South Island of New Zealand, three seals were shot by H.E. Sir George Bowen, which proved to be the Eared Seal or Fur-Seal of New Zealand, as it is termed by the traders *. They were shot from a boat while basking on ledges of rock; and although several others were mortally wounded, their great activity enabled them to scramble into deep water, so that only three were secured. I took the following measurements of the two largest, which were male and female adults. Both had the same form, colour, and general appearance, the male being the largest in every respect except the length of the hind flippers and tail, which were of slightly greater proportional dimensions in the female. The male weighed 258 lbs., and the female 208 lbs.

In both the snout was obliquely truncate, the upper surface being prolonged so as to overhang the mouth. Nostrils vertical elongated slits; nose jet-black; a few stout bristles on

* Only previously known as *Phoca ursina* of J. R. Forster, who gives a figure and account of it in Cook's 'Voyage,' and Buffon's 'Histoire Naturelle.'—J. E. Gray.

the snout, which is short and not separated from the head; head round; the eyes lateral; ears with slender, pointed tubular conch. Colour uniform black when wet, but when dry rusty in the male and grizzled in the female; scattered hairs rising from the fur; fur close, dense, and about half an inch deep; tips of the fur bluish, middle parts chestnut-brown, and pure white at base.

Flippers marked with a few chaffy scales; the anterior flippers with small nails immersed on the first four digits, and only a faint mark on the fifth. Posterior flippers with strong nails immersed on the three central digits, the first and fifth being feeble.

Table of Measurements, in inches.

	Male.	Female.
Total length	82	80
Nose to ear	9	8·5
,, angle of mouth	8	7·8
,, eye	4·5	4·5
Length of ear	1·8	1·7
Width of nose	1·7	1·7
Anterior flipper, length of exterior surface from shoulder-joint	31	29
Ditto, length of interior surface from axilla	17	16
Posterior flipper, length from hip-joint	15	16
Length of tail	4	4

Incisor teeth $\frac{6}{4}$, those external in the upper jaw resembling the canines in form and size; the others small, and feebly implanted in the jaw; canines very strong, and locking, 1·7 inch long; molars simple, conical, compressed.

One day the chase of five of these seals with the steam-pinnace in the still waters of the sound afforded a most exciting and novel kind of sport. The seals, startled by the snorting of the little high-pressure engine, instead of taking their usual dignified plunge out of sight, went off at full speed, diving and reappearing in order to get a glimpse of the unnatural monster that pursued them so closely. The utmost speed we could make barely kept up with them, until they began to show signs of distress, and one by one doubled and dived under the boat. Two of them, however, held out for a run of three miles, and succeeded at last in getting into safety among the rocks on the opposite shore. As all the ammunition had been previously expended by the party, except some small shot, the chase was productive of nothing more substantial than excitement. From the experience gained from the race, the pace at which the seals go through the water may be considered between six and seven miles an hour.

Colonial Museum, Wellington.
April 3, 1871.

IV.—*On the Agamic Reproduction of a Species of* Chironomus, *and its Development from the Unfecundated Egg.* By OSCAR VON GRIMM *.

[Plate III.]

Introduction.

"Nature goes on her way, and what seems to us an exception is according to rule."—GOETHE.

ALTHOUGH the parthenogenesis, that is to say the agamic reproduction, of many insects (such as the worker bees, humble bees, wasps, ants, Coccidæ, &c.) had long been known, people were disinclined to put any faith in the discovery of Prof. N. Wagner, of Kasan, that the larva of a Cecidomyid propagates asexually. For fully two years Wagner's discovery had to submit to unmerited mistrust, although it had been crowned with the Demidow prize by the St. Petersburg Academy of Sciences; and it was only in the year 1863 that it was published in the 'Zeitschrift für wissenschaftliche Zoologie.' But however incredible the fact discovered by Wagner might appear, it had at last to be accepted when it was completely comfirmed by the investigations of Meinert, Pagenstecher, Leuckart, Ganin, and Metschnikow. Nevertheless this alternation of generations among insects is regarded as an extremely rare case, although, in my opinion, we possess no satisfactory reasons for limiting it to a few insects; on the contrary, among the Diptera it appears to occur frequently, and although not in the greater number of these insects, still by no means only in a few isolated cases.

In the spring of last year (1869) I found in my aquarium a great number of ova, which afterwards proved to be those of a species of *Chironomus*, and which I employed for the investigation of the embryonic development. But when I surprised the egg-laying animal itself engaged in oviposition, I could not but subject it to a close examination, especially as it proved to be an imperfectly developed insect. I had conse-

* Translated by W. S. Dallas, F.L.S., from the 'Mémoires de l'Acad. Imp. des Sciences de St. Pétersb.' 7e sér. tome xv.

quently to do with a case of asexual reproduction by an imperfectly developed insect; that is to say, I had before me an insect which is subject to what Von Baer calls *pædogenesis* *.

But as I was obliged to interrupt my investigations during the whole summer, I resumed them in the autumn; and now, as it seems to me that I have attained to sufficiently interesting results, I venture to describe my researches, although I can perceive many deficiencies in my investigation.

I. *Pædogenesis of the species of* Chironomus *observed.*

In the eggs detected by me there were developed larvæ 0·47 millimetre in length (Pl. III. fig. 2), and very similar in their structure to the larvæ of *Chironomus* described by Weismann †. They are transparent, clear, and of a yellowish colour, possess a large head, a broad thorax, and a nine-jointed abdomen, the segments of which are pretty sharply separated from each other. The mouth consists of two pairs of very strong brownish jaws (*md*, *mx*), of which the lower pair, having the median margins soldered together, is converted into an immovable lip. The small palpi (*p*) attached to the upper lip are chiefly serviceable to the larva in feeding. The antennæ (*a*) are large and composed of six joints, of which the last four form a style, which is surrounded at the base by six setæ; the basal joint bears a large seta, nearly equal in length to the second joint. On the sides of the head the little eyes (*e*) are situated, with some brownish points near them. The thorax possesses on its ventral surface a transverse fold, which is divided in the middle by a deep furrow, and transformed into a pair of clinging-feet (*ff*). These are furnished with claws, the number of which afterwards increases. As the development of the larva advances the feet become elongated, until finally, after the casting of the third skin, they reach to the mouth (fig. 3, *ff*). The last abdominal segment also possesses a pair of feet (*hf*), which are likewise furnished with claws, but much stronger ones than those on the anterior feet. Besides these we find at the same place four finger-like processes (*f*), which are seated close to the anus, and serve for the respiration of the larva ‡. The upper angle of this same segment is furnished with two tufts of very long hairs. In the interior

* For K. E. von Baer on Prof. N. Wagner's discovery of larvæ that propagate, Ganin's similar and supplementary observations, and on pædogenesis in general, see Mél. Biol. de l'Acad. de St. Pétersb. tome v.

† Dr. A. Weismann, "Die Entwicklung der Dipteren im Ei, nach Beobachtungen an *Chironomus* sp.?, *Musca vomitoria* und *Pulex Canis*," Zeitschr. für wiss. Zool. xiii. p. 148.

‡ Weismann, *l. c.* p. 148.

of the larva the œsophagus, proventriculus (*pv*), stomach (*s*), and intestine are to be seen. The stomach is still filled with the remains of the vitellus. In the abdomen also we see the central nervous system, consisting of eleven ganglia: some of the anterior and posterior ganglia lie close together; but the middle ones distinctly show their double commissures.

This larva, constantly twisting about and working with its fore feet, whilst the hinder feet serve it rather as points of attachment, feeds upon the finest Algæ (*Spirogyra*), and at the same time surrounds itself with the detached filaments of the Algæ. These become interlaced by giving off side-shoots, and thus form a canaliform cocoon which is inhabited by the larva. Here it is constantly in motion, its abdomen twisting about in all directions; and this movement is indispensable to the larva, as by it the cocoon is widened and at the same time the deteriorated water contained in it is replaced by fresh. From time to time also the larva comes out and swims about very briskly in the water, still always moving in a serpentine manner. This occurs frequently at night. After such excursions the larva takes to the nearest cocoon without caring whether this belongs to itself or to another.

The larva grows very rapidly, so that within six or seven days it becomes four or five times its original length, and at the same time the second form of the metamorphosis, the pupa, is developed in it, the parts of which, such as the compound eyes, the feet, wings, &c., already shine very distinctly through the clear integuments of the larva (fig. 3). Even the ovaries do not slumber, ova are developed in them.

At last, after the third moult, the larva measures 4 millims. in length; its head has become much smaller in proportion; the fore feet have become elongated; the chitinous skin has acquired a very pretty, delicate rose-colour, which is most perceptible on the last abdominal segments, and is caused by the development of the pupa-skin*. The movements of the larva in the cocoon become perceptibly weaker, and finally cease almost entirely. It then casts off the fourth skin, and thus becomes transformed into the very remarkable pupa.

The pupa (fig. 4) measures 3 millims. in length, and has a longish head, which, when seen from the side, is not unlike that of a cat, a thorax with three pairs of very long legs, and a nine-jointed abdomen, which is covered with an immense number of paired small hairs and longer single setæ. The

* Leuckart, "Die Fortpflanzung und die Entwicklung der Pupiparen," Abhandl. der Naturf. Gesellsch. zu Halle, 1858, iv. p. 147.

sides of the abdominal segments exhibit longitudinal brown chitinous bands (*c b*), which serve as a support for the extremely delicate outer integument; these bands in the penultimate segment terminate in somewhat dilated lamellæ furnished at the margin with a few claw-like processes, which give them a still closer resemblance to a claw. In the middle of the lower surface of the same segment there are two oval apertures (*go*), through which the mature ova are expelled. Behind these is the smaller, but likewise oval, rudimentary anal orifice (*ao*). The very small terminal segment has on each side a rounded plate furnished on its margins with a series of very long and delicate hairs. At the boundary between every two abdominal segments a plumose hair is attached on each side to a cup-shaped cell; these are present also in the larva. The thorax is dilated on the dorsal surface into a shield (*pn*), which covers the head from above. At the sides of the thorax the embryonic wings (*w*) are attached, forming cases consisting of an extremely delicate membrane, which conceal within them the wings of the imago already formed and folded together. The wings of the perfect insect are developed even in the larva; for even in the youngest pupæ we may already see the hairs with which the wings are covered. The three pairs of legs are attached to the pectoral surface of the thorax; the first pair, seated at some distance from the posterior legs, have 4-jointed tarsi; the middle legs have 5-jointed, and the posterior again only 4-jointed tarsi. These legs are really the perfectly developed legs of the imago, only covered, in the same way as the wings, by a delicate envelope, through which the claws shimmer in the same way as the hairs of the wings. They are immovable; and being bent round the wings, they lie with these altogether upon the ventral surface of the pupa; so that all these structures together appear to the observer, at the first glance, exceedingly curious appendages; and this singularity of appearance is still further increased, because the pupa, in consequence of the wings lying thus upon its belly, swims about upon its back.

As already stated, the head of the pupa, when viewed from the side, is not unlike that of a cat. It is elongated and rounded off. At the sides of the head are the large, very prominent, pyriform eyes, between which the 6-jointed antennæ are attached. The mouth consists of a round aperture, which is situated at the apex of the conical cephalic appendage. The pupa has neither jaws nor proboscis, as it takes no nourishment. Superiorly this buccal appendage is covered by a row of strong and rather long setæ, the tips of which are approximate. The 4-jointed palpi are attached at the sides. Above the head, on the pronotum, there are two thick filaments, which are described by Weismann, in the pupa of *Corethra plumicornis*, as stigmatic branchiæ (*sb*). Of stigmata our pupa, as living in water, is entirely destitute. The tracheal system is comparatively very small; it consists of a main tube running through each side of the whole body, which gives off a few small ramified branches, of which the thoracic branch is the most considerable. The central nervous system consists of eleven ganglia united to one another by double commissures. The greater part of the abdomen is now occupied by the ova, which are already perfectly developed and lie irregularly in the body-cavity. But when the pupa is dissected, it is still not difficult to detect the ovarian parts with the undeveloped ova.

This pupa, which has emerged from the larva in the cocoon, quits the place of its birth, and after swimming about for a short time, extrudes the ova contained in it through the above-described apertures situated in the penultimate ventral segment. These are now placed in a very regular row * (Pl. III. fig. 1). They are, as has been stated, imbedded in a hyaline mass (*a*), and are attached by their whole surface to the glasses of the aquarium in the form of two cords, each 2·5 millims. in length. The pupa then dies; but in some cases, after depositing a small number of ova, it became further developed into the imago.

The case is quite different with the same pupæ in the autumn. Now, after undergoing the same development as in spring, differing in nothing except perhaps the much more considerable number of ova contained in them, they become transformed into the perfectly developed insect, a fly of the genus *Chironomus*, without depositing their ova. The abdomen of the escaped yellowish-green fly is shorter than that of the pupa, for which reason the two hindermost abdominal segments of the latter appear empty before the emergence of the fly. The pupa-case then bursts on the dorsal side; the fly first of all protrudes its abdomen, then draws the feet out of their tubes, then the head, and, lastly, the wings, which it finally unfolds, and then flies away, probably to deposit its fertilized ova, after copulation, again in the water.

* It is worthy of remark that, if the ova are taken earlier out of the parent organism and placed in water, they always take the same position; that is to say, they place themselves in the same order in which we find them in the homogeneous mass after they have been deposited by the pupa. Even when they have been scattered too far apart, a small movement of the water suffices to cause them to arrange themselves in a row, as if they possessed some attractive power.

It is therefore an insect living principally in the water, perhaps living only for a day or two, or even a few hours, in another sphere.

But if we remove from the perfectly developed insect, before it has yet quitted the pupa-case, the ova which would otherwise have been subjected to fecundation, and preserve them in water, the development of the larva takes place in them also; it only lasts a little longer (about six days), and is frequently obstructed.

We have thus seen that our *Chironomus* is subject to an alternation of generations, namely to *pædogenesis*. But this case of pædogenesis is somewhat different from that of the *Cecidomyiæ*, in which the second generation is produced agamically by the larva, and not by the pupa. This, however, of course, is of no very great consequence. Von Baer has already expressed the opinion that different animals may be subject to pædogenesis at different stages of development*. But, at any rate, our case of pædogenesis unites that of the *Cecidomyiæ* with the parthenogenesis of the Coccidæ, for example, especially because in the *Chironomus* the imago, which requires impregnation, is developed chiefly (perhaps, indeed, exclusively†) in the autumn—just as the Coccidæ produce their ephippial ova after copulation, and the agamic eggs without the cooperation of the male; but the larvæ of the *Cecidomyiæ* become converted into the imago, according to Wagner‡, when they find themselves under favourable conditions, without being subjected to the influence of the seasons. We shall see hereafter that both the structure and the development of the ova of *Chironomus* demonstrate this transition, inasmuch as they are perfectly identical with those of the Aphides and other insects, but not with those of the Cecidomyid larvæ.

Besides being subject to pædogenesis, our *Chironomus* appears to be not quite a stranger to parthenogenesis, at least in some instances, perhaps induced by artificial causes. Parthenogenesis, as is well known, is the designation of the agamic reproduction of perfectly developed but unfecundated females, to which worker bees§, humble bees, wasps, Psy-

* "Ueber Prof. N. Wagner's Entdeckung &c.," Mél. Biol. de l'Acad. de St.-Pétersb. v. p. 280.

† The instances of the development of the imago in spring have perhaps been influenced by the temperature of the room and other artificial causes.

‡ "Beitrag zur Lehre von der Fortpflanzung der Insectenlarven," Zeitschr. für wiss. Zool. 1863, xiii. p. 524.

§ In the bees it occurs rarely; but among the wasps, humble bees, and ants it apparently occurs constantly (Leuckart).

chidæ, &c. are subject. The ova of the perfectly developed *Chironomus* are also developed, as we have seen, without fecundation, when they have been removed from the parent organism.

II. *The Development of the Ovary and Ova.*

For the sake of clearness in discussing the developmental history of the ova, I must anticipate a little, and commence my description with the development of the ovary itself.

We shall see hereafter that the development of the embryo from the unfecundated ovum deposited by the pupa of our *Chironomus* is perfectly identical with that of the fecundated ova of the imago, which has also been found to be the case with the Cecidomyidæ*. We shall see the development of the germ- or blastodermic cells; we shall see that, of the germ-cell formation, one germ-ball precedes another, inasmuch as it enters earlier into the blastema-layer, and here, surrounded by the protoplasm, becomes converted into the nucleus of a membraneless cell; this cell passes into the inferior polar space of the ovum, and divides here into two and then into four cells, which are indicated as polar cells (fig. 5). Leaving the discussion of the embryonal development for the present, I will now direct attention to these polar cells, as they are the primordial forms of the subsequent generation, the two next generations, the germinal vesicles of which combine, or, in one word, represent the germs of the ovaries and ova†.

With the advancing division of the germ-cells the bulk of the contents of the ovum increases, so that the polar spaces soon entirely disappear, and the polar cells, which were placed in the inferior, acute polar space, bury themselves in the layer of the formative vitellus or blastoderm. When we trace their destiny further, we find them (at the moment of the production of the primitive caudal furrow, which soon disappears, and is apparently of no importance in the further development of the embryo, but, according to Weismann, "must only be regarded as the earliest expression of the bilateral type in

* Leuckart, "Die ungeschlechtliche Fortpflanzung der Cecidomyienlarven," Archiv für Naturg. 1865, p. 299.

† To these polar cells, which, according to Weismann (*l. c.* p. 208), are "so enigmatical," no embryologist, except Prof. Metschnikow, has paid any attention, or, at any rate, only Robin, who has founded upon them his theory of the origin of germ-cells by sprouting. Metschnikow was the first who recognized the polar cells in *Simulia* and *Cecidomyia* as the germs of the sexual glands. (See his 'Embryologische Studien an Insecten," pp. 31–33 & 103–105; and Zhurn. M. H. Pr. 1865, Th. cxxvi. 5. p. 113.)

accordance with which the embryo is to be built up"*) dividing into two groups (fig. 6), which then pass to the sides of the ovum. We then find that each of these groups, consisting of two nuclei, each with a nucleolar corpuscle, is surrounded by a homogeneous transparent mass, in which a few small hyaline corpuscles are enclosed. This mass has apparently been formed from the embryonal cells and the protoplasm of the polar cells, whilst the large nuclei with their nucleolar corpuscles, representing the nuclei of the polar cells, originate, as we shall see hereafter, from the germinal vesicles of the ovum or from the nucleus of the ovary of the preceding generation.

The nuclei of the embryonal ovary (fig. 7) increase by division; and the tertiary nuclei proceeding from them are each separately surrounded by a portion of the common protoplasm with the nucleiform embryonal cells contained in it; so that we may now regard the whole structure as a body which is composed of eight mutually independent cells: the protoplasm of these cells consists partly or, rather, chiefly of nuclei, *i. e.* embryonal cells. After the lapse of a certain time, when the embryo is already perfectly developed, the ovaries also have become more mature. We now find that the whole ovary has acquired a more elongated form; and from its superior extremity, or that directed towards the head of the embryo, there rises a thin filament, and the ovary itself encloses small corpuscles with a few nuclei, which represent the still imperfectly developed ovarian tubes.

In these embryonal ovaries, at the first glance, under a low power, we cannot overlook the agreement with those of the Cecidomyid larva as described by Leuckart†, Metschnikow‡, and Ganin§, and even with those of *Platygaster*, according to Ganin||. But, on a more careful examination of their further development, their difference becomes clear: they are in their whole nature perfectly similar to the ovaries of fully developed insects as described by Claus¶, Leydig**, and others.

* Weismann, "Die Entwicklung der Dipteren im Ei (*Chironomus*)," Zeitschr. für wiss. Zool. 1863, Bd. xiii. p. 115.

† "Die ungeschlechtliche Fortpflanzung der Cecidomyienlarven," Arch. für Naturg. 1865, p. 290.

‡ Embr. Studien an Insecten, Taf. 24. fig. 4.

§ Zapiski Imp. Ak. Pauk, 1865, vii. fig. 3.

|| "Beiträge zur Erkenntniss der Entwicklungsgeschichte bei den Insecten (*Platygaster*)," Zeitschr. für wiss. Zool. 1869, Taf. 30. fig. 3.

¶ "Beobachtungen über die Bildung des Insecteneies," Zeitschr. für wiss. Zool. 1864.

** Der Eierstock und die Samentasche der Insecten, 1866.

In our larva they are concealed among the adipose bodies (*corpora adiposa*), being situated in the seventh abdominal segment on each side of the intestine (fig. 3, *o*), so that they can only be seen occasionally during the movements of the adipose bodies and intestine; and if we wish to study them more continuously, we are compelled to have recourse to compression with the glass cover, as has already been stated by Leuckart*. Their intimate structure, however, can be studied only by preparation, by cutting or pressing them out.

To return to the developmental history of the ovary. The bodies, or composite cells, which we have seen in the embryonal ovary, representing the rudiments of the ovarian tubes, consist of a homogeneous protoplasm, in which the nuclei derived from the embryonal cells lie; among these nuclei the largest may easily be distinguished, as it only contains one nucleolar corpuscle, whilst the others, formerly embryonal cells, contain usually two, but sometimes even three. The large nucleus represents the nucleus of the cell, and originated, as we have already seen, from the nucleus of the polar cell; the whole structure, however, is nothing but a composite membraneless cell. Somewhat later we observe an elongation of this cell; and at the same time a membrane (*tunica propria*) is developed, which apparently originates from the protoplasm. Beneath this *tunica propria* there is a layer of fine epithelial cells, produced by the continued division of the embryonal cells.

The residuary nuclei of the ovarian tubes remain in the protoplasm, and now form the so-called *formative cells of the vitellus*; and the whole cell may now receive the name of an ovarian tube. Metschnikow, indeed, states that the formative cells of the vitellus originate from the nuclei of the polar cells, and the epithelial cells from the embryonal cells†, so that the ovum has nothing in common with the epithelial cells—"that the germ-cells stand in no genetic relation to the epithelial cells, and that only the germigenous and vitelligenous cells are of common origin"‡. But, in accordance with our direct observations, we must differ from Metschnikow's opinion, inasmuch as we deduce the genesis of both the vitelligenous and the epithelial cells from the embryonal cells.

These ovarian tubes, as we already know, pass into thin filaments, which are covered by a common membrane (the peritoneal envelope of the entire ovary), represent the undeveloped parts of the ovarian tubes §, and probably serve

* *Loc. cit.* p. 290.

† Embryologische Studien, p. 32. ‡ *Ibid.* p. 104.

§ Der Eierstock und die Samentasche der Insecten, p. 49.

for the attachment of the ovary*. But the question as to the course of this cord, and also as to its point of attachment, has remained unsolved by me. I cannot say whether it attaches itself to the Malpighian vessels, as in the Cecidomyid larvæ, according to Leuckart † and Metschnikow ‡, or to the adipose bodies on the one hand, and the intestine on the other, as is asserted of the same larva by Ganin §, or, finally, whether it runs to the dorsal vessel, as has been proved to be the case in many perfect insects by Leydig ‖; for latterly I had very few young larvæ, and in older ones it is almost impossible to solve this question, as the ovary at this time becomes very tender, so that it breaks up into fragments at the least touch. Unfortunately I have never succeeded in making a preparation of a mature uninjured ovary—that is to say, at the time when some ova are already perfectly developed but have not yet fallen out into the body-cavity. Even when the ovary still appeared quite strong and uninjured, when it could still be pushed

* It will be superfluous now to discuss the opinion of Johannes Müller that the lumen of this filament passes into that of the dorsal vessel, so that the whole of the ovarian tube would be nothing but an altered blood-vessel, and the ova be developed directly from the blood, seeing that, by Leydig's investigations, it is completely demonstrated that this union does not occur, and that only the peritoneal envelope passes into that of the dorsal vessel in some insects, whilst the ovarian tubes terminate cæcally before reaching the heart (Leydig, 'Der Eierstock &c.,' pp. 45–49). Moreover this was proved long before (in 1849, and therefore twenty years ago) by Meyer (Hermann Meyer, 'Ueber die Entwicklung des Fettkörpers, der Tracheen und der keimbereitenden Geschlechtstheilen bei den Lepidopteren," Zeitschr. für wiss. Zool. Bd. i.), who expresses himself as follows:—"We often see definitely that this point *terminates cæcally* at the dorsal vessel; and by this alone the signification of a vessel (which has frequently been ascribed to it) would be contradicted, even if the recognition of the significance of this cord did not unconditionally exclude any such opinion" (*l. c.* p. 183).

† "Die ungeschl. Fortpfl. der Cecid.," Archiv für Naturg. 1865, p. 290, fig. 2.

‡ Embr. Studien, Taf. 24. fig. 4, and Zhur. Mni. Par. Pr. 1865, May, p. 107.

§ Zap. Imp. Ak. 1865, p. 46.

‖ 'Der Eierstock &c.' It must, however, be remarked here that in the flies (e. g. *Musca domestica*) the ovaries do not attach themselves to the dorsal vessel (Leydig, *l. c.* p. 34). Meyer also, who has already been quoted, says, with regard to the Lepidoptera:—"A point (of the adipose body) regularly goes off anteriorly and attaches itself to the dorsal vessel; this subsequently serves for the attachment of the testis to the latter, and in the ovary it becomes the thread which runs from the anterior extremity of the ovary to the dorsal vessel" (*l. c.* p. 138). Under the name of the point (*Zipfel*) of the adipose body, Meyer means the peritoneal envelope of the ovary, as he himself states (p. 182), when he says the envelope "bears the character of an adipose-body lobe of the particular kind of adipose-body lobes which are arranged around the dorsal vessel."

to and fro with all its ova, the ova separated from one another and fell out of the ovary during its preparation, so that only rudiments of the ovary with a few undeveloped ova could be obtained. Notwithstanding this, I have thoroughly investigated the structure both of the entire ovary and of its individual parts. I frequently succeeded in extracting the ovary only partially, obtaining a fragment of the peritoneal envelope of the ovary, and a series of the remains of the ovarian tubes. These consist in the present case of not more than four chambers, reckoning even the least-developed one, representing the so-called vitelline or terminal chamber, according to Claus*.

A perfectly developed ovary of our larva (fig. 8) consists of a bundle of ovarian tubes, of which we have counted as many as eight†; these ovarian tubes consist, as we have frequently observed‡, of an extremely elastic structureless membrane, lined internally with a layer of epithelial cells. The contents of these tubes consist of a ductile mass§, in which lie the vitelligenous cells, which usually contain several nucleolar corpuscles, and a larger nucleus with only one nucleolar corpuscle. By the division of these contents a whole series of compartments or germ-chambers are produced, in each of which is developed an ovum; so that such a many-chambered‖ ovarian tube may be regarded as an egg-colony: comparing it, for example, to a Tapeworm—just as the latter consists of a series of independent individuals, which only cohere during the period of their incomplete development, and are arranged according to their degree of maturity, so also does the ovarian tube (but, of course, not its envelope) consist of a complete series of similarly arranged germ-chambers; those most highly

* "Beob. über die Bildung des Insecteneies," Zeitschr. für wiss. Zool. 1864, p. 43.

† Their number is very different in different insects. Thus *Liparis auriflua* has four ovarian tubes (Meyer), and some Coccidæ as many as twenty (Leuckart, "Die Fortpflanzung der Rindenläuse," Arch. für Naturg. 1857).

‡ This is mentioned also by Claus (in *Lecanium, l. c.* p. 43), Leydig (*l. c.* p. 52), and others.

§ Meyer says it is albuminous (*l. c.* p. 191).

‖ In each ovarian tube of many insects, as also in our *Chironomus*, several ova are constantly developed; but in others only one ovum is developed in each, as, for example, in *Lecanium* (Claus) and generally in most Coccidæ (Leuckart, "Die Fortpfl. der Rindenläuse," Arch. für Naturg. 1859, p. 216). However, no sharp limit exists between the single- and many-chambered ovarian tubes; for the ovarian tubes of some insects, as, for instance, *Chermes laricis* (Leuckart, *l. c.* p. 217), may be regarded as at once many- and single-chambered, because here the second germ-chamber is only formed after the complete development of the first.

developed are furthest from the terminal filament, and when they have attained a certain degree of maturity they fall apart like the proglottides of the Tapeworm.

The development of the ova, like that of cells, takes place by endogenous division. Each ovarian tube represents an elongated cell, as we have already seen; in this cell or tube the terminal portion of the contents with the half of the nucleus becomes constricted off (fig. 11), the nucleolar corpuscle having been previously divided *. A cell thus cut off is the germ-chamber, which, after the deposition of the vitellus, becomes directly and completely converted into the ovum; and that portion of the ovarian tube from which the germ-chamber has been constricted off may be designated the vitelline chamber or terminal chamber †, so long as it has not yet given off the following germ-chamber. Then commences the constriction of the second or younger germ-chamber, and afterwards that of the third, and so on. The contents of the separated cells or germ-chambers, the future ova, consist of large round vitelligenous cells ‡ (Stein). These vitelligenous cells extrude oil-drops, and at the same time become converted into the vitellus of the future ovum. The vitellus therefore originates from the same elements which have also formed the epithelial cells of the ovarian tube §. As the mass of the

* From this it is clear that the nucleolar corpuscle by no means plays so unimportant a part as Leuckart, for instance, supposes (art. "Zeugung," Wagner's Handwörterb. der Phys. Th. 4. p. 815); on the contrary, the nucleolar corpuscle appears, so to speak, to give the impulse of the division, superinduces the division of the nucleus, and therefore also the development of the germ-chamber corresponding to the ovum. But the nucleus appears to exert no such essential influence upon the division; for whilst it divides after the commencement of the constriction of the protoplasm, its function only commences subsequently. Lubbock says that the nucleolar corpuscle is only subsequently developed (see note *infrà*, §).

† Claus, "Beobacht. über die Bildung des Insecteneies," Zeitschr. für wiss. Zool. Bd. xiv. p. 43.

‡ Meyer calls the vitelligenous cells *abortive ova,* and to their nuclei, as also that of the germinal vesicle, he gives the name of *germinal vesicles*; thus he says, "the germinal vesicles of the abortive ova (*i. e.* the vitelligenous cells) become filled with a colourless, more or less finely granular fat, and sooner or later lose their nuclei" (*l. c.* p. 192).

§ Lubbock (On the Ova and Pseudova of Insects) is of opinion that the vitelligenous cells and the germinal vesicles are only altered epithelial cells. His "vitelligenous cells" become converted into the ova in the following way:—The nucleus of a cell of the kind becomes converted into the germinal vesicle by the later development of the germinal spot (nucleolar corpuscle); the membrane of this cell disappears, and the vitellus collects upon it, having been secreted by other but similar vitelligenous cells; and finally the vitelline membrane is developed. He has found this to be the case also with the pseudova; but here he could not attain certainty as to the genesis of the germinal vesicle (Report by Dr.

vitellus increases, it collects in the lower extremity of the ovum; and the nucleus, which is already the germinal vesicle, descending from the upper extremity, buries itself in the constantly increasing vitelline mass. The chorion, however, is formed by the activity of the epithelial layer of the *tunica propria*; but whether this structure is formed as a cuticular deposit of the epithelial cells, as described by Leydig*, or the epithelial cells are directly converted into the chorion, as stated by Stein†, I am unable to say‡.

It is therefore clear that the germinal vesicle of the ovum has originated from the nucleus, and the vitellus with the oil-drops and the chorion (corresponding to the epithelial cells of the *tunica propria*) from the vitelligenous cells, which represent the embryonal cells of the ovarian tube. But when we remember that the ovarian tube has been produced by the conversion of the polar cell, that the nucleus of the former (*i. e.* the ovarian tube) is only a portion of the nucleus of the latter (*i. e.* the polar cell), and the nucleus of the polar cell, again, is only a part of the germinal vesicle, we become convinced that this generation stands in direct connexion with the preceding one, and that its germinal vesicle is only a part of that of the first§.

W. Keferstein in 'Zeitschr. für rat. Medicin,' 1862, Bd. xiii. pp. 198, 199). The same opinion is also partially supported by Claus, who says that "epithelial cells, vitelligenous cells, and ova" (*i. e.* the germinal vesicles; but we have already seen that these are of different origin from the vitelligenous cells, and therefore we cannot agree with him) "are modifications of originally homogeneous elements, that they have proceeded genetically from the same cells, and by a different mode of development have attained such divergence of form" (*l. c.* p. 44). Stein thinks that the epithelial cells also take part in the formation of the vitellus; and Leydig is of opinion that they only secrete the chorion (Der Eierstock &c. p. 57); but nevertheless he admits their affinity to the ova in other animals, resting his opinion upon the investigation of La Vallette (*ibid.* p. 56, note 1). With regard to Metschnikow's opinion, *vide suprà.*

* Leydig very accurately describes the development of all the layers of the chorion in *Timarcha tenebricosa* (see his 'Eierstock und Samentasche,' pp. 11, 14, and 57, Taf. 2. figs. 7–10).

† Leydig, *l. c.* p. 59.

‡ Meyer ("Ueber die Entwicklung des Fettkörpers, &c.," Zeitschr. für wiss. Zool. Bd. i. p. 193) says that when the vitellus collects, the epithelial cells divide in the direction of the radii of the ovum, and lie with their outer ends on the chorion, and "strengthen it," and afterwards, "whilst the epithelial cells amalgamate with the chorion, they become thick-walled, unite firmly with each other, and lose their nuclei."

§ M. Ganin ("Beiträge zur Erkenntniss der Entwicklungsgeschichte der Insecten," Zeitschr. für wiss. Zool. 1869, p. 387) says:—"At any rate, it is clear that both the central cell and its nucleus (from which the embryo is developed) must be regarded as new formations." It seems to me, however, that this opinion is by no means correct, any more than Weismann's theory of the free formation of the germ-cells, which has recently been supported by Ganin in the Pteromalinæ (*ibid.* p. 439).

This connexion will be rendered clearer by the following table:—

Ovum of generation 1.	=	Germinal vesicle.	+	Formative vitellus.				
Polar cell.	=	Nucleus of the polar cell.	+	Protoplasm.		Embryonal cells.		
Ovarian tube	=	Nucleus of the ovarian tube.	+	Tunica propria.	+	Vitelligenous cells.	+	Epithelial cells.
Ovum of generation 2.	=	Germinal vesicle.	+			Vitellus.	+	Chorion.

The ovum, now fully developed, which originally, as we have seen, had an elongated form, contracts and acquires a spherical form. We see now that the vitelline mass, with the oil-drops enclosed in it, occupies one half of the ovum, the other half being still occupied by the vitelligenous cells; the nucleus of the germinal vesicle has disappeared; the epithelial cells have become fewer, for where the vitelligenous cells are placed, and where the vitellus is imbedded, they are no longer to be seen, being replaced by the chorion. The ovum does not long retain the spherical form; before it has become quite filled with the vitellus, its form again undergoes an alteration, becoming oval, and finally egg-shaped.

Both the summer (pseudova) and winter ova (ova) are developed in the manner above described*. Moreover these two kinds of ova are not distinguished by their structure. Even resting only upon these two facts, we cannot, with Huxley, designate the one form as eggs (*ova*) and the other as false eggs (*pseudova*). It is true that fecundation is taken as the basis of this distinction, those ova which require fecundation for the development of the embryo being called *true*, and those which furnish the embryo without the aid of the male element *false* ova; but even if we are to rely upon the act of fecundation, we must distinguish the product of the development caused by fecundation from the product of the development which has taken place without fecundation, but not the ova, which truly, as Claus has stated quite correctly†, do not acquire the character of the product of the sexual organs by fecundation. Nay, the designation of the summer ova as

* Lubbock has found the same thing: according to him the ova and pseudova are developed in accordance with one and the same type: but "he expresses himself more doubtfully with regard to the origin of the germinal vesicle in the pseudovum" (Keferstein).

† Claus, "Beobachtungen, &c.," Zeitschr. für wiss. Zool. Bd. xiv. p. 51.

false ova we regard as the less justifiable because, according to our observation already communicated, the development of the embryo also takes place in the winter ova without previous fecundation by the male.

Of course our opinion will lose nothing, even should it in time be proved that no evolution takes place without fecundation in the animal kingdom, *i. e.* that the cases of parthenogenesis and pædogenesis are only cases of self-fecundation.

It will not be superfluous to remark here, that in my judgment the fate of the parthenogenesis of plants awaits the theory of the agamic reproduction of some animals. As in the former case the parthenogenesis set up by Radlkofer and Alex. Braun has been brought down to the grade of ordinary hermaphroditism by the investigations of Regel, Karsten, De Bary, Schenk, and many others, so also it will probably be proved for the animal kingdom that some parts of the ovary produce spermatozoa instead of ova—which, indeed, may very easily be possible, as the ovary and the testis are originally perfectly similar structures.

Not long since I learned that H. Balbiani is now publishing his memoir upon the Aphides, in which he endeavours to demonstrate the hermaphroditism of those insects; and thus the supposition above expressed is already confirmed. Unfortunately I have been unable to make myself acquainted with this work.

[To be continued.]

V.—*Contributions to the Fauna of the Upper Tertiaries.* No. I. *The "Mud-deposit" at Selsey, Sussex.* By Alfred Bell.

It is now some twenty years since Mr. Dixon, of Worthing, called the attention of geologists to a superficial deposit upon the sea-shore of the Sussex coast, near Selsey, eight miles south of Chichester, to which he gave the name of "mud-deposit." This deposit was afterwards fully described by Mr. Godwin-Austen in a paper upon the Newer Tertiary Deposits of the Sussex Coast, read before the Geological Society and published in their 'Quarterly Journal,' 1857. Both these gentlemen gave lists of fossils; but, owing to unfavourable circumstances, the beds or scattered patches being very inaccessible, and only workable at low tides, the lists only enumerate about forty-five species of various organisms. Some favourable opportunities presenting themselves last summer and autumn, I was enabled to add materially to these lists; and as the results *prove* the deposit to be unique as regards the fauna (which, as pointed out by the above gentlemen, had a southern facies), a detailed description of the whole may not be unworthy of a place in the 'Annals and Magazine of Natural History,' prefaced by a few words indicative of the position of the deposit itself.

Seldom visible, it extends in patches along the shore of the Selsey peninsula, from Bracklesham to Pagham, with a slight extension inland and a greater one seawards. It is capped by a clay full of ice-borne boulders of all sizes and formations, some of them being of French origin, others of the far west of England (none of these, as far as I can find, bear traces of the striæ so common on rocks of the true glacial period). This in turn is overlain by a water-worn gravel containing marine or estuarine shells, corresponding in age to the "elephant-gravel" of Dr. Mantell. Above this is a deposit of Löss, the ordinary vegetable soil covering all. Speaking of the Löss, I may say, *par parenthèse*, that many English geologists confound this with ordinary fluviatile deposits, forgetting that the Löss may be identified by its fauna, which is purely terrestrial; and, judged by this standard, the only English localities for this deposit are the present, which reaches nearly to the Goodwood Hills, some patches in the Medway gravels, and another on the shore at Swale Cliff, near Herne Bay.

The Mud-deposit itself is composed of a grey sandy mud, full of organisms and small stones, and, when last seen by myself, was covered by a layer of bright-yellow sand, and that again by the ordinary rolled shingle and sand of the shore. It was only by digging through this that I could reach the bed below half-tide.

The presence of a large river having access to the bay or estuary would account for the mammals, land-shells, pieces of wood, &c. found intermixed with the marine remains.

Of the 140 shells, 30 do not exist nearer than the west of England, the Channel Islands, or North Spain, 6 or 8 not passing this side of Gibraltar, all being littoral (or sublittoral) species. As British quaternary fossils, 42 are peculiar to Selsey (unless otherwise mentioned), and 20 others probably find here their earliest place in British geological history.

The recent South-European forms are marked †, the peculiar Selsey fossils *.

List of Fossils from the Selsey "Mud-deposit."

MAMMALIA.

Elephas antiquus, Falc.
—— *primigenius*, Blum.
Equus caballus, L.
Bos, sp.
Cervus elaphus, L.
Capra hircus?, Gmel.

PISCES.

Otolites, three species, of doubtful origin.

CRUSTACEA.

Carcinus Mœnas, L.
Pagurus Bernhardus, L.
Bairdia, sp.
Balanus crenatus, Brug.
Verruca Stromia, Müll.

MOLLUSCA.

Anomia ephippium, L. (small).
Ostrea edulis, L.
—— ——, var. *parasitica*, Turt.
Pecten maximus, L. (valves united).
—— *opercularis*.
†*—— ——, var. *Audouinii* (very rare). *Hab.* S. Europe.
†*—— *polymorphus*, Bronn (with valves united). *Hab.* Portugal and S. Europe.
—— *tigrinus*, Penn. (one valve).
—— *varius*, L.
Mytilus edulis, L.
—— *ungulatus*, L.
Modiolaria discors, L. (one valve).
Nucula nucleus, L.
—— ——, var. *radiata*, Hanl.
Lepton nitidum, Turt.
Montacuta bidentata, Turt.
**Lasea rubra*, Mont.
Kellia suborbicularis, Mont.
Cardium edule, L.
—— *exiguum*, Gmel.
—— *echinatum*, L.
—— *fasciatum*, Mont.

Cardium nodosum, Turt.
*—— *papillosum*, Poli. Nearest habitat, Channel Islands.
—— *tuberculatum*, L.
Lucina borealis, L.
**Loripes lacteus*, L.
Axinus flexuosus, Mont.
**Diplodonta rotundata*, Mont.
Cyamium minutum, Fabr. Lochaber and Belfast are the only recorded localities for the fossil shell.
Cytherea chione, L. And in the Macclesfield Drift.
Venus ovata, Penn.
—— *verrucosa*, L.
Tapes aureus, Gmel. Also an Irish fossil.
*—— ——, var. *quadrata*, Jeffr.
—— *decussatus*, L. (very large, with valves united).
—— *pullastra*, W. Wood.
—— *virginea*, L.
Tellina balthica, L.
**Gastrana fragilis*, L. (double, and excessively rare).
Mactra stultorum, L.
—— *subtruncata*, Da C.
Lutraria elliptica, Lam.
—— *oblonga*, Chemn.
†*—— *rugosa*, Chemn. (valves united, but rarely found). Range: Portugal to Tunis, Canary Islands.
Scrobicularia piperita, Gmel.
Syndosmya alba, W. Wood.
*—— *tenuis*, Mont.
Solen siliqua, L.
*—— *vagina*, L. (*in situ*, very finely preserved).
**Pandora inæquivalvis*, var. *rostrata*, Leach. The Channel Islands is the nearest locality for the recent shell.
Corbula gibba, Olivi.
Mya arenaria, L. (Dixon).
—— *truncata*, L. (occasionally with the siphons partially preserved).
Saxicava rugosa, L.
Pholas candida, L.
—— *crispata*, L. Enormously large: one has been met with 6 inches in breadth. The nearest in size I have seen to this monster is from the Belfast Clay, measuring 4½ inches. It is not known to attain this size now.
—— *dactylus*, L. (double, and very large).

Helix hispida, L.
—— *nemoralis*, L., and var. *hortensis*, Müll.

**Dischides Olivi*, Scacchi (very rare). Ranges from Gascony to Teneriffe and the Mediterranean Sea.

†**Dentalium dentalis*, L. (moderately common, but small). *Hab.* West France to the Canaries and the Ægean Sea.

—— *tarentinum*, Lam.

**Chiton fascicularis*, L.

*—— *discrepans*, Bronn. Nearest habitat, Cornwall.

*—— *marginatus*, Penn.

†*—— *siculus*, Gray. Range, Cadiz to the Ægean Sea.

Patella vulgata, L.

Tectura virginea, Müll.

Fissurella græca, L.

†*—— *costaria*, Grat. (=*F. neglecta*, Desh.). Range: South France and the Mediterranean Sea.

Trochus cinerarius, L. (abundant).

*—— *exasperatus*, Pult. Sir H. James records it from Wexford.

—— *lineatus*, Da Costa. I only know it from Barnstaple. The Scotch localities are doubtful.

—— *magus*, L. Adult shells scarce, young shells plentiful. I have not met with a description of the young shell, which loses some of its characters as it approaches maturity, and therefore give one:—

Shell depressed; whorls 4–5, flatly convex, with close-set spiral ridges, the two at the base of each whorl being stronger than the others, and forming a deep suture as it increases in size, the whole intersected by fine striæ, which are more developed between the ridges, and most of all so within the two just referred to. The interior is nacreous, and the umbilicus small.

*—— *striatus*, L. (very rare).

—— *tumidus*, Mont.

—— *umbilicatus*, Mont.

—— *ziziphinus*, L.

**Phasianella pullus*, L. I have seen it in an Irish deposit, but from no other English formation than at Selsey; very plentiful and bright-coloured.

Lacuna puteolus, Turton.

—— *pallidula*, Da Costa.

Littorina littorea, L.

—— *obtusata*, L.

—— *neritoides*, L.

—— *rudis*, L. All very common.

—— ——, var. *nigrolineata*, Phil.

—— ——, ,, *saxatilis*, Johnst.

—— ——, ,, *tenebrosa*, Mont. The colour in this variety is exceedingly well preserved, as, indeed, it is in all the species into which red or purple enters as part of the colouring. *Pecten polymorphus*, *Phasianella*, *Pleurotoma lævigata*, and some of the *Trochi* may serve for examples.

Hydrobia ulvæ, Penn., and var. *subumbilicata*, Mont.

(*Assiminea Grayana*, Leach (?). On the authority of Mr. Sowerby. I have not seen it.)

†**Rissoa cimex*, L. (moderately common). Ranges from South Spain to the Ægean Sea.

—— *costata*, Adams.

*—— *costulata*, Alder.

*—— *lactea*, Michaud. Nearest habitat, Channel Islands. "Our rarest *Rissoa*," Jeffr.

—— *membranacea*, Adams.

*—— ——, var. *venusta*, Phil.

*—— ——, var. *elata*, Phil.

—— *parva*, Da Costa, and var. *interrupta*, Adams.

*—— *punctura*, Mont. (Jeffreys).

—— *striata*, Adams.

—— *striatula*, Mont. There are but two other localities in Britain recorded for this exquisite shell,—Largs and Lochgilphead.

Turritella terebra, L. (non Lam.) = *T. communis*, Risso.

Scalaria communis, Lam. (very rare).

**Aclis unica*, Mont.

Odostomia acuta, Jeffr.

—— *conoidea*, Broc.

—— *pallida*, Mont.

—— *plicata*, Mont.

*—— (*Chemnitzia*) *lactea*, L. Is also a Belfast fossil.

—— (——) *indistincta*, Mont.

*—— (——) *suturalis*, Phil.

*—— (——) *rufa*, Phil.

Natica catena, Da Costa.

—— *Alderi*, E. F.

**Adeorbis subcarinatus*, Mont. Is also an Irish fossil.

Cerithium reticulatum, Da Costa.

Purpura lapillus, L.

Buccinum undatum, L.

Nassa incrassata, Ström.

—— *reticulata*, L.

*—— *nitida*, Jeffr.

Murex erinaceus, L.

**Lachesis minima*, Mont. Much larger than the recent British forms.

**Defrancia reticulata*, Renier.

†**Pleurotoma Bertrandi*, Payr. Ranges from South France to the Morea.

*—— *lævigata*, Phil. This is the typical form, which is not found living north of the Channel Islands. It is a rare fossil.

—— *rufa*, Mont. (moderately common).

*—— ——, var. *semicostata*, Jeffr. *Hab.* Channel Islands.

—— *turricula*, Mont.

Cypræa europæa, Mont.

Utriculus truncatulus, Brug.

—— *obtusus*, Mont.

*—— *Lajonkairiana*, Bast.

**Bulla hydatis*, L. (fragments only).

**Conovulus bidentatus*, Mont.

Rhizopoda.

Cornuspira foliaceus, Phil.

Biloculina, sp.

Echinodermata.

Echinocyamus pusillus.

Spatangus purpureus.

VI.—*On the American Eider Duck.* By R. B. Sharpe, F.L.S. &c., Librarian to the Zoological Society of London.

Some time ago I received a hint from Mr. D. G. Elliot, so well known for his great work on the Birds of North America, that the Eider Duck of Europe was not identical with the Eider of America, although both species had, from the time of Linnæus, been united under the name of *Somateria mollissima.* Mr. J. H. Gurney also wrote to me independently on the same subject; and having had occasion to examine the matter when writing the history of the Eider Duck for the 'Birds of Europe,' I find that the surmise of both Mr. Elliot and Mr. Gurney is correct, and that the American *Somateria* is not the same as the European species. To begin with, the American Eider Duck is a very much finer bird than its European congener, and both male and female have the sickle-shaped inner secondaries more fully developed. The chief difference, however, lies in the bill, the form of which in each species is illustrated by the accompanying woodcuts.

From these it will be seen that in *Somateria Dresseri*, as I propose to name the American bird, the bare ridges running up from the nostril to the eye are very much broader, and also differ in being distinctly rugose. Again, the sea-green

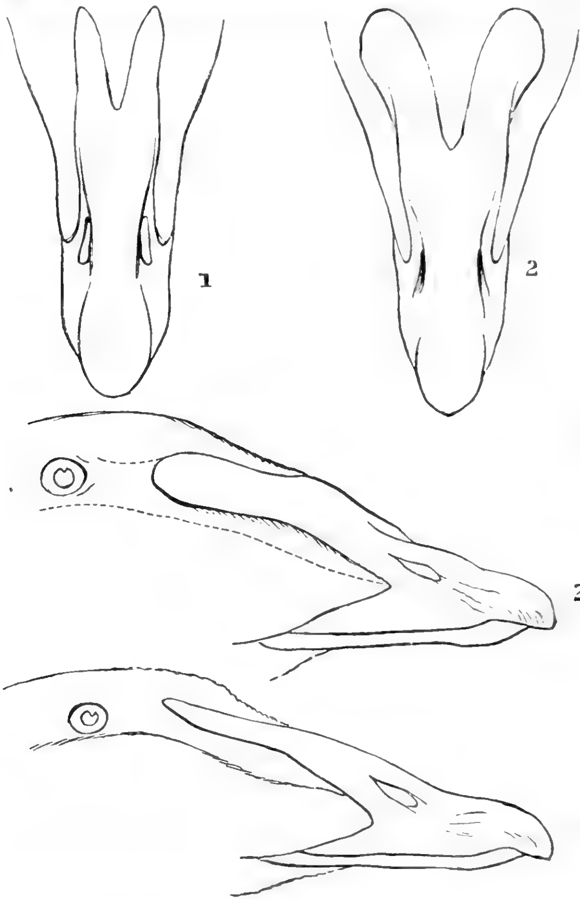


Fig. 1. *Somateria mollissima.* Fig. 2. *S. Dresseri.*

colour, which in *S. mollissima* is confined to the hinder portion of the auricular region and the nape, in *S. Dresseri* extends along the cheeks and on the occipital line of feathers which part the hinder portion of the crown. I have therefore no hesitation in giving the American Eider a new name, and propose to call it, after my excellent colleague in the 'Birds of Europe,'

Somateria Dresseri, n. sp.

♂. Similis *S. mollissimæ*, sed conspicue major: genis, regione parotica cum nucha et striga occipitali viridi clare lavatis; rostro robustiore, cera lata rugosa.

Long. tot. 27, culm. 2, alæ 11·8, caudæ 4·3, tarsi 1·35.

On comparing the above measurements with those of the European species, it appears that the latter has a longer bill and tarsus. The females of the two species, as might be expected, do not differ very conspicuously; but that of the American bird is much larger in size, and exhibits the same difference in the nasal ridges.

VII.—*On the Vermes collected by* M. von Heuglin *in the Sea of Spitzbergen.* By Prof. Ehlers*.

The catalogue here given, as regards the Chætophorous Annelides, supplements Malmgren's admirable memoirs ("Nordiska Hafs-Annulater," Œfvers. af K. Vet. Akad. Förhandl. 1865, and 'Annulata polychæta,' Helsingfors, 1867), which have disclosed to us the Annelidan fauna of the Arctic Sea. The names employed by Malmgren are therefore retained here, without, however, any intention of thus expressing an unconditional acceptance of the numerous genera established by Malmgren.

Annelida polychæta.

Nychia cirrosa (Pall.). Storfjord (Wybe Jans Water).

Harmothoë imbricata (L., Malmgr.). Storfjord.

Numerous examples and many colour-varieties.

Antinoë Sarsii (Kinb.). Storfjord. Zweigletscherbucht (Mohn Bay).

This species, of which there are numerous specimens, occurs in two races definitely separated by difference of colour; and as Malmgren only mentions one of these, both of them may be here briefly described. The more abundant form presents the coloration which, according to Malmgren, distinguishes the Spitzbergen form from the Baltic one; the inner margins of the elytra are broadly chestnut-brown; the dorsal (and sometimes also the ventral) surface exhibits a light ground-colour, upon which there are light brownish band-like markings; sometimes the whole coloration is uniform; in other cases the elytrophora were of a deeper brown colour. The largest animals of this form were of the size given also by Malmgren for the Spitzbergen form, viz. 35 millims. in length and 17 millims. in breadth, including the setæ.

The other race possesses a clearly marked coloration and pattern. The elytra are broadly bordered with greenish grey on the inner and hinder margins, and usually bear, at the

* Sitzungsberichte der phys.-medic. Societät zu Erlangen, June 7, 1871. Translated by W. S. Dallas, F.L.S., from a separate impression communicated by the author.

point where the inner marginal part passes into the hinder, a darker spot of the same colour projecting a little towards the light central surface; the ground-surface of the elytra is in other respects of the same pearl-grey as in the preceding race. The ventral surface and the rami are colourless; the dorsal surface of each segment bears a sharply bounded banded marking of dark greyish-green colour, the arrangement of which in general is such that a broad transverse band runs in the middle of each segment, and is continued, either of the same width or becoming narrower, to the apices of the dark-coloured elytrophora; before and behind this band there is a concolorous narrower one, which is separated from the main band by a fine line of the pale ground-colour, and bounded anteriorly or posteriorly by the colourless margin of the segment. If the pigmentation extends further, the whole dorsal surface of the segment may appear coloured, with the exception of a fine pale line, running in front and behind, near and parallel to the colourless margins of the segment. If the pattern is less distinctly marked, it resembles the dorsal pattern of an *Harmothoë imbricata*; if it is strong, it reminds one of the coloration of *Melænis Loveni* (Malmgr.). Two large specimens with strong coloration, now before me, were so much the more like *Melænis Loveni*, because they bore quite small, and evidently newly formed, elytra, and the number of setæ in the upper branch of the ramus was considerably diminished. The animals of this form attained larger dimensions than the brown ones; the largest was 46 millims. in length, and, with the setæ, 24 millims. in breadth.

These varieties of *Antinoë Sarsii* from the Spitzbergen Sea acquire a special interest when we compare them with the variety living in the Baltic. According to Malmgren, this smaller Baltic form possesses a greenish dorsal coloration and elytra with brownish margins; it thus occupies a middle place between the two races from Spitzbergen now before me, of which one possesses only greenish-grey, and the other only brownish pigment.

Malmgren has already shown that *Antinoë Sarsii*, which occurs only in the northern part of the Gulf of Bothnia, is to be numbered among those animals the limited diffusion of which here is explained by Lovén's view, according to which the Baltic was united with the Arctic Sea, in the glacial period, through the White Sea and Bay of Ladoga. If the present form of *Antinoë Sarsii* in the Baltic differs from its relatives at Spitzbergen by its smaller size, this is in accordance with the observation repeatedly made that marine animals diminish in size during adaptation to less saline water, as in the present case the water of the Baltic is; but with regard to the peculiar coloration of the Baltic form, it seems probable that this has retained, since the glacial period, the original coloration, from which the two races of the Spitzbergen Sea have subsequently been developed by differentiation.

I may remark, further, that I found in the intestine of one of the largest greyish-green animals a perfectly preserved bivalve shell (*Nucula*, sp.) 8 millims. in length, 4 millims. in thickness, and 6 millims. in depth, an evidence of the large size of the animals which these worms are able to seize upon for their nourishment.

Melænis Loveni (Malmg.). Advent Bay, Zweigletscherbucht.

Nephthys longisetosa (Œrst., Malmg.). Storfjord.

Phyllodoce grönlandica (Œrst., Malmg.). Storfjord.

Mysta barbata (Malmg.). Storfjord.

New to the arctic fauna. Malmgren knew the animal only from the shore of Bohuslän.

Eteone arctica (Malmg.). Advent Bay.

Nereis zonata (Malmg.). Zweigletscherbucht.

Lumbriconereis fragilis (O. F. Müll.). Storfjord, Zweigletscherbucht.

Scoloplos armiger (Müll.). Storfjord.

Travisia Forbesi (Johnst.). Storfjord.

Brada inhabilis (H. R.). Storfjord.

Brada granulata (Malmg.). Zweigletscherbucht.

Amphitrite cirrata (Müll.). Storfjord.

Scione lobata (Malmg.). Storfjord.

Of this species I found a large specimen, which agreed in all points, except a peculiarity which will be mentioned immediately, with the description given by Malmgren. The worm was enclosed in its tube, which consists of a fine smooth membrane, the outer surface of which was coated by a dense mass of mud, to which various kinds of foreign matters adhered. It was very remarkable that a little way behind the orifice of the anterior, wider portion of the tube, the wide entrance into it was closed by a transversely placed plate, as if by an operculum; for a closure of this kind, such as occurs in the tubes of Serpulaceæ, has not, so far as I know, been hitherto observed in a tube which evidently belonged to a Terebellacean. I therefore split up the tube longitudinally with care, exposing its inmate, the *Scione lobata*, and ascertained that in reality the closure of the tube was effected by an operculum which was formed by a tentacle of the worm. Immediately behind the operculum was the worm, and nearest to it the closely compressed circlet of tentacles. On examining the worm after its removal, I was able to ascertain with certainty that one of the tentacles bore the disciform operculum; but during my endeavours to ascertain precisely the position of this specialized tentacle among the rest, it separated, with a number of the neighbouring filaments, and I could only make out with certainty that it had its place not in the median line but in the right half of the bundle of tentacles. On the isolated tentacle there could be distinguished the piece (11 millims. in length) by which the filament was attached to the cephalic lobe among the others, the operculiform circular plate effecting the closure (with a superficial diameter of 3 millims.), and a filiform piece (2·5 millims. in length) which projected freely from the centre of the outer surface of the operculum. With the aid of the microscope it was ascertained that the operculum was composed of the same tissues as the filament; but the mode in which the opercular disk may be formed from the filament is not quite clear to me. On the surfaces of the disk there was a chitinous cuticle, such as occurs on the tentacles; and this was evidently in connexion with the above-mentioned sections of the tentacular filament on each surface in the centre of the disk; and thus it might seem as if the disk were formed by a duplicature of the wall of the tentacle, perhaps by a portion of the tentacle being compressed discoidally by a pressure acting in the direction of its longitudinal axis. In the space between the two lamellæ forming the disk there were, besides a small quantity of connective tissue, a number of spherical bodies, which, perhaps, are to be regarded as corpuscles of the body-fluids. The point in connexion with the structure of the disk into which I could not get a clear insight was, that in the interior of the disk and closely approximated to its margin there was a short filament, which fell out when I removed the chitinous cuticle of one of the surfaces: in its appearance the filament resembled a piece of tentacle; one of its extremities was apparently intact, and the other evidently injured, as if the little filament had been here torn away. I must leave the more accurate investigation of this opercular disk to others, who may have more abundant material at their command. Here I would only call attention to one or two points. In the first place the evident homology which exists between this operculum of a Terebellacean and that of a Serpulacean; in both cases one of the appendages issuing from the cephalic part is modified in such a manner as to form an operculum; and although the thin opercular disk of our *Scione* does not attain the development of the strong operculum of the Serpulaceæ, on the other hand it displays the peculiarity of possessing, in the little filament which springs from the outward wall, a structure which evidently represents the variously formed processes of many Serpulacean opercula. Future observers will also have to take into consideration whether the operculum of *Scione*, like that of many Serpulaceæ, plays any part in the business of reproduction.

It still remains to be noticed as remarkable that this structure is not mentioned by Malmgren, who is so circumspect, especially as it is evident that he had before him numerous specimens of the worm from various localities. I cannot suppose that in my case we have to do with a structure produced by accident, or one which is to be regarded as a singular malformation, which has led, in this instance, to the formation of an organ analogous and homologous with the operculum of the Serpulaceæ. Here, also, the examination of more abundant material will decide whether the occurrence of the operculum in this worm is unexceptional, or on what conditions it depends.

Ereutho Smithi (Malmg.). Storfjord.

Terebellides Strömii (Sars). Storfjord.

Sabella spetsbergensis (Malmg.). Zweigletscherbucht.

Potamilla, sp. Zweigletscherbucht.

Of this genus, established by Malmgren, of which no Spitzbergen species has hitherto been known, I have an animal before me which I cannot identify with any of the described species. The description given by Malmgren of *Potamilla neglecta* (Sars) suited it best; and I should probably have entertained no doubt of having to do with that species, had not the proportions of the body been quite different from those of the above-mentioned species. For whilst in the latter the branchiæ are nearly half as long as the rest of the body, they are considerably smaller here; for the body, consisting of 30 segments, measuring 20 millims. in length, whilst even the last segments are deficient, bears a branchia only 4 millims. long. The tube consists of a membrane which is for the most part coated with sand-grains and fragments of various kinds, and also in part possesses a muddy coat. The single specimen before me, which, moreover, is not uninjured, does not suffice to make sure whether we have to do with a new species or what its characters are.

Euchone rubella, n. sp. Advent Bay.

Body colourless, stout, of uniform thickness throughout its length, consisting of 34 segments, 30 millims. in length, 2 millims. in breadth, with short branchiæ 3 millims. in length. First segment with the straightly extended gorget, which is but slightly emarginate on the ventral surface, nearly as long as the four following, concave in the middle of the ventral surface, on the dorsal surface convex, emarginate towards the following segment; the next segments three times, and those of the middle of the body once and a half as broad as long; extremity of the body linguiform, depressed, with greatly abbreviated segments, and a broad anal furrow, which extends for a distance of 2·5 millims. over nine segments. Ventral furrow sharp on the ventral surface of the posterior part, deviating to the left on the ninth segment; on the back of the first eight segments a distinct faint longitudinal furrow. Ventral scutes broad, rectangular, contiguous. Setæ yellowish red, especially on the hinder part of the body, slender, with a narrow wing-like border, and shorter and rendered almost spatuliform by a broad wing-border; the bundles formed by them increase considerably in length on the hinder segments, and are directed forwards, lying close to the body. Uncini of the anterior segments with a long shaft and the point bent at a right angle, its edge being finely serrated; those of the posterior segments short, with a broadly dilated base and a strong terminal hook, the edge of which is serrately denticulated. Each half branchia formed of 9 rays, which are united for more than half their length by a membrane; with fine, slender branchial filaments, which extend to the apex of the bordered branchial ray, but here become very short. On each side four slender tentacular cirri. The tube of the worm clothed with a black coat of mud.

As I cannot identify this animal with any of the described species, I propose for it the above name, and remark further that the remarkable shortness of the branchiæ and the very striking coloration of the setæ suffice for its recognition at the first glance. In habit the animal most closely resembles the *Euchone rubrocincta* (Sars), figured by Malmgren, from which it is distinguished by the two forms of straight setæ and by the number of branchial filaments and tentacular cirri. It is equally easy to distinguish from *Euchone analis* (Kr.) and *E. tuberculosa* (Kr.), which are found near Spitzbergen—from the former by its general habit, as well as the form and number of the branchial filaments and tentacular cirri, and from the latter essentially by the different nature of the ventral scutes.

Gephyrea.

Phascolosoma Œrstedii (Kef.). Zweigletscherbucht.

There is one specimen which agrees, within a few details, with the description of *P. Œrstedii* given by Keferstein (Zeitschr. für wiss. Zool. xv. 1865, p. 436). From the end of the body to the anus the animal is 17 millims. in length, and in this portion it has a thickness of 4 millims., whilst the thinner proboscis is 15 millims. long. The smooth surface is of a pearl-grey colour, with faint yellowish pigment-spots. On the intestine I found three suspensors, whilst Keferstein gives only one, and moreover the convolutions of the intestine were twisted round one of the retractors—a character which is probably to be regarded as a malformation caused by disturbance of development. The species was previously known only from Greenland.

Halicryptus spinulosus (V. Sieb.). Storfjord.

The occurrence of this animal in the sea of Spitzbergen was made known by a note of Keferstein's (Zeitschr. für wiss. Zool. 1865, xv. p. 441), who saw large specimens, collected by Malmgren, in the Museum of Stockholm. As, to my knowledge, the worm has never been found in the North Sea; but its occurrence beyond the Arctic Ocean is limited to the Baltic (Reval, Riga, Danzig, Hiddensee, and the harbour of Kiel), there appears to be a similar condition for its distribution as for that of *Antinoë Sarsii*, except that the *Halicryptus* occurs also in the southern part of the Baltic, where *Antinoë Sarsii* is wanting. That *Halicryptus* is consequently to be regarded as an originally widely diffused inhabitant of the Northern Ocean, which has been displaced from the Norwegian coast, since the glacial period, by the invasion of the gulf-stream, but has maintained its existence in the Baltic, may probably be affirmed, although its distribution cannot be accepted as a proof that the icy sea was formerly united with the Baltic through the White Sea and Ladoga Bay; for as it occurs also in the southern part of the Baltic, it cannot be denied that the combination of Baltic and Spitzbergen forms may have taken place, in the glacial period, through water-passages, such as the Sound and the Belt, which now unite the North Sea and the Baltic. But this renders more remarkable the peculiar distribution of *Antinoë Sarsii*, the Baltic forms of which, as above mentioned, are so shut off in the Baltic that their diffusion cannot have taken place in this way. Sänger has stated (according to Leuckart's Report on the Progress of the Natural History of the Lower Animals in 1868–69, in Arch. für Naturg. xxxv. part 2, p. 281) that the *Halicrypti* of the Bay of Kiel and those occurring near Danzig and Reval exhibit differences in the œsophageal teeth, the Kiel variety having 8 series of œsophageal teeth each with 8–12 lateral teeth, and the Danzig variety only 5 series of œsophageal teeth, each with 4–8 lateral teeth. We do not know whether differences in the general size of the animals are combined with this. It would be interesting to ascertain whether local races have been developed in this case, and in what proportion these stand to the Spitzbergen form; and I may mention that, with regard to the structure of the œsophageal teeth, the animal now before me occupies a middle place between the forms from Kiel and Danzig; for in this animal, which is 19 millims. long, I count, as in the Kiel variety, 8 series of large, readily recognizable œsophageal teeth, which bear on each side near the principal point 2–4 subsidiary teeth, and therefore in all, like the Danzig form, 8–10 subsidiary teeth. But as I have only a single small specimen from the coast of Spitzbergen, no great importance is probably to be attached to this observation.

Nemertina.

The few Nemertina found I have been unable to identify with those already described; but here we must take into consideration that many of the existing descriptions are by no means of such a kind that determinations can be made by them with certainty, especially when, as in the present case, we have to do with worms which are preserved in spirit. It is to be hoped that the Arctic Platyelmia may soon find a worker as trustworthy as the Annelides have done, and to him it must be left to decide whether I am in the right in proposing new names here. The generic division has been made in accordance with Keferstein's work.

Nemertes maculosa (mihi). Zweigletscherbucht.

Worms 25–40 millims. in length, nearly cylindrical, thickest in the anterior half of the body (2–4 millims.), scarcely narrowed towards the anterior end, gradually and but slightly narrowed towards the posterior end. Colour dirty whitish, more or less reddish brown, generally pigmented in spots; surface in strongly contracted parts of the body closely transversely ringed. The short acutely conical cephalic extremity without eyes, with a longitudinal fissure on each side running from the buccal orifice nearly to the apex, but not attaining the orifice for the proboscis; orifice for the proboscis terminal; proboscis longer than the body, cylindrical, filiform (0·5 millim. in thickness), without armature, with low papillæ arranged in rows.

The animals differ from *Nemertes fusca* (Fab., Leuck. Arch. für Naturg. 1849, xv. part 1, p. 152) by the lateral fissures of the head not reaching so far.

Nemertes teres (mihi). Zweigletscherbucht.

Worm 50 millims. in length (although, perhaps, a piece of the caudal end is wanting), cylindrical, thicker in the anterior third of the body (4 millims.) than in the portion towards the caudal extremity, which is of nearly uniform thickness

(1·5 millim.). Surface smooth, uniformly dark greenish grey. Cephalic extremity obtusely conical, shorter than broad, somewhat separated from the rest of the body by an indistinct constriction at the base, with a longitudinal fissure on each side reaching almost to the apex, without eyes; orifice for the proboscis terminal; proboscis cylindrical, filiform, without armature, with broad, low papillæ arranged in rows, lying in numerous loops in the anterior thickened part of the body.

Borlasia incompta (mihi). Zweigletscherbucht.

Worm 30 millims. long, cylindrical, of uniform thickness (2 millims.), with the exception of the pointed cephalic and caudal extremities; surface smooth, whitish. Cephalic extremity not separated from the body, very shortly conical, without eyes or lateral fissures; orifice for proboscis ventral, close behind the apex of the head, and with the buccal orifice immediately behind it; the extended proboscis shorter than the body (18 millims. long), but almost of equal thickness, cylindrical, without papillæ on its surface; immediately behind the orifice a principal stylet upon a long brown basal piece, and on each side of this a pouch with three subordinate stylets.

VIII.—*On a new Species of Humming-bird belonging to the Genus* Spathura. By J. Gould, F.R.S.

Comparatively speaking, it was but the other day that only a single species was known of this form, respecting the generic designation of which much confusion exists. In 1846 I proposed the term *Ocreatus*, which I subsequently discovered had been previously employed. I therefore, in 1850, substituted that of *Spathura*. In the meanwhile, 1849, Dr. Reichenbach employed that of *Steganurus*, which he changed in 1853 to *Steganura*. I have here given preference to my own term; but, of course, ornithologists may adopt which they please, so long as they give me credit for discriminating the new species.

The bird alluded to as the only one originally known is the *Ornismya Underwoodi* of Lesson, published by him in 1831. Since that date three or four others have been discovered and named; and I now propose to characterize a fifth—thus raising the number of species now known to six, all of which possess specific characters whereby they may be at once distinguished from each other. These Racket-tails, as they have been familiarly termed, are denizens of the Andes and the Cordilleras, from New Granada to Bolivia, including the great spur which juts off into the Caraccas. I find that the two white-booted species, *Spathura Underwoodi* and *S. melananthera*, frequent the regions north of the equator, that those with red boots, *S. peruana*, *S. rufocaligata*, and the new one about to be described, are as exclusively found to the south of it, and that the white-booted *S. melananthera* and this new red-booted species inosculate in Ecuador. The latter, for which I now propose the specific name of *solstitialis*, differs from *S. peruana* in having, like the white-booted *S. Underwoodi*, the outer margin of the spatulate tipped tail-feathers grey—a character which is not to be found in either of the other red-booted species.

To monograph the species is easy:—

1. *Spathura Underwoodi.* New Granada and Caraccas.
2. —— *melananthera.* Ecuador.
3. —— *solstitialis.* Ecuador.
4. —— *Peruana.* Peru.
5. —— *rufocaligata.* Bolivia.
6. —— *scissura.* Peru.

Of the last-mentioned bird I have as yet seen but immature specimens; and a doubt has arisen in my mind as to whether it may or may not be some abnormal state of a previously known species; yet I should be wanting in judgment were I at the present moment to sink the name of *scissura* into a synonym.

One of the birds I describe below has been placed in a box by itself in my collection for many years; but I have deferred characterizing it until further evidence of its being distinct had been procured: this has now been obtained by an examination of additional specimens sent home by Mr. Buckley.

Spathura (or *Steganurus*) *solstitialis*, Gould.

Male. Bill black; crown of the head and all the upper surface, flanks, and under tail-coverts dull green; wings and outer tail-feathers purplish brown, the outer margins of lateral or spatulate feathers grey, the remaining tail-feathers rich bronzy green above; throat and chest fine glittering green; tarsi thickly clothed with reddish buff feathers.

Total length 5 inches; bill $\frac{3}{4}$, wing $1\frac{3}{4}$, tail $3\frac{1}{8}$.

Female. Destitute of the tail-spatules and of the thick clothing of the tarsi, which are only thinly covered with buff feathers; buff is also the colour of the crissum; upper surface grass-green; tail bronzy green, the outer feather on each side tipped with white; under surface beautifully spotted with green on a white ground. In size of body she is about the same as the male.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

May 11, 1871.—General Sir Edward Sabine, K.C.B., President, in the Chair.

"On Protoplasmic Life." By F. CRACE-CALVERT, F.R.S.

A year since, the publication of Dr. Tyndall's interesting paper on the abundance of germ-life in the atmosphere, and the difficulty of destroying this life, as well as other papers published by eminent men of science, suggested the inquiry if the germs existing or produced in a liquid in a state of fermentation or of putrefaction could be conveyed to a liquid susceptible of entering into these states; and although at the present time the results of this inquiry are not sufficiently complete for publication, still I have observed some facts arising out of the subject of protoplasmic life which I wish now to lay before the Royal Society.

Although prepared, by the perusal of the papers of many workers in this field, to experience difficulties in prosecuting the study, I must confess I did not calculate on encountering so many as I met, and especially those arising from the rapid development of germ-life, of which I have hitherto seen no notice in any papers which have come under my observation. Thus, if the white of a new-laid egg be mixed with water (free from life), and exposed to the atmosphere for only fifteen minutes, in the months of August or September, it will show life in abundance. From this cause I was misled in many of my earlier experiments, not having been sufficiently careful to avoid even momentary exposure of the fluids to the atmosphere. To the want of the knowledge of this fact may be traced the erroneous conclusions arrived at by several gentlemen who had devoted their attention to the subject of spontaneous generation.

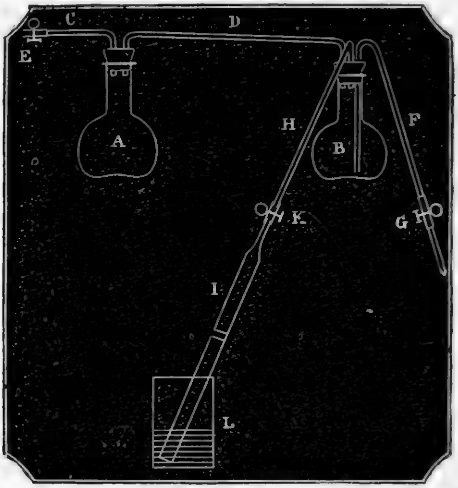
I believe that I have overcome the difficulty of the fluids under examination becoming polluted by impregnation by the protoplasmic life existing in the atmosphere, by adopting the following simple method of working.

As a pure fluid free from life, and having no chemical reaction, was essential to carrying out the investigation, I directed my attention to the preparation of pure distilled water. Having always found life in distilled water prepared by the ordinary methods by keeping it a few days, after many trials I employed the following apparatus, which gave very satisfactory results, as it enabled me to obtain water which remained free from life for several months.

It consists of two flasks, A and B (A rather larger than B), fitted with perforated caoutchouc stoppers*. These flasks are connected by the tube D. Into the stopper of A is fitted a tube C, to which is joined a piece of caoutchouc tubing, which may be closed by the

* The stoppers and caoutchouc tubing used for the various joints must be new, and must be well boiled in water before use.

clip E. Through the stopper of B is a siphon, F, the long limb of which is cut and joined with caoutchouc tubing, which can be closed by the clip G. Through this stopper is a third tube, H, connected



by caoutchouc with the tube I; this can be closed by the clip K. The tube I is about 3 feet long, and goes into the vessel L, which is partly filled with water.

The water to be distilled is mixed with solution of potash and permanganate of potash, and placed in the flask A*. Before distillation is commenced, a rapid current of pure hydrogen, or some other gas, must be passed through the apparatus by the tube C to displace the air and carry off all the germs the air may have contained. The clip G is first left open, then this closed and the clip K opened, which allows the gas to pass through the water in the vessel L.

The gas should be passed through for about fifteen minutes. The clip E is then closed, and the distillation carried on. When the operation is complete, the gas must be again passed through the apparatus, and the connexion with the tube I broken by closing the clip K. The water is drawn off through the siphon F. The long tube acts as a safety-tube, and is made so long that the absorption is noticed in ample time to close the clip before any air can enter through that tube.

The water has to be redistilled three or four times before it is obtained free from germs, and must be kept in the apparatus in which it is distilled until wanted, to prevent any contact with air.

Some water which had been distilled on the 20th of November,

* The reasons why I employed permanganate of potash (in large excess) were that under the influence of heat its oxidizing powers were much increased, and that it gave off no gas that could interfere with the purity of the water, this salt in solution not even yielding oxygen under any circumstances.

1870, being still free from life on the 7th of December, was introduced by the siphon H into twelve small tubes, and left exposed to the atmosphere for fifteen hours, when the tubes were closed. Every eight days some of the tubes were opened, and their contents examined. On the fifteenth, therefore, the first examination was made, when no life was observed; on the twenty-third two or three other tubes were examined, and again no life was detected; whilst in the series opened on the 2nd of January, 1871 (that is to say, twenty-four days from the time the tubes were closed), two or three black vibrios were found in each field.

Being impressed with the idea that this slow and limited development of protoplasmic life might be attributed to the small amount of life existing in the atmosphere at this period of the year*, a second series of experiments was commenced on the 4th of January. The distilled water in the flask being still free from life, a certain quantity of it was put into twelve small tubes, which were placed near putrid meat at a temperature of 21° to 26° C. for two hours, and then sealed. On the 10th of the same month the contents of some of the tubes were examined, when two or three small black vibrios were observed under each field. This result shows that the fluid having been placed near a source of protoplasmic life, germs had introduced themselves in two hours in sufficient quantity for life to become visible in six days instead of twenty-four. Other tubes of this series were opened on the 17th of January, when a slight increase of life was noticed; but no further development appeared to take place after this date, as some examined on the 10th of March did not contain more life than those of the 17th of January.

This very limited amount of life suggested the idea that it might be due to the employment of perfectly pure water, and that the vibrios did not increase from want of the elements necessary for sustaining their life. I therefore commenced a third series of experiments. Before proceeding to describe this series, I would call attention to the fact that the water in the flask had remained perfectly free from life up to this time, a period of close on sixteen weeks.

On the 9th of February 100 fluid grains of albumen from a new-laid egg were introduced, as quickly as possible and with the greatest care, into 10 ounces of pure distilled water contained in the flask in which it had been condensed and an atmosphere of hydrogen kept over it. On the 16th some of the fluid was taken out by means of the siphon H, and examined; and no life being present, twelve tubes were filled with the fluid, exposed to the air for eight hours, and closed. On the 21st the contents of some of the tubes were examined, when a few vibrios and microzymas were distinctly seen in each field. On the 27th other tubes were examined, and showed a marked increase in the amount of life. In this series life appeared

* During the intense cold of December and January last I found it took an exposure to the atmosphere of two days at a temperature of 12° C. before life appeared in solution of white of egg in the pure distilled water, whilst as the weather got warmer the time required became less.

in five days, and an increase in ten, instead of requiring twenty-four days, as was the case when pure water only was employed.

Albumen therefore facilitated the development of life. Of course the contents of the flask were examined at the same time; but in no instance was life detected. I believe that these three series of experiments tend to prove the fallacy of the theory of spontaneous generation; for if it were possible, why should not life have appeared in the pure distilled water, or in the albuminous solution, which were kept successively in the flask B, as well as in the fluids which were contained in the tubes, and had been exposed to the atmosphere or near animal matter in a state of decay, and had thus become impregnated with the germs of protoplasmic life? What gives still further interest to these experiments is, that, having operated during the severe weather of last winter, when little or no life existed in the atmosphere, I was able to impregnate the fluids with germs without introducing developed life.

The quantity of life produced in the above-recited experiments being comparatively small, I was led to infer that this might be due to the influence of the atmosphere of hydrogen employed to displace the air in the apparatus used for obtaining the water. I therefore, on the 2nd of March, prepared a solution of albumen similar to that before employed, but expelled the air out of the apparatus by pure oxygen; and as the contents of the flask B were free from life on the 8th of March, a series of small tubes were filled and exposed for twenty-six hours to the atmosphere near putrid matter, and then sealed. Several of these tubes were opened on the 11th, and immediately examined, when only a few cells were observed in each field. A second lot was opened on the 14th; and they showed considerable increase of life, there being two or three vibrios under each field. A third quantity was opened on the 25th, when no increase had taken place. This latter result tends to show that although oxygen appears to favour the development of germs, still it does not appear to favour their reproduction.

As the weather had become much warmer, and a marked increase of life in the atmosphere had taken place, some of the same albumen solution as had been employed in the above experiments was left exposed in similar tubes to its influence, when a large quantity of life was rapidly developed and continued to increase. This result appears to show that the increase of life is not due to reproduction merely, but to the introduction of fresh germs; for, excepting this fresh supply, there appears to be no reason why life should increase more rapidly in the open than in the closed tubes.

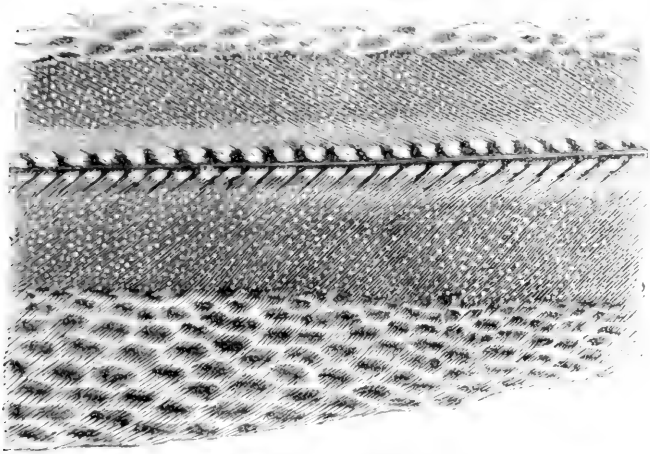
In concluding this paper I have great pleasure in recognizing the able and persevering attention with which my assistant, Mr. William Thompson, has carried out these experiments.

MISCELLANEOUS.

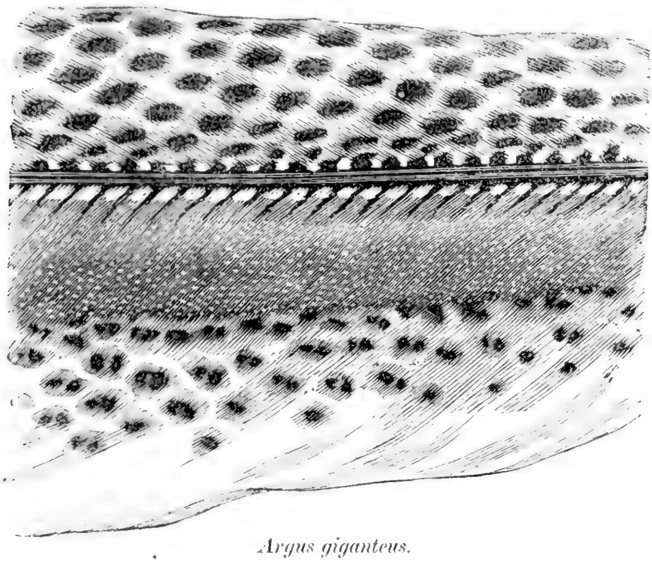
On a new Species of Argus Pheasant.

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

GENTLEMEN,—A letter of mine appeared in the 'Field' newspaper of April 8th ult., the purport of which will, I think, be of interest to your readers: it relates to a feather of an unknown bird, which I found amongst some loose feathers of *Argus giganteus*, to the



Argus (?) bipunctatus.



Argus giganteus.

primaries of which it bears sufficient resemblance to make it highly probable that the bird itself is a member of that superb genus. This interesting feather is, in all probability, a primary from the right wing; and the chief points in which it differs from those of the known species are as follows:—

An elongated space of chocolate-colour, dotted with white, ornaments the narrow as well as the broad web of the feather. The tooth-like markings on the narrow web, close to the shaft, are very boldly defined, the light spaces being of a pale ochre-yellow colour: these markings are separated from the chocolate patch on this web by a narrow strip of pale yellowish brown. The dark spots outside of the chocolate spaces are similar on both webs; and there is no plain space bordering the inner web, the ground-colour of which is darker and more reddish than in the known species. Besides the above-mentioned differences, this feather is much smaller than the corresponding ones of *giganteus*, having the shaft much more slender and of a blackish colour, instead of the beautiful blue of that species. The shaft has the remarkable peculiarity of being extremely narrow on its upper side, so that a section of it would appear almost triangular. The length of the specimen is 9 inches; but it has been injured, a portion having been broken off both ends; if perfect, it would probably measure 12 inches.

A few feathers which exist in the museum of the Jardin des Plantes at Paris have been attributed to an unknown *Argus*; and it is quite possible that the feather now under notice may belong to that species.

The drawing on the wood not having been reversed, the impression from it is a representation of a feather from the left wing instead of the right. I may also state that the light spots close to the shaft of the feather of *A. giganteus* have been engraved too white.

In conclusion, I propose the specific name of *bipunctatus* for the bird of whose existence this feather is the indisputable proof, the white dots on both webs distinguishing it at once from the known species.

I remain, Gentlemen,

Yours very truly,

London, June 22, 1871. T. W. Wood.

P.S. I have forgotten to state that in the recently described bird, *Argus Grayii*, the primaries are almost exactly like those of the old species.

Notes on Podocnemis unifilis. By Dr. J. E. Gray, F.R.S. &c.

A freshwater Tortoise from Guiana was thus described in 1848:—

"*Podocnemis unifilis*, Trosch. n. s. (Schomburgk, Reise in Brit. Guiana, iii. p. 647).

"This Tortoise has much affinity to *P. expansa*, Wagl., and is distinguished principally by this, that it has only *one* short beard-thread under the chin. The head is black and shows some white spots; of these, one is situated behind the nose, one on either side behind the eye, one on either side at the margin of the frontal plate, however, without a dark spot in its middle, a larger one on either side at the margin of the parietal plate close over the tympanum, and one below behind each lower-jaw branch. These spots are discernible in quite young animals.

"Found by us common in Rupununi and Takutu. Their way of living agrees perfectly with that of *Peltocephalus Tracaya*; they belong also to the edible Tortoises of Guiana. Long. 10–12 inches."

Mr. Sclater, in his list of accessions, Proc. Zool. Soc. 1871, p. 36, observes, "A small Tortoise of the genus *Podocnemis* from the Upper Amazons, purchased December 16th, and certainly referable to *P. unifilis* of Troschel (Schomb. Guian. iii. p. 647). Mr. Edward Bartlett, who has met with this species in the same district, informs me that his specimens of it in the British Museum have been referred to the young of *P. Dumeriliana*. *This, I think, can hardly be correct.* But I shall have some further remarks to make on this subject in some notes, which I have in preparation, on the Tortoises living in the Society's Gardens."

The place where *Podocnemis unifilis* was described had escaped me, so that I did not refer to it in my 'Supplement to the Catalogue of Shield Reptiles.' It is very true that there is a specimen in the Museum, purchased of Mr. Bartlett, which agrees with the description of *P. unifilis* above quoted, and which I have considered a young specimen of *Podocnemis Dumeriliana*, as it agrees with the other young specimens in the Museum in every particular. These young specimens have already been described as distinct species under the names of *Emys cayanensis*, Schweigger, *E. erythrocephala*, Spix, and also as *Hydraspis lata*, Bell, from a specimen formerly in the Zoological Gardens.

The character which M. Troschel seems to depend on as distinctive of his species, from the manner in which he underlines the words, and the name which he gives to it, viz. *P. unifilis* (that is, from having only *one beard* in the front of the chin), is, I believe, common to all the species of the family *Peltocephalidæ*; at least it exists in all the Museum specimens (except one small specimen of *P. expansa*) of *Chelonemys Dumeriliana*, *Podocnemis expansa*, and *Bartlettia Pitipii*; and Cornalia mentions it as one of the characters of his *Podocnemis 6-tuberculata*, which is unknown to me. The single exception mentioned is in all respects like the other specimens: the two beards are quite close together in the front of the chin as if it were one beard slit down the centre, and not far apart as in all two-bearded Tortoises. The spots on the head are only found in young specimens, and disappear as the animal increases in age; therefore I think we may decide that *Podocnemis unifilis* is a synonym of *P. Dumeriliana* in the young state. And it is curious that so accurate an observer as Troschel should have overlooked this fact when he considered it a new species; but very likely he had no species of the family at his command. It is less excusable in Mr. Sclater to make the observation he has done, who is, by his own account, new to the study of Tortoises (see P. Z. S. 1870, p. 667), but who could have examined the extensive series of these animals in the Museum.

Sir Charles Schomburgk observes that "the flesh of the Tortoises of this family is fat, and the most savoury of any of the freshwater Tortoises."

Note on Testudo chilensis. By Dr. J. E. Gray, F.R.S. &c.

Mr. Sclater, who gives the name of "*Chilian Land-Tortoise*" to this species in his list of accessions, P. Z. S. 1870, p. 667, objects to my calling it *Testudo chilensis*, because there is a doubt of its being found on the west side of the Andes. Though his notes on this subject appear before my paper, which is printed in p. 706 of the same volume, it was sent to him before his observations were made. Mr. Sclater declares all through his observations that the Tortoise observed by Burmeister, D'Orbigny, and others in South America is *Testudo stellata*, one of the most common Indian species, instead of *T. sulcata*, which *is* the species that these authors erroneously considered common to Africa and America.

Note on Dactylopora*.

A large quantity of materials, together with a careful study of many living and Tertiary species of *Dactylopora* (among them many from the Paris Eocenes and Mr. Karrer's remarkable *D. miocænica*), and Dr. Carpenter's publications, have materially assisted me in throwing some light on the Triassic forms. The only difficulty is to make generally intelligible the structure of minute organic forms (although giants among the Foraminifera) imbedded in limestones or dolomites, most of them imperfectly preserved, some of them mere casts, others with calcareous infiltrations taking the place of organic substance. The Triassic forms must undoubtedly be ranked among the genus *Dactylopora* in Dr. Carpenter's sense, analogous organisms occurring among the Eocene forms from Paris. These ancient species seem to be essentially characterized by the want of cameræ (in the sense in which Dr. Carpenter uses this term), as merely canals in circular order, frequently grouped by two and two or by four and four, extend from a cylindrical cavity occupied by sarcode, towards the including, calcareous, compact tegument. Dr. Carpenter's "cameræ," as they occur in living and in most of the Tertiary species, cannot, therefore, be admitted as chief generic characters, being evidently mere appendices to the chief sarcode-cylinder, and liable to complete obliteration in certain groups of forms.

Of the ancient forms a striking abundance and diversity are presented, admissible as specifically different, as they occur constantly and uniformly in alpine localities very distant from each other. English naturalists would perhaps recognize the whole series of

* From Dr. C. W. Gümbel's letter to Director Fr. von Hauer, dated Munich, April 23, 1871. Communicated by Count Marschall.

forms as mere modifications of some few, or even of one single species. Subjective as the idea connected with the term "species" may be, it must be adhered to objectively wherever differences (even the most minute ones) are *constantly* observed in certain groups of forms, whatever may be their size and degree of organization. The *Dactylopora* from the Wetterstein limestones is very remarkable. Had not the Neocomian age of this deposit been ascertained by stratigraphical facts, the occurrence of this species in it would have raised the question whether it should not rather be regarded as belonging to the deeper Triassic horizons.

Pala Wax.

Near this village I noticed for the first time the "pa-la," or "white-wax insect," which produces the famous so-called vegetable wax of Sz-chuan. The branches of the smaller trees and shrubs along the road for a great distance appeared to be covered with snow, from the quantities of these insects, resembling small moths, of a delicate white colour, with a fluffy tail curling over the back.

The cultivation of wax is a source of great wealth to the province of Sz-chuan, and ranks in importance second only to that of silk. Its production is not attended with much labour or risk to the cultivator. The eggs of the insect which produces the wax are annually imported from the districts of Ho-chin or Ho-king, and Why-li-tzow, in Yunnan (where the culture of eggs forms a special occupation) by merchants who deal in nothing else but "Pa-la-tan" (white-wax eggs). The egg-clusters, which were described to me as about the size of a pea, are transported carefully packed in baskets of the leaves of the "Pa-la-shu" (white-wax tree), which resembles a privet shrub, and arrive in Sz-chuan in March, where they are purchased at about twenty taels per basket. The trees by the middle of March have thrown out a number of long tender shoots and leaves; and then the clusters of eggs, enclosed in balls of the young leaves, are suspended to the shoots by strings. About the end of the month the larvæ make their appearance, feed on the branches and leaves, and soon attain the size of a small caterpiller or, rather, a wingless house-fly, apparently covered with white down, and with a delicate plume-like appendage curving from the tail over the back. So numerous are they, that, as seen by me in Yunnan, the branches of the trees are whitened by them, and appear as if covered with feathery snow. The grub proceeds in July to take the chrysalis form, burying itself in a white wax secretion, just as a silkworm wraps itself in its cocoon of silk. All the branches of the trees are thus completely coated with wax an inch thick, and in the beginning of August are lopped off close to the trunk, and cut into small lengths, which are tied up in bundles and taken to the boiling-houses, where they are transferred, without further preparation, to large cauldrons of water, and boiled until every particle of the waxy substance rises to the surface; the wax is then skimmed off and run into moulds, in which shape it is exported to all parts of the empire.

It would seem that the wax-growers find that it does not pay them to reserve any of the insects for their reproductive state—and hence the necessity of importing eggs from Yunnan. In the districts of Ho-chin and Why-li-tzow, where the culture of the eggs is alone attended to, both frost and snow are experienced; so that it would not be difficult to rear the insect in Europe; and, considering its prolific nature, the production of white wax might repay the trouble of acclimatizing this curious insect.—*Cooper's 'Pioneer of Commerce,'* pp. 323, 420.

Chinese Freshwater Crabs and Hairy Tortoises.

We brought up alongside a boat laden with immense quantities of crabs for Chung Ching. The crabs, taken in the lakes in spring and autumn, are sent to Sz-chuan, where they are considered a great delicacy. The boats in which they are carried are fitted up with tiers of basins, holding about a pint and a half of water each: and every crab has a separate basin, which is carefully refilled every day with fresh water, and the crabs are fed on raw minced meat. Cared for in this way, they make the voyage of forty or fifty days to Sz-chuan, during which not more than one in a hundred die. In the lake-country these crabs are bought for about three chen each.

Besides crabs, there were a number of a species of small water-tortoises, which the Chinese call hairy tortoises. These curious little animals were about two inches long, and covered on the back with a long confervoid growth, resembling green hair. The tortoise being a sacred emblem in China, the Chinese make pets of the hairy tortoise, which they keep in basins of water during the summer months, and bury in sand during winter. A small lake in the province of Kiang-see is famous for these so-called hairy tortoises: and many persons earn a livelihood by the sale of these curious little pets.

The day after leaving Sha-su, I was enabled to get up and take the fresh air on the deck of our boat: we were already in the lakes, which were unusually full of water; and on every lake busy fleets of small boats were at work, procuring loads of weeds which grow during the summer. The crews employed long double rakes, working like a pair of tongs, for gathering the weeds, which are used in the surrounding country for manure.—*Cooper's 'Pioneer of Commerce,'* p. 424.

E. Claparède.

We regret to have to announce the death of this celebrated naturalist, which took place at Sienna, on the 31st ult. The cause of his death was a disease of the heart, from which he had long suffered acutely. His age was only 39.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

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IX.—*Supplement to a "Catalogue of the Zoophytes of South Devon and South Cornwall," with Descriptions of new Species.* By the Rev. THOMAS HINCKS, B.A.

[Plates V. & VI.]

IN 1861–62, I published, in the pages of the 'Annals,' a "Catalogue of the Zoophytes of South Devon and South Cornwall," including under the term "zoophyte" the Hydroida, the Lucernarian section of the Discophora, the Actinozoa, and the Polyzoa—in short, the groups embraced in Dr. Johnston's 'History.' As many as 241 species* were recorded as occurring in the district, of which 18 were new to science and 3 found a place for the first time in the fauna of Great Britain. Others have been met with since, including two or three very interesting new forms of Hydroida, which I have lately procured by dredging, in Salcombe Bay; and in the present Supplement 24 species are added to the list, raising the whole number of south-western forms hitherto observed to 265.

A few species which had only been found in the north have their range of distribution extended southward. *Syncoryne eximia*, which I have noted, in my 'History of the British Hydroid Zoophytes,' as confined to the north-eastern coast, where it is the common representative of its family, has just occurred to me in great abundance in South Devon. *Calycella fastigiata* (Alder) and *Halecium sessile* (Norman) are added to the group of forms which is common to the western side of Scotland and the south-west of England. *Diastopora sarniensis* (Norman), found hitherto only in the Channel Islands, proves to be also a native of the Cornish coast.

The new species of Hydroida which I am about to describe are peculiarly interesting. One of them must be referred to a

* I omit *Tubularia Dumortierii*, which was inserted in the Catalogue by mistake.

new genus of *Corynidæ*, exhibiting curious intermediary characters; the other is a Campanularian distinguished by its exquisitely graceful calceoliform capsule. I have also recently obtained the gonozooid of the genus *Lovénella* (Hincks), which had not been previously noticed. It presents some very distinctive peculiarities, and confirms the title of the form to generic rank, which hitherto rested on characters supplied by the trophosome alone.

For the sake of convenience, and to mark the connexion between the present paper and its predecessor, I have retained the term zoophyte in the title in the sense originally given to it in the Catalogue.

Subkingdom *CŒLENTERATA*.

Class HYDROZOA.

Order **HYDROIDA**. Suborder **Athecata**.

Family **Clavidæ**.

Genus TUBICLAVA, Allman.

T. lucerna, Allman.

On loose stones in a rock-pool, Torbay (*Allman*); on *Murex erinaceus* (living), dredged in Salcombe Bay (*T. H.*).

In the "Catalogue" I have remarked, under *Clava multicornis*, that there is much diversity in the extent to which the polypary is developed in that genus, and that in some cases it covers a third or more of the body of the polypite. I have little doubt that the specimens which exhibited the more fully developed polypary, and suggested this remark, should be referred to *Tubiclava*, and not to *Clava*.

Family **Podocorynidæ**.

Genus PODOCORYNE, Sars (in part).

P. carnea, Sars.

On *Nassa reticulata*, off the Oar Stone, Torbay; Salcombe Bay, on the same.

The *Nassa* is seldom dredged without this zoophyte as a "commensal."

Family **Corynidæ**.

Genus CORYNE, Gaertner.

C. pusilla, Gaertner.

Salcombe, in the higher rock-pools; common.

When the "Catalogue" was published, the species of *Coryne* and *Syncoryne* had not been accurately determined. The form to which I have assigned Gaertner's classical name is distinguished by its sparingly branched, closely annulated stems, and its long linear polypites, with very numerous tentacles. It prefers the higher and smaller pools, while *C. vaginata* usually fringes the sides of the larger and deeper pools, nearer to low-water mark, amongst a luxuriant growth of Algæ.

Genus SYNCORYNE, Ehrenberg (in part).

S. eximia, Allman.

Salcombe Bay, dredged on stones, sponge, &c.; abundant.

The Devonshire specimens were inferior in size to those which I have obtained from the Durham and Yorkshire coasts, but richly coloured and (in May) profusely laden with gonophores.

S. pulchella, Allman.

Salcombe, North Sands, in rock-pools. The polypites were of a watery-white colour, with occasionally a slight tinge of orange. Gonophores were obtained towards the close of May.

Genus GYMNOCORYNE, nov. gen.

GEN. CHAR. *Polypites* clavate, sessile, rising immediately from a filiform stolon, invested by a delicate chitinous polypary; tentacula capitate, very numerous, the uppermost furnished with large capitula and forming a circle round the oral extremity, the rest scattered over nearly the whole of the body. Reproduction unknown.

This interesting form differs from *Coryne*, as *Clava* from *Tubiclava*, in the absence of a distinct stem clothed with a polypary; the polypites are truly sessile. I have not been able to satisfy myself that there is even a slight sheath of chitine, as in *Clava*, round the base of the body. If such a structure exists, it must be of the most filmy and rudimentary character.

Another point in which this genus differs from *Coryne* is the disposition of the uppermost tentacles in a perfect circle (usually consisting of 8) round the oral extremity of the body (Pl. V. fig. 1, *a*). They have thicker stems and much larger capitula than the rest of the tentacles, and constitute a single verticil closely resembling that of *Clavatella* when in a state of contraction. Nothing of this kind occurs in *Coryne*: the oral tentacles, indeed, are frequently larger than the rest; but they are never disposed, as in *Gymnocoryne*, in a regular wreath so as completely to encircle the body a little below the mouth.

The remaining tentacles in the present form, which are extremely numerous, are slender, and have small capitula; they are scattered over the body, and extend to within a very short distance of the base of it.

In its polypite this genus has points of resemblance both to *Coryne* and *Clavatella*, combining some of the characters of each. By the total absence of a stem clothed with a polypary, it is separated from all the rest of the *Corynidæ*. In this respect *Clavatella* comes nearest to it.

Unfortunately I have not had the opportunity of examining the gonozooid. No trace of reproductive bodies appeared among a large colony which I succeeded in keeping alive and in perfect health for about three weeks.

G. coronata, n. sp. Pl. V. figs. 1, 1 *a*.

Polypites very minute, slender, enlarging slightly upwards; proboscis opake white, the central part of the body reddish; tentacles about forty (or more), a wreath of eight, with rather stout stems and large capitula, encircling the oral extremity, the rest irregularly distributed, slender, and with smaller capitula, extending over more than three-fourths of the body. Gonozooid unknown.

This is an exquisite species. The polypites are extremely minute, not more, I should think, than one-sixth of an inch in height; some *Clavatellæ*, which were kept in the same vessel with the *Gymnocoryne*, appeared like giants beside it. The verticil of oral tentacles encircles the conspicuous opake-white proboscis like a crown; it is usually composed of eight; but nine are met with occasionally. The other tentacles are scattered over the body, but with the tendency towards a verticillate arrangement which prevails more or less amongst the *Corynidæ*; they are very slender, and surmounted by small capitula, and decrease very markedly in size towards the base of the polypite. The endoderm is laden with reddish granules, which show through the transparent ectoderm; the colour is most vivid on the upper part of the body, and becomes fainter below. The polypites are extensile, and become very slender when fully elongated.

Hab. Salcombe Bay, in a deserted bivalve shell.

Family **Clavatellidæ**.

Genus Clavatella, Hincks.

C. prolifera, Hincks.

Additional habitat. North Sands, Salcombe Bay, in the small basins on the higher blocks of rock. In May the gonozooid was obtained, laden with gemmæ in various stages of development. One specimen occurred with seven arms (six being the more usual number), and bore seven buds—two very fully developed, two more with the lobes formed, and three in a very rudimentary state. On one of the young, buds were already forming. The zooid seemed less active in its habits than later in the season, when not burthened by so heavy a load.

Family **Eudendriidæ.**

Genus EUDENDRIUM, Ehrenberg.

E. ramosum, Linn.

Note.—The polypites of this species are furnished with a number of bosses, composed of thread-cells piled together, which are ranged in a circle round the body, about halfway between the base and the tentacles.

E. capillare, Alder.

Additional habitat: Salcombe Bay, not uncommon; gonophores abundant in May.

Family **Atractylidæ.**

Genus PERIGONIMUS, Sars.

P. repens, T. S. Wright.

Salcombe Bay, on *Turritella* &c., and in rock-pools.

P. serpens, Allman.

"On the stems of *Plumularia setacea*, from about 12 fathoms, Torbay" (*Allman*).

P. coccineus, T. S. Wright.

I refer to this species a *Perigonimus*, obtained at Salcombe, which seems to agree on the whole with Wright's description. It is larger than *P. serpens*, and the polypary not so delicate and yielding; the body does not rise, when extended, high above the top of the stem and assume a slender cylindrical form, as in the last-named species. The colour is red, very vivid just below the arms, but becoming much paler below. The tentacles are twelve in number and colourless; Wright gives only eight in *P. coccineus*. The stem tapers slightly downwards. For safe identification we require much fuller and more precise descriptions of many of the minute Hydroids than we have yet obtained.

Genus Bougainvillia, Lesson.

B. muscus, Allman.

"In a rock-pool, Torquay, where it occurred abundantly, creeping over the bottom in small moss-like tufts" (*Allman*).

Family **Tubulariidæ.**

Genus Tubularia, Linnæus (in part).

T. humilis, Allman.

Salcombe Bay, between tide-marks and dredged in shallow water.

The *T. Dumortierii* of the "Catalogue," I suspect, should be referred to this species.

Suborder **Thecaphora.**

Family **Campanulariidæ.**

Genus Campanularia, Lamarck.

Section *c.* With branching stems.

C. calceolifera, n. sp. Pl. VI.

Stem filiform, subflexuous, simply pinnate or very slightly branched, ringed above the origin of the pedicels. Hydrothecæ alternate, rather small and delicate, campanulate, with a plain and everted rim, borne on ringed pedicels of varying length. Gonothecæ (female) axillary, smooth, calceoliform, spirally curved at the upper extremity and tapering off below; orifice a tubular passage projecting into the interior, and opening out immediately below the spiral; borne on ringed stalks. Height of the shoot about 1½ inch.

The trophosome of this species is not marked by any very distinctive features. The shoots are generally unbranched, and very slightly flexuous; occasionally one or two short branches occur, but the habit is eminently simple. The calycles are of the usual campanulate shape, delicate, and graceful in their proportions, and with a decidedly everted margin, which gives them a very elegant appearance. The capsules are produced in great numbers, and are ranged along both sides of the stem, but seem to be confined to the lower half of the shoot. They are perfectly hyaline, and of a unique and singularly graceful form (Pl. VI. figs. 3, 4). They are best described as slipper-shaped; but the upper extremity is curved into a most exquisite spiral, while the lower portion tapers rapidly away towards the point of junction with the ringed stem. Immediately below the spiral a wide opening (Pl. VI. fig. 3, *y*) leads into the tubular passage by which the embryos make their escape, which bends upwards within the capsule and terminates in a circular orifice near the top (Pl. VI. fig. 3, *x*). The gonophores, which are numerous, form an elongated mass nearly filling the cavity of the gonotheca; the ova seem to be discharged successively from the uppermost, and to pass into the planule stage while lying free in the capsule. The embryos, when mature, make their way by means of their cilia towards the upper extremity, enter the tubular passage at *x*, and make their escape into the water at *y* (Pl. VI. fig. 5).

If the external tubular orifice of an ordinary Campanularian capsule were reversed, and drawn within the cavity, so as to project into it instead of projecting from the summit into the water, and were then bent round and upwards on one side, we should have the very form which is characteristic of this species. A slight modification of structure has resulted in the production of a most exquisite shape.

Hab. Salcombe Bay, on stones &c.; not uncommon.

Genus Lovénella, Hincks.

L. clausa, Lovén.

On small stones, dredged off the Oar Stone, at the entrance to Torbay, in about 10 fathoms; Salcombe Bay, abundant, especially on shells of *Turritella communis*.

When the genus *Lovénella* was first characterized, I was only acquainted with the trophosome; but in May I procured specimens at Salcombe with gonothecæ, and was able to study the gonozooid, and so complete the diagnosis. The reproductive zooid is medusiform, and bears a general resemblance to that of *Clytia Johnstoni*; but there are important differences in the number and position of the marginal bodies and in the tentacles. The following should be added to the generic character as given in my 'History of British Hydroid Zoophytes,' vol. i. p. 177:—

Gonothecæ borne on the stems and producing free medusiform zooids.

Gonozooid.—Umbrella (at the time of liberation) globose; manubrium short, with a simple orifice; radiating canals 4; *marginal tentacles of two kinds*—4 *in connexion with the radiating canals, of which two only are fully developed at the time of birth, springing from non-ocellated bulbous bases,* 4 *intermediate, of smaller size, without bulbs, slightly clavate, with thread-cells only towards the extremity* (?); *lithocysts* 4, *one of* *which is placed halfway between each pair of the larger tentacles and close to one of the smaller.*

[Pl. V. figs. 2, 2 *a*, 2 *b*.]

The gonotheca of *L. clausa* is borne on a rather long ringed pedicel, which rises from the stem a short distance below the calycle. It is elongate in form, tapering off from the truncate top to the base, the sides presenting a slightly sinuated outline. It contains many gonophores, from each of which a medusiform zooid is liberated. The latter may probably undergo important changes as it advances to maturity. At the time of birth two only of the principal tentacles are fully developed, the remaining pair are represented by the bulbous bases. The small intermediate tentacles are destitute of any enlargement at the point of origin; they spring directly from the circular vessel, close to the lithocyst, which stands out from the inner margin. They are extensile, and when at rest are spirally contracted; they are slightly clavate in outline, and, as far as I could determine during a brief examination, the extremity is rather thickly covered with thread-cells. The lithocysts include a single spherule; numerous thread-cells dot the surface of the umbrella.

The polypite of *L. clausa* is remarkable for its great length; when expanded, it rises high above the top of the calycle (Pl. V. fig. 2), and is a most beautiful object. The latter, tall as it is, is often insufficient for the accommodation of its tenant, and the body has to be bent, as represented in one of the figures, or even *looped*, to find space enough within.

Genus Gonothyræa, Allman.

G. gracilis, Sars.

Salcombe Bay, dredged on shell.

This beautiful species was discovered by Sars at Bergen; it has also occurred on the coast of Connemara.

Family **Lafoëidæ.**

Genus Calycella, Hincks.

C. fastigiata, Alder.

Cornwall, on *Aglaophenia tubulifera* and *Diphasia pinnata*, from deep water. Also found in Shetland and the Hebrides.

Family **Haleciidæ.**

Genus Halecium, Oken.

H. sessile, Norman.

Salcombe Bay, on *Antennularia* and *Salicornaria*.

MOLLUSCOIDA.

Class POLYZOA.

Order **INFUNDIBULATA** (Gymnolæmata, *Allman*).

Suborder **Cyclostomata.**

Family **Tubuliporidæ.**

Genus ALECTO, Lamouroux.

A. retiformis, n. sp.

Polyzoary lobate, the lobes diverging from a common centre, much and irregularly branched, the branches anostomosing so as to form a rude network, the extremities generally bifid; surface minutely punctate, and often grooved transversely; zoœcia scattered irregularly, the free extremities of the tube projecting to a considerable distance, erect, orifice plain. The polyzoary frequently rises into short cylindrical processes with a cellular apex.

Specimens of this fine species measure about an inch across, and form somewhat circular patches. Four or five much-branched lobes radiate from a central point, the ramifications anastomosing freely so as to form irregular reticulations. The extremities of the lobes and of the branches are bifid. The surface is often much thickened and grooved transversely; but in the newer portions towards the end of the branches the lines which mark the walls of the zoœcia are distinctly visible. In one of my specimens the erect processes with cellular extremities are numerous and characteristic. The colour of the polyzoary is white.

The *A. diastoporides*, Norman, is perhaps the most nearly allied species.

Hab. Salcombe Bay, on a valve of *Pecten maximus*; Cornwall, on *Pinna* from deep water.

Family **Diastoporidæ.**

Genus DIASTOPORA, Lamouroux.

D. sarniensis, Norman.

Cornwall, on stone from deep water.

Suborder **Paludicellea.**

Genus PALUDICELLA, Gervais.

P. Ehrenbergi, Van Beneden.

On the underside of the leaves of water-lilies in the river Clist, near Bishop's Clist, South Devon (*Parfitt*). This and the following species of freshwater Polyzoa have been recorded by Mr. Parfitt in his 'Catalogue of the Zoophytes of Devon,' which forms part of a fauna of the county, upon which he has been long engaged*.

Order **PHYLACTOLÆMATA.**

Suborder **Lophopea.** Family **Plumatellidæ.**

Genus Lophopus, Dumortier.

L. crystallinus, Pallas.

In a pond near Exeter, attached to the roots of *Glyceria fluitans* (*Parfitt*).

Genus Plumatella, Lamarck.

P. repens, Linn.

Note.—Mr. Parfitt records the occurrence of Allman's var. *a* on the leaves of water-lilies in the Clist river, near Bishop's Clist.

P. limnas, Parfitt.

On an old shell of *Anodon cygneus* in the canal, Exeter (*Parfitt*).

P. lineata, Parfitt.

On the leaves of water-lilies in a pond in Veitch's old nursery, Exeter (*Parfitt*).

P. emarginata, Allman.

I learn from Mr. Parfitt that, since the publication of his Catalogue, he has discovered this interesting form in the river Clist, at Bishop's Clist. This is, I believe, the first record of its occurrence in England, though Prof. Allman obtained it in various parts of Ireland.

Genus Fredericella, Gervais.

F. sultana, Blumenbach.

Near Penzance (*Couch*). Mr. Parfitt informs me that it occurs plentifully in one or two places in Cornwall.

The affluence of the South-western fauna is abundantly proved by the foregoing Catalogue and Supplement. As I have remarked before, it is brought out strikingly by comparing the present list with the largest previously published, Mr. Alder's excellent 'Catalogue of the Zoophytes of North-

* In this work an additional habitat is given for the rare *Aglaophenia pennatula*, which may be inserted here:—"Several tufts of five or six plumes each, of the typical form, were dredged in Salcombe Bay by F. Walker, Esq. . . . . The plumes measure from 4 to 5 inches in height."

umberland and Durham,' in which 164 species are recorded for the north-eastern district against 265 for the south-western.

The species contained in this Catalogue and Supplement are thus distributed amongst the various groups:—

Hydrozoa	Hydroida	92	
	Discophora (Lucernariidæ)	2	
		—	94
Actinozoa	Zoantharia } = { Coralligena	37	
	Alcyonaria } = { (*Huxley*)	4	
		—	41
Polyzoa	Cheilostomata	87	
	Cyclostomata	16	
	Ctenostomata	17	
	Paludicellea	1	
	Pedicellinea	3	
	Lophopea	6	
		—	130
			265

EXPLANATION OF THE PLATES.

Plate V.

Fig. 1. *Gymnocoryne coronata*, Hincks, highly magnified: 1 *a*, the circle of oral tentacles.

Fig. 2. *Lovénella clausa*, Lovén, with gonotheca, magnified: 2 *a*, the gonozooid; 2 *b*, the same, seen from below.

Plate VI.

Fig. 1. *Campanularia calceolifera*, Hincks, nat. size.

Fig. 2. A portion of a shoot, magnified.

Fig. 3. A gonotheca, magnified, to show the internal structure: *x*, the internal tubular orifice; *y*, the point of exit.

Fig. 4. Another gonotheca.

Fig. 5. The upper portion of a gonotheca, more highly magnified, showing a planule escaping through the tubular orifice.

Fig. 6. A gonophore, highly magnified.

X.—*Notes on* Trionyx Phayrei *of* Mr. Theobald *and* Dr. Anderson. By Dr. J. E. Gray, F.R.S. &c.

There seems an unfortunate fatality attending the tortoises named after Lieut.-Col. Sir A. P. Phayre, late Chief Commissioner of British Birma. Mr. Blyth named a *Testudo* after him which has caused much controversy. Mr. W. Theobald, in a paper published in the 'Journal of the Linnean Society' for 1868 (vol. x. p. 18), named after him a species of *Trionyx*, thus :—

" *Trionyx Phayrei*, Theobald.

"Capite typico, faciali forma forsan rotundiore. Sterni sculptura modica, sive reticulationibus minoribus quam in *T. gangetico*. Sculptura ad latus regulariter reticulata, sed vertebrali regione post secundas costas parum dilatata sive incrassata. Thorace valde cartilagineo, vix ullis (præter ad latus) tuberculis osseis armato. Colore supra olivaceo, lineis fuscis eleganter marmorato, subter flavescente pallido.

"*Habitat* in fluminibus montium Arakanensium, prope Bassein."

The Latin appears to be a translation of the following observations :—

"Granulation of sternum not very coarse, less so than in *T. gangeticus*, on the sides regular, but coarser and larger along the centre of the back behind the second pair of ribs. Thorax highly cartilaginous, and almost devoid of bony callosities save at the margin, where the granulations are slightly developed. Colour during life dark dull brown, handsomely lined, as in Günther's figure, *l. c.*; below yellowish white. Captured in a hill-stream on the Arakan hills in the Bassein district."

It is curious that in both these descriptions Mr. Theobald has mistaken the thorax for the sternum, and the sternum for the thorax; unless this is so, these descriptions are not intelligible or consistent with the following observations :—

"This is a somewhat aberrant species in some respects, and was at first confounded by me with *Chitra indica* of Günther's Monograph, from the precise resemblance which the marbling of the upper part bore to that figure. Since, however, examining the specimens in the British Museum, I find that the animals are very different. The true *Chitra* of Gray (Proc. Zool. Soc. Feb. 23, 1864, p. 17) does not, to my knowledge, occur in Birma. The *Chitra indica* figured in Günther's monograph is, on the authority of Dr. Gray, his *Pelochelys Cantori*. The skull of the present species cannot readily be distinguished from that of *T. gangeticus*, though to my view it seems more arched, and rounded in profile. The thorax resembles that of *T. gangeticus*; but the sternum *presents a remarkable difference in the development of the bony plates, and more nearly, in general characters, approaches to* Dogania subplana, *Gray. The osseous tubercular surface, however, is less developed and more feebly sculptured* (the age and size of the specimen considered) *than in any of its allies*, and at a glance serves to discriminate the present species from them.

"*a.* Adult. Length 21 inches, breadth 14½ inches; length of osseous sternum 12½ inches."

It appears that Mr. Theobald only obtained one specimen, which he informed me he gave to the Bristol Museum; so that Dr. Anderson cannot have a better means of determining this species than the above description affords. Mr. Theobald showed me his specimen as *Chitra indica*, and I was quite unable to decide, in the dried state, to what Asiatic species it belonged, as the skull was enclosed and could not be examined, and the animals vary so little in their external appearance when they have lost the characteristic markings of their coloration, which only can be observed in their young state. The great resemblance in their external appearance is manifest from the fact that Mr. Theobald compares it with such distinct things as *Trionyx gangeticus*, *Dogania subplana*, *Chitra indica*, and *Pelochelys Cantori*, belonging to two families of very different structure and habits.

But the chief character that he seems to rely upon as the characteristic of the species is the part of the above description which I have marked in italics, *i. e.* the slight development of the sternal callosities.

Dr. Anderson, in the 'Proceedings of the Zoological Society,' 1871, p. 154, describes a species he calls *Trionyx Phayrei*, observing that "the chief differences that separate it from *T. gangeticus* are the less developed character of the osseous portion of the sternum, and the relatively finer character of its sculpturing on both aspects." He gives a figure of the sternum, which does not accord with this remark, but represents it as having not only large and well-developed lateral callosities, not in the slightest degree resembling the small narrow linear lateral callosities found in *Dogania* as described by Mr. Theobald, but also having large triangular anal callosities and the odd osseous semicircular bone in the front of the sternum covered with a lunate callosity not even found in *Trionyx gangeticus*; so that this animal can have no connexion with the species described by Mr. Theobald, except that it comes from a nearly similar part of Hindostan. But, unfortunately, that is no criterion of their identity, as many species of *Trionycidæ* and *Chitradæ* are found in that district, as has been proved by Cantor and Mr. Theobald himself. The fact is, that the specimen described by Dr. Anderson is a specimen of my genus *Landemania*, and probably the species which has been named *L. perocellatus*.

I know how much the sternal callosities change during growth; but a person who has examined many species of the three-toed tortoises in different stages can form a very good opinion on the form which the callosities found on a young specimen will assume when it becomes adult; and I never saw a lateral linear callosity like that of *Dogania*, which Mr. Theobald says his species possesses, become a broad callosity, dilated at each end like that figured by Dr. Anderson; and Mr. Theobald does not mention any anal callosities as found in his specimen, which we must recollect, from its size and the state of its coloration, must have been half-grown, if not an adult animal. And therefore I cannot believe that it would have the large triangular anal callosities occurring in Dr. Anderson's figure. Species that have such a callosity generally have a small circular callosity even in their youngest state; and therefore I conclude, from all these characters, that the *Trionyx Phayrei* of Dr. Anderson has no affinity with the animal described under that name by Mr. Theobald.

Dr. Anderson objects to the genus *Sciurus* being separated into genera by organic characters, such as the shape of the skull and the pencilling of the ears (Proc. Zool. Soc. 1871, p. 139), but prefers dividing them, according to their colouring, into lineated grizzled squirrels and dorsal lineated squirrels, and lateral lineated squirrels and ventrilineated or (as he calls it in another place) belly-banded squirrels. To my mind this is a retrograde movement rather than an advance in zoological science. I see no objection to a man refusing to adopt the new generic names; but when a genus has been divided by organic characters founded on the examination of a large series of species, including a large collection of specimens, it certainly is an advantage to use those divisions as sections of a genus, or at least to take care, in describing the species, that the characters on which these divisions are founded are carefully examined and fully described. If Mr. Theobald and Dr. Anderson had availed themselves of the characters afforded by the skulls and the development of the callosities of the mud or three-toed tortoises, and had referred the specimens they described to the sections so proposed (although they did not adopt the genera or subgenera), they would not have left the species they described in such doubt, or they would not have referred two species so evidently unlike to the same name. But then I know that it is not easy to do this when the describer depends on Indian drawings for his materials. I can only understand Dr. Anderson's remarks on the species of squirrels by his attention being confined to external appearances as represented in figures; and we may judge of the kind of inartistic figures he has to work from by the plate of *Sciurus quinquestriatus* which he has published (Proc. Zool. Soc. 1871, pl. 10).

Dr. Anderson says he has carefully compared the skull of his specimen of *Trionyx Phayrei* with that in the British Museum which is named *Trionyx Jeudii*, and he cannot detect any characters to separate the two. I regret that, as he seems to have had the skull in England to compare, he did not show it to me, who am so well acquainted with the skulls of the genus.

The papers of Dr. Anderson in the 'Proceedings of the Zoological Society' for 1871 do not give one a very high opinion of the state of zoological knowledge in the Imperial Museum at Calcutta*. They all belong to what Prof. Edward Forbes used to call the school of zoology that regarded animals as skins stuffed with straw; for they contain no reference to any points in the internal structure or economy of the animals described, indeed little but the details of the species that can be derived from the inspection of figures made by a native artist, who merely copies what he thinks he sees—which is the more extraordinary, as Dr. Anderson, besides being Director of the Imperial Museum at Calcutta, is Professor of Comparative Anatomy of the Medical College of that city. He has been shown that the form of the skull, the form of the palate, and the structure of the alveolar surface of the jaws form very important characters for the distinction of the species of the genus *Trionyx* in its widest sense; yet here we have a description of a doubtful species in which none of these points are mentioned; and the only particulars of the species which he gives (for Dr. Anderson does not undertake to give specific characters) are measurements of the different parts, which are given in such a way that one cannot understand whether they are intended for inches and lines or for inches and tenths; and one is not helped by consulting his other papers, where he appears to use a different system. The sternum is thus described:—" *Seven* osseous plates, of which

* Dr. Anderson, as Director, claims the monopoly of describing and naming; for he observes:—"I cannot allow Dr. Jerdon's statement that he had my permission to describe and name this lizard to pass without comment. I placed the museum collection of reptiles at Dr. Jerdon's disposal for comparison; but I certainly never contemplated that he would make use of the confidence I reposed in him to describe this lizard without my sanction." (Proc. Zool. Soc. 1871, p. 156.) This regulation is neither advantageous to the study of zoology, the advancement of the collection, nor to the scientific knowledge of the curator, as it prevents healthy competition. For the last half-century that I have been connected with the British Museum, every one (native or foreign) has had full permission to use any of the zoological specimens as if they were his own, on the simple condition that he does not injure them or render them less useful to his successors; and this principle has certainly worked well for science and for the collection.

five are visible and granular," which I suppose means the *nine* bones of which the sternum of all *Trionyces* or mud-tortoises (and, indeed, of all Testudinata) is formed: thus he does not seem to be aware that what he calls the abdominal plates are each formed of two bones, as he may see if he will only consult Cuvier on the osteology of tortoises, in his 'Ossemens Fossiles,' vol. v. p. 204. He goes on to describe the odd osseous plate as "semicircular, 7″ 5‴ along the curve, and 1″ 3‴ in diameter in the mesial line; anteriorly in contact with the anterior pair, and posteriorly with the abdominal ones,"—a very important observation; for, as Cuvier observes, Geoffroy describes the sternum as composed of nine bones, of which eight are in pairs and the ninth is odd and placed constantly between the four anterior ones, with the first two of which it adheres in preference when it is not attached to the four. Then follows:—"The greatest length of the abdominal plates is 8″; they enclose an hourglass-shaped cartilaginous area, the anterior portion being the largest, and measuring 4″ 3‴ in diameter and 6″ 8‴ in length from the posterior contraction to the odd plate." Thus you either only have the general character of the order or the measurements of parts and the shape of parts, as the cartilaginous area of the sternum, given as the character of the species, which are liable to vary in the different stages of growth of the same specimen.

It would have been very useful if Dr. Anderson, instead of criticising the works of other naturalists, and altering the names because they are not in accordance with his idea of euphony, and describing individual specimens as species, had studied the changes that occur in the sternal callosities, the dorsal disk, and other variations that do take place in the growth of the *Trionyces*, which has made them so difficult to understand by European naturalists who have had but a few specimens in the museums to examine, but which at great labour I have attempted in my various papers to unravel; for he lives in a country where certainly some species of the genus are abundant, and where they are to be obtained in the markets, or certainly from the fishermen, with very little labour; and it would be very useful if a person having such advantages would controvert or confirm the observations I have made. Had he pursued such a study, which is quite consistent with the post he occupies, I am certain he would not have confounded his specimen (which is, as I say, a *Landemania*, according to my division of the family) with the *Trionyx Phayrei* of Theobald, which is most probably an *Aspilus* or *Dogania*. And I consider such observations of far greater importance to science than determining whether the animal is to be called *Trionyx Phayrei* or *T. Jeudii*; for fortunately the study of zoology is not all confined to the study of nomenclature, which is but a means to enable us to determine with some certainty the species on which one's observations on structure, development, habits, and economy may be recorded.

XI.—*Additions to the Australian* Curculionidæ. Part I. By Francis P. Pascoe, F.L.S. &c.

Five or six years ago our knowledge of the Australian Curculionidæ was comparatively in a not much more advanced state than it was left in by Schönherr* in 1845. This author was acquainted with 229 species, including 10 from Tasmania. Erichson, however, in 1842 (Archiv für Naturgeschichte) had published 41 species, which were not noticed by Schönherr. In 1848, Germar (Linnæa Entomologica) added 24 to the list. The number was slightly increased by Mr. Waterhouse in 1853–54 and 1861 (Trans. Entomolog. Soc.), by Boheman in 1858 (Eugenies Resa), and by M. Jekel in 1860 (Insecta Saundersiana). In 1865, Mr. W. MacLeay published a very large number of species belonging to the subfamily Amycterinæ, in the 'Transactions of the Entomological Society of New South Wales.' Hope, Blanchard, Perroud, Roelofs, and, in 1867, Redtenbacher (Novara-Reise) may be mentioned as having contributed a few more. Many new genera and species have been recently described by me in the 'Journal of the Linnean Society' and elsewhere; so that now we may reckon upon about 730 species. There are still, however, a great many species new to science in my collection, and, thanks to some of my friends in Australia, especially Mr. Masters, of Sydney, and Mr. Odewahn, of Gawler, I am frequently adding to the number. I purpose publishing some of these occasionally in

* 'Genera et Species Curculionidum.' This elaborate work, in eight volumes, each of two parts (volumes in themselves), included the Bruchidæ, Brenthidæ, and Anthribidæ, as well as the Curculionidæ. The latter amounted to 6335 species (the whole number was 7141), and were described by Boheman, Gyllenhall, Fahræus, and Rosenschöld, Schönherr only reserving to himself the descriptions of the genera. It is very usual to quote Schönherr only, but I have invariably quoted the authors whose names followed the specific descriptions. In the 229 species mentioned above, about 10 should be subtracted for Bruchidæ, Brenthidæ, and Anthribidæ. Rather more than 20 species of these families are now known from Australia.

the 'Annals.' The following is a list of those in the present communication:—

Otiorhynchinæ.
  Isomerinthus Jansoni.
Leptopinæ.
  Leptops iliacus.
  —— cicatricosus.
  —— ovalipennis.
  —— hypocrita.
  —— tetraphysodes.
Cylindrorhininæ.
  Catastygnus, n. g.
  —— scutellaris.
  —— stigma.
  —— limbatus.
  —— rivulosus.
  —— textilis.
  Enchymus, n. g.
  Enchymus punctonotatus.
  Centyres, n. g.
  —— turgidus.
Gonipterinæ.
  Oxyops farinosus.
  Gonipterus hyperoides.
  —— turbidus.
Erirhininæ.
  Meriphus longirostris.
  Myossita tabida.
Belinæ.
  Rhinotia pruinosa.
  Isacantha congesta.
  —— bimaculata.
  Pachyura papulosa.

Isomerinthus Jansoni.

I. niger, nitidus, supra squamis niveis maculas formantibus ornatus; rostro brevi, crasso, basi gibbosulo; antennis sat incrassatis, sparse squamosis; prothorace globoso, haud crebre punctato, utrinque maculis incertis notato; elytris globoso-ovatis, ante apicem sat subito angustioribus, striato-punctatis, punctis ampliatis, paulo approximatis; interstitiis convexis, maculis niveis conspicuis adspersis; corpore infra pedibusque albo-squamosis. Long. 3 lin.

Hab. Lizard Island.

In general appearance this species resembles one from Morty, but it has a much shorter and stouter rostrum, thicker antennæ, a globose prothorax, &c. It is, I believe, the first described Australian species of this large Malasian genus. It is true Fabricius has a *Curculio scabratus* (redescribed by Boheman as an *Isomerinthus*) collected by Labillardière, and credited to "noua Cambria" (Syst. El. ii. p. 522); but its true habitat must be considered doubtful, as it does not seem to have occurred in any of the many collections sent to this country. I have preferred the use of the term *Isomerinthus*, following Messrs. Saunders and Jekel, notwithstanding that it is posterior in date to *Coptorhynchus*, Guér. (adopted by Lacordaire), partly because the latter has been changed from *Sphæropterus*, which ought not to have been suppressed, and partly because it is not at all certain that it is distinct from *Psomeles* (Guérin, Voy. de la Coquille), which has a priority of two pages over *Sphæropterus*, a fact sufficiently conclusive for a certain school of naturalists. I dedicate it to Mr. Janson, who has kindly spared it to me from his private collection. There are two more examples in the British Museum.

Leptops iliacus.

L. obovatus, niger, omnino dense griseo-squamosus; rostro sat robusto, quam capite duplo longiore, in medio late subsulcato; antennis squamosis, funiculo art. secundo quam primo paulo longiore; oculis late ovatis, infra rotundatis; prothorace subcylindrico, longitudine latitudini æquali, supra rugoso, in medio obsolete carinato; scutello distincto, rotundato; elytris breviter obovatis, postice sensim latioribus, magis convexis et subito declivibus, striato-punctatis, punctis parvis vix approximatis, interstitiis tertio quintoque elevatis, subtuberculatis, tuberculo ultimo majusculo desinente, lateribus verticalibus albidis, apice rotundato; pedibus squamis elongatis dispersis. Long. 5–6 lin.

Hab. Cape York.

Like *L. squalidus*, but the rostrum is differently sculptured. The form of the eye is somewhat opposed to Lacordaire's definition of *Leptops*, as it is in some other species; but that character in this genus seems to be only of specific value.

Leptops cicatricosus.

L. obovatus, niger, squamulis sordide argenteis ubique densissime vestitus, squamisque majoribus elongatis silaceis vage adspersis; rostro robusto, in medio sulcato, sulcis lateralibus distinctis, scrobibus arcuatis ab oculis remote desinentibus; antennis dense squamosis, clava nigricante; oculis angustis, infra rotundatis; prothorace subcylindrico longitudine latitudini æquali, supra subtransversim crebre tuberculato, longitudinaliter sulcato, in medio sulci carinula abbreviata nigra nitida notato; scutello distincto, oblongo; elytris breviter ovatis, postice sensim latioribus et subito declivibus, seriatim punctatis, punctis parvis, remotis, interstitiis tertio septimoque tuberculatis, tuberculo ultimo pone medium majusculo, parte declivi haud tuberculato; tibiis sparse pilosis. Long. $5\frac{1}{2}$ lin.

Hab. Queensland.

In colour like *L. clavus*, Enc., but readily distinguished by the glossy black ridge in the groove on the prothorax.

Leptops ovalipennis.

L. ovatus, niger, griseo fuscoque squamosus; capite rostroque rugoso-squamosis, hoc valido, apicem versus vix incrassato, supra bisulcato; scrobibus arcuatis, ad oculos approximatis; prothorace transverso, pone apicem utrinque fere parallelo, in medio sulcis duobus transversis tenuiter impresso, ad latera rugoso-punctato; scutello perparvulo, distincto; elytris ovalibus, paulo ampliatis, haud nodosis, substriato-punctatis, singulatim lineis quatuor parum elevatis instructis, apice subacuminatis, lateribus et pone medium maculis fuscis subnotatis; corpore infra pedibusque dense griseo-squamosis, his squamis majoribus nigris adspersis. Long. $6\frac{1}{2}$ lin.

Hab. Lizard Island.

Allied to *L. subfasciatus*; but the elytra are without any nodes or callosities. The two species differ from most of their congeners in having a second line of punctures at the base, near the scutellum.

Leptops hypocrita.

L. ovatus, niger, squamis albido-griseis, aliquando pallide viridi-metallicis, sat dense tectus; rostro modice elongato, in medio canaliculato, lateraliter leviter longitudinaliter excavato; scrobibus subflexuosis; antennis tenuatis, cinereo-pubescentibus, clava nigra; prothorace transverso, utrinque rotundato, in medio antice paulo impresso, postice obsolete carinulato; scutello parvo; elytris ampliatis (♀ sola) singulatim tuberculato-tricarinatis, carina extima tuberculo primo prominulo, inter carinas punctis remotis in seriebus duobus instructis, apicibus subacuminatis; corpore infra pedibusque dense squamosis, pilis longioribus vestitis. Long. $4\frac{1}{2}$–$5\frac{1}{2}$ lin.

Hab. South Australia.

This is the most abnormal in appearance of all the specie of this polymorphous genus. There were four or five specimens in the collection of Mr. Wilson, of Adelaide.

Leptops tetraphysodes.

L. ovatus, fuscus, ubique densissime griseo-squamosus; rostro capite duplo longiore, supra bisulcato; antennis attenuatis, scapo oculum paulo superante, funiculo art. duobus basalibus sequentibus plus duplo longioribus; oculis subovatis; prothorace oblongo, angusto, subcylindrico, supra modice convexo, sat confertim tuberculato; elytris breviter ovatis, elevato-convexis, prothorace multo latioribus, striato-punctatis, striis subflexuosis, punctis sat remotis, interstitiis latis, apicibus acuminatis, singulis elytris sex-tuberculatis, tuberculis tribus minoribus ante medium oblique sitis, duobus majoribus, quorum intimo validiore, postice, alteroque versus apicem, sitis; sternis femoribusque squamis elongatis adspersis; tibiis tarsisque setulosis. Long. 4 lin.

Hab. Queensland.

A peculiar species, owing to its strongly convex elytra and the apparent absence of a scutellum; this part, however, is clearly present in individuals when the scales surrounding it have been removed. In some respects it is like *Amisallus*, from which it is distinguished by the cavernous corbels of the posterior tibiæ.

The three following new genera belong, in Lacordaire's system, to the second of his two groups of Cylindrorhininæ, which is distinguished by the club of the antennæ being distinct from the funicle. To the three genera which he referred to it I have already added one, and have now to characterize three more. The table below will render their differentiation easy. All the genera, except *Enchymus* and two or three species of *Perperus*, have the rostrum as long, or nearly as long, as the prothorax, rather robust, gradually broader towards the apex, scaly, and with one or three carinæ above; the scrobe terminal, and becoming shallower or vanishing behind; the antennæ slender, the club generally distinctly 4-jointed; the eyes ovate, often a little pointed below, and not contiguous to the prothorax; the fore legs stouter than the others, with their tibiæ flexuous towards the apex, and the claws free.

Second abdominal segment as long as the next two together.
  Body scaly.
    Elytra at the base scarcely broader than the prothorax.
      Scape scarcely impinging on the eye .... *Pantopeus*, Schön.
      Scape impinging on the prothorax .... *Perperus*, Schön.
    Elytra at the base broader than the prothorax.
      Corbels cavernous.
        Scrobe running beneath the eye .... *Peripagis*, Pasc.
        Scrobe not running beneath the eye........ *Catastygnus*, n. g.
      Corbels open .... *Enchymus*, n. g.
  Body pubescent .... *Steriphus*, Er.
Three intermediate segments of the abdomen equal .. *Centyres*, n. g.

Catastygnus.

Rostrum modice elongatum, apicem versus gradatim crassius, supra tricarinatum; *scrobes* terminales, obliquæ, infra medium oculorum currentes. *Funiculus* articulis obconicis. *Prothorax* transversus, utrinque rotundatus, basi apiceque truncatus, lobis ocularibus distinctis. *Scutellum* parvum, distinctum. *Elytra* basi prothorace multo latiora, oblonga vel subovata, ♀ ampliata, magis ovata, postice declivia, humeris prominulis. *Pedes* validi; *femora* incrassata; *tarsi* articulo tertio fortiter bilobo; *unguiculi* divaricati.

In this genus the scrobe runs obliquely to a point below the middle of the eye, and is nearly straight except at its commencement. The first three species here described are tolerably homogeneous, the others less so, although preserving all the characters of the genus.

Catastygnus scutellaris.

C. fuscus, squamulis griseis sat dense tectus, scutello albo; clava antennarum ovali haud elongata; rostro fortiter tricarinato, squamis piliformibus transversim sitis; prothorace rugoso-punctato; elytris sat leviter striato-punctatis, apice subacuminatis; corpore infra pedibusque sejunctim squamulosis. Long. 6–8 lin.

Hab. Queensland.

In a very fresh state this species has a peculiar dusty hue, the white scutellum showing very distinctly.

Catastygnus stigma.

C. niger, squamulis griseis parcius munitus, prothorace vitta laterali elytrisque plaga magna pone humeros, maculaque communi V-formi pone medium e squamis albidis effectis notatis; rostro parcius squamuloso; funiculo clavaque elongatis; prothorace rugoso-punctato; elytris sulcato-punctatis, interstitiis convexis; corpore infra pedibusque sejunctim squamulosis. Long. 5–8 lin.

Hab. Queensland.

The conspicuous V-shaped mark on the elytra and their punctation render this species easily recognizable.

Catastygnus limbatus.

C. niger, parcius, elytris dense griseo-squamosus, his sutura lateribusque nigro-subvittatis; antennis minus elongatis, articulis duobus basalibus funiculi in utroque sexu æqualibus; rostro carinis lateralibus minus notatis, squamis piliformibus transversim sitis; prothorace rugoso-punctato, in medio leviter canaliculato, utrinque linea albida e squamis effecta ornato: elytris striato-punctatis, punctis unisquamigeris, interstitiis planatis, margine exteriore dense albido-squamosis; tibiis anticis intus manifeste denticulatis. Long. 5–6 lin.

Hab. Port Dennison.

The dark stripes on the elytra are due to the sparseness of the scales, which varies considerably in different examples; the denticulations or spines on the tibiæ are well marked, and occur also in the two preceding species, but are nearly hidden by the hairs which are generally present on that part in all Curculionidæ.

Catastygnus rivulosus.

C. niger, ubique dense griseo-squamosus; rostro in medio tenuiter carinulato, carinulis ad latera obsoletis; antennis fuscis, griseo-pubescentibus; funiculo elongato; prothorace minusculo, transverso, granulis parvis nigris adsperso, in medio linea nigra denudata notato; elytris antice subparallelis, striato-punctatis, punctis nigris, bene limitatis, apicem versus minoribus, interstitiis setulis fuscis subbiseriatim positis instructis; tibiis anticis intus modice denticulatis. Long. 5 lin.

Hab. Moreton Bay.

The elytra, under an ordinary lens, appear to be striped with very fine, distinct, slightly flexuous lines; these are caused by brown adpressed setulæ, which follow each other nearly in two rows between the punctures.

Catastygnus textilis.

C. niger, dense pallide griseo-squamosus; capitis fronte nigra, circa oculos rostroque griseis, hoc valido, in medio fortiter carinato; antennis nigris, parce griseo-pubescentibus; prothorace in medio canaliculato, utrinque modice rotundato, basi vix constricto; scutello subscutiformi; elytris ab humeris gradatim angustioribus, apicibus subacuminatis, substriato-punctatis, punctis nigris, approximatis, interstitiis vix convexis, squamis elongatis majusculis in seriebus alternatis quinque vel sex instructis; corpore infra pedibusque dense subargenteo-squamosis, tibiis tarsisque pilosis. Long. 7 lin.

Hab. Lizard Island.

The arrangement of the larger scales on the elytra gives their surface a woven appearance, the tip of one scale nearly touching the base of the two behind it and on each side, and forming what may be called the web or warp, while the woof consists of the ordinary scales between. The front of the head is apparently denuded, but under a strong lens it is seen to be clothed with small scales of the same colour as the parts they cover.

Enchymus.

Rostrum modice elongatum, apicem versus crassius, supra tricarinatum; *scrobes* terminales, arcuatæ, ad latera rostri desinentes. *Funiculus* articulis obconicis. *Prothorax* subtransversus, lobis ocularibus fere obsoletis. *Scutellum* parvum, distinctum. *Elytra* cordato-ovata, humeris prominulis. *Femora* incrassata; *tibiæ* posticæ apice apertæ; *tarsi* articulo tertio fortiter bilobo, ultimo elongato; *unguiculi* divaricati.

The open corbels of the posterior tibiæ, and the arched scrobe terminating at some distance from the eye on the side of the rostrum, are the two principal characters of this genus. The sculpture of the species described below is somewhat peculiar; the elytra are marked with several dark spots, which, under a lens, are seen to be caused by punctures much larger than the others, and which are irregularly impressed in the striæ.

Enchymus punctonotatus.

E. niger, omnino sat dense griseo-squamosus; capite rostroque setulis nigris adspersis; antennis ferrugineis, parce setulosis; clava nigra; prothorace utrinque rotundato, in medio canaliculato, supra albido subnotato, basi apiceque latitudine æqualibus, rugoso-granulatis, granulis apice puncto setigero instructis; elytris pone medium latioribus, leviter striato-punctatis, punctis plurimis majusculis fuscescentibus impressis, interstitiis, præsertim postice, elevatis, setulis numerosis adspersis, apice subacuminatis; femoribus albido-subannulatis; tibiis anticis intus denticulatis. Long. 5 lin.

Hab. South Australia.

Centyres.

Rostrum prothorace paulo brevius, modice robustum, supra tricarinatum; *scrobes* terminales, arcuatæ, versus partem inferiorem oculorum desinentes. *Funiculus* articulis obconicis. *Prothorax* subtransversus, lobis ocularibus distinctis. *Scutellum* parvum. *Elytra* ovata, basi quam prothorax latiora, humeris rotundatis. *Pedes* validi; *femora* incrassata; *tibiæ* posticæ apice cavernosæ. *Abdomen* segmentis tribus intermediis æqualibus.

The latter character is at present unique in this group. The species described below has a decided resemblance to our *Liophlœus nubilus*, only it is very much larger.

Centyres turgidus.

C. niger, omnino pallide cinerascenti-squamosus; rostro carina intermedia fortiter notata; antennis piceis, pubescentibus; funiculo sat elongato; clava modice ovata; prothorace utrinque rotundato, confertim punctato, puncto singulo squama repleto; scutello subcordato; elytris ampliatis, apice acuminatis, striato-punctatis, punctis unisquamigeris, interstitiis latis, convexis; tibiis anticis intus leviter denticulatis. Long. 6 lin.

Hab. Queensland.

Oxyops farinosus.

O. late obovatus, sat valde convexus, niger, squamositate silacea cavitatibus repletis, et parce albido-setulosus; rostro brevi, crasso, supra tricarinato; prothorace evidenter transverso, pone apicem utrinque sat subito rotundato, supra inæquali, rugoso-granulato, basin versus depresso et in medio leviter carinato; scutello oblongo; elytris cordato-trigonatis, humeris calloso-prominulis, supra seriatim foveatis, foveis subquadratis, singulatim tuberculo magno basali, alterisque duobus posticis, quorum uno minore versus apicem sito; corpore infra pedibusque squamositate pulverea munitis, setulis numerosis intermixtis. Long. 6 lin.

Hab. Albany.

A short robust species, with somewhat trigonate elytra. *O. aulicus* appears to be its nearest ally.

Gonipterus hyperoides.

G. subovatus, fuscus, squamulis elongatis albidis adspersus; capite inter oculos et rostro longitudinaliter leviter excavato; hoc brevi, crasso; antennis ferrugineis, sat incrassatis, funiculi articulo ultimo subtransverso; prothorace breviter subconico, supra vittis tribus e squamis condensatis subnotato; scutello rotundato; elytris basi parum convexis, humeris haud prominulis, tuberculo subhumerali nullo, lateribus subparallelis, apicibus subacuminatis, striato-punctatis, singulatim fascia arcuata obliqua, extime ampliata, suturam versus postice sensim angustiore, aliquando fascia vel macula subobsoleta posteriore, e squamulis albidis condensatis, ornatis; corpore infra pedibusque ferrugineis, parce squamulosis. Long. $2\frac{1}{2}$ lin.

Hab. Queensland.

This pretty little species is not very obviously related to any of its congeners; it agrees with the following, as well as with *G. cionoides*, in having no subhumeral tubercle.

Gonipterus turbidus.

G. subovatus, niger, squamositate fusca, squamisque elongatis numerosis albidis vestitus; capitis fronte profunde canaliculata; rostro tenuiore, magis elongato; antennis ferrugineis, paulo incrassatis; prothorace subconico, longitudine latitudini æquali; scutello oblongo; elytris modice convexis, tuberculo subhumerali nullo, lateribus subparallelis, apicibus submucronatis, sulcato-foveatis, singulatim postice macula indistincta albida notatis; corpore infra pedibusque sejunctim albido-squamosis; tarsis articulo ultimo breviusculo. Long. $2\frac{1}{4}$ lin.

Hab. Tasmania?

The short terminal joint of the tarsi affords an approach to *Syarbis*, in which it is altogether wanting. Schönherr, it is true, gives this as a character of *Gonipterus*, evidently, however, only in contrast to *Entimus*, with which he compares it. It is singular that this acute entomologist should never have recognized the affinity of this genus to *Oxyops*: so close, indeed, is it, that it seems to me no valid distinction can be drawn between them, the slightly prominent mesosternum of *Gonipterus* differing in no great degree from the more prominent and pointed organ of *Oxyops*. It is remarkable, too, that these genera are the only ones, with one exception, in which the characters of the under parts are alluded to in the long descriptions given in his voluminous work on the Curculionidæ.

Meriphus longirostris.

M. fusco-piceus, supra setulis griseis parce, infra squamulis albidis sejunctim vestitus; rostro, apice excepto, ferrugineo, oblongo-punctulato, prothorace plus triplo longiore; antennis subferrugineis, scapo oculum haud attingente, clava tenuata; prothorace manifeste granulato; elytris subtrigonatis, basi prothorace duplo latioribus, sat fortiter striatis, interstitiis uniseriatim conico-granulatis; tibiis ferrugineis. Long. $2\frac{1}{2}$ lin., rostr. incl. 4 lin.

Hab. Albany.

Like *M. umbrinus*, but larger, with a distinctly granulate prothorax and trigonate elytra, &c. The funicle not attaining the eye is against the Erichsonian character of the genus; but in *M. guttatus*, and perhaps in others, I believe this character is only sexual.

Myossita tabida.

M. oblonga, depressiuscula, pallide fulvescens, leviter pilosa; rostro silaceo, prothoracis longitudini æquali, subtiliter punctulato; prothorace latitudine longitudini æquali, crebre inæqualiter punctato; scutello oblongo, apice late rotundato; elytris subovatis, leviter striato-punctatis, punctis subareolatis. Long. $2\frac{1}{2}$ lin.

Hab. South Australia?

A slightly pubescent species; the punctures on the elytra appear in certain lights to be surrounded by a paler ring.

Rhinotia pruinosa.

R. elongata, postice parum ampliata, nigra, elytris obscure rubris, regione suturali infuscata; capite inter oculos rude granulato-punctato, supra oculos longe albo-piloso; rostro basi carinula brevi instructo; antennis ferrugineis, versus apicem nigris; prothorace granulato, vitta media lateribusque albo-pilosis; elytris confertim granulatis, pube subtili sublineatim vestitis; corpore infra pedibusque albo-pilosis. Long. 6 lin.

Hab. South Australia.

The prothorax is canaliculate, as in the other species, but the ridge bounding it on each side is not so well marked. The female is considerably broader.

Isacantha congesta.

I. oblonga, postice sensim ampliata, nigra, nitida, supra granulata, pube silacea confertim maculata; rostro longiusculo, cylindrico, fere recto, crebre punctato et transversim corrugato, ♀ versus apicem gradatim minus sculpturato, scapo art. duobus sequentibus conjunctim longiore, ♂ apice rostro glabro, scapo art. duobus sequentibus conjunctim breviore; antennis nigris, basi ferrugineis, art. ultimo apice flavo; prothorace perparum transverso, crebre granulato; scutello ochraceo-piloso; elytris piceis, sat confertim irregulariter granulatis, apice late angulatis; corpore infra pube silacea maculata; metasterno fascia obliqua dense ochraceo-pubescente; femoribus infra bidentatis. Long. 4–$7\frac{1}{2}$ lin.

Hab. Queensland (Wide Bay).

The pubescence on this very distinct species is rather deciduous; but the oblique band on the metasternum seems to be very persistent.

Isacantha bimaculata.

I. sat angusta, fusco-ferruginea, supra disperse albo-pilosa; rostro prothorace haud longiore, basi latiore et supra paulo excavato, crebre punctato; antennis art. basali breviusculo; prothorace confertim granulato, versus basin canaliculato; elytris parallelis, apice rotundatis, confertim granulatis, singulis macula alba e pilis condensatis pone medium sitis; corpore infra longe albo-piloso; pedibus ferrugineis, femoribus anticis infra dentibus minutis, duobus apicalibus majoribus, instructis; tibiis intus denticulatis. Long. $3\frac{1}{2}$ lin.

Hab. Tasmania.

A small, rather narrow form, noticeable for the two spots on the elytra and the denticulation of the inner margin of the tibiæ.

Pachyura papulosa.

P. oblonga, postice ampliata, picea, supra confertim granulata, pube silacea maculatim varia, elytris nigro-maculatis; rostro longitudine prothorace cum capite æquali, crebre oblongo-punctato; antennis ferrugineis, art. basali paulo elongato, tertio æquali; prothorace sparse silaceo-maculato; elytris singulis maculis nigris in seriebus quatuor notatis; corpore infra pedibusque rufo-piceis, griseo pilosis; tarsis nigris. Long. 6 lin.

Hab. New South Wales (Rope's Creek).

This species, having the femora unarmed and foveiform scrobes, must be placed with *Pachyura*; in habit, however, it closely resembles *Isacantha.*

XII.—*Description and Illustrations of a new Species of* Tethya, *with Observations on the Nomenclature of the* Tethyadæ. By H. J. Carter, F.R.S. &c.

[Plate IV.]

Tethya casula, n. sp. Pl. IV. figs. 1–9.

Massive, erect, sessile, consisting of a hemispherical head or body (Pl. IV. fig. 1, *a*) supported on a conical or umbrella-like expansion (fig. 1, *b b*), which, *in situ*, is sunk into the sand, and serves the purpose of a root. Colour light greyish yellow. Surface of the head rough, hispid, from the projection of fine spicules in lines corresponding with polygonal interspaces in which the pores (fig. 2, *a*) and vents (fig. 2, *b*) are respectively situated. Ends of the spicules radiating from the surface generally, short and erect on the summit, becoming longer and more inclined towards the base, where they are continuous with those of the conical expansion, thus giving the whole of the outer surface a white, glistening, asbestine appearance. Conical expansion (fig. 1, *b b*) smooth, even, thinning towards the circumference, composed of long spicules overlapping each other in parallel bundles, which, radiating from a common centre at the summit, in continuation with the lowermost structure of the head, become more or less mixed with sand downwards (fig. 1, *d*), and at length end freely at the circumference in a circular, fringed border (fig. 1, *c* and fig. 3). Pores chiefly confined to the upper part of the head (fig. 2, *a*); vents occupying the larger polygonal interspaces at the base (fig. 2, *b*). Vault or inner summit of the conical expansion apparently occupied by a few pores and vents, from which point the bundles of long spicules radiate in all directions, to end in the fringed border just mentioned; more or less concealed in their course by a zonular layer of sand, which covers two-fifths of the distance between the fringe and the summit (fig. 1, *d*). Spicules of the body, and conical expansion probably, radiating in bundles from a common point or denser portion of the internal structure, called the nucleus, to the periphery generally; held together by sarcode, and permeated by the branches of the excretory canal-system. Spicules of five kinds, viz.:—1, the longest, consisting of a delicate, smooth shaft, pointed internally, and terminated externally by a trifid forked head (figs. 5, *a*, & 6, *a*); 2, shorter than the last, but still long, straight, smooth, fusiform, acerate (figs. 5, *b*, & 6, *b*); 3, short, smooth, stout, curved, fusiform, acerate (figs. 5, *c*, & 6, *c*); 4, minute, consisting of an extremely delicate, flexible shaft, pointed inwardly and terminated at the other end by a bifid or trifid, unequal-armed, forked head (figs. 6, *d*, & 7); 5, very minute, bihamate, contort, C- or S-like (figs. 6, *e*, & 8). These spicules average respectively, as they are described, 5-12ths, 1-5th, 1-18th, 1-60th, and 1-1800th of an inch long. The two former, which are by far the longest, are alone found in the conical expansion; and the first, being much longer than the second, extends beyond the latter, so that the extreme border of the fringe is exclusively composed of the trifid heads of the longest spicule (fig. 3, *b*, *c*, fig. 4). The other three are confined to, and form the greater part of, the structure of the head, mixed, also, with trifid and straight acerate spicules of all sizes, like those of the conical expansion, but much shorter. While the shafts of the trifid spicules are by far the longest, those of the acerate ones again are by far the stoutest, being in the proportion of 1- to 3-1800ths of an inch. Size of specimen:—height of summit of conical expansion or root 8-12ths, height of head or body ½, total height 14-12ths, diameter of circumference of conical expansion 1½, diameter of base of head 11-12ths of an inch.

Hab. Marine; growing in sandy bottom.

Loc. Port Elizabeth, Natal, Cape of Good Hope.

Obs. This specimen, described and illustrated at the request of Dr. J. E. Gray, is in the British Museum. It has been considerably injured, as will presently be mentioned; and, as the specimen is unique, it has been thought desirable not to extend the injury by sections: hence several parts are doubtfully described; but the Tethyadæ are so much alike, that what is not present here can, almost with certainty, be supplied from the known structure of other and similar species.

Unless such sponges are carefully removed from their habitat in the sea, soaked in fresh water at once, and as carefully dried, the ends of the delicate asbestiform spicules which project from their surface are almost sure to be broken off, and the sarcode, if allowed to decompose, to become charged with the mycelium and sporidia of Mucorideæ, which are very likely to be mistaken for parts of the sponge: hence I feel now assured that my figure of a trifid spicule bearing a number of globular cells was erroneously supposed to be a part of *T. arabica* (Annals, 1869, vol. iv. pl. 2. fig. 20).

The Mucorideæ, too, feed upon the soft parts; and thus the dermal sarcode, as there is no cortex here, especially disappears, which, of course, removes at once the pores and the more circumscribed parts of the orifices of the excretory canals or vents, so that the situation and form of both become problematical. This is the case in the present instance; but *T. casula* being closely allied in structure and composition to *T. arabica*, which I found myself *in situ*, and have minutely described and illustrated (Ann. *l. c.*), it is not difficult for me to supply these particulars, as before stated, with almost perfect certainty.

Indeed, with the exception of the absence of the anchor-head, and the presence of the delicate unequal-armed trifid spicule of the sarcode in *T. casula*, we have every other kind that I have delineated in *T. arabica*. The surface of the latter is equally silky and asbestiform, from the presence of the projecting ends of the delicate spicules arranged in lines circumscribing polygonal interstices in which the pores and vents are respectively situated; and as the outward structure of *T. arabica* so closely corresponds with that of *T. casula*, we may fairly infer that the internal structure does so also, and therefore that it is most probably the same as that given in the above description; without cortex, but with an extremely dense and contractile sarcode, which, after death, from its stringent contractility, renders the branching of the excretory canal-system almost imperceptible.

In addition to the form, then, of the entire sponge, we have the absence of the anchor-head and the presence of the minute unequal-armed trifid spicule of the sarcode as the peculiarities of *T. casula*.

The absence of sarcode also in the summit of the conical expansion of *T. casula* renders it very doubtful if there ever were any pores and vents in this part of the cavity, especially as, *in situ*, the whole of the cavity must have been shut out from the sea by insertion in the sand of the greater part, at least, if not the whole, of the conical expansion, in no part of which are there any polygonal interstices or other indications of pores and vents such as are seen on the surface of the head or body.

Of the colour it can only be stated, as above, that in the dried state it is light greyish yellow, exactly like that of *T. arabica* in a similar condition, but which, when fresh, presents internally an orange-yellow sarcode with pinkish nucleus; while *Tethya dactyloidea*, Cart., and *T. atropurpurea*, C., are both dark purple on the surface and, for the most part, throughout.

Of the habitat of *T. casula* we know nothing further than may be learnt from the specimen, viz. that it did not grow in a pendent position, but in the sand at the bottom of the sea, as the presence of the sand testifies; that is to say, we do not know whether it lived in deep or shallow water. The specimen of *T. arabica*, which I found *in situ* on the south-east coast of Arabia, was growing on the basaltic rocks of the shore, where, having been left uncovered by the tide at low water, I found it; and so resistant was it, that I had to dig it off in pieces with hammer and chisel. All that is stated of *T. cranium* is that it adhered "to stones in deep water" (Johnston, Brit. Spong. p. 83). Schmidt (Atlant. Spong. Faun. p. 66) also mentions that *T. cranium* was found off Florida in 152–183 fathoms; but nothing is stated in this respect of his *Tetilla euplocamus* or *T. polyura*.

Undoubtedly the office of the conical expansion in *T. casula*, of the twisted cord in *Tetilla euplocamus*, Sdt., of the beard-like tufts in *T. polyura*, Sdt., and of the beard of *Tethya dactyloidea*, Cart., is the same as that of the stem in *Hyalonema*, already noticed by Schmidt; but while the longest spicules in the Tethyadæ do not exceed half an inch, those of *Hyalonema* are more than half a yard. Still, when it is stated that the anchor-headed spicules are for the purpose of fixing the Tethyadæ *in situ*, it should be remembered that there are no anchor-heads at all in *T. casula*, and that where (in most of the species) they are present they are as plentiful in the *upper* portion and free surface of the body of the *Tethya* as in any other part; while in the fixed or sessile form of *T. arabica* the base of this hemispherical sponge is agglutinated to the rock by a layer of horny sarcode; and therefore it is probable that the agglutination of the spicules in the conical expansion of *T. casula* to the sand serves to fix it there as much as the spicules.

The minute bihamate and contort C- and S-shaped spicules, with which the sarcode of the head in *T. casula* is densely charged, finds its equal in every respect in *T. cranium* (Bowerbank, Brit. Spong. vol. ii. p. 85) and in *T. arabica* (*l. c.*). It is also present in like manner in *T. atropurpurea* (Annals, 1870, vol. vi. p. 176, pl. 13), but larger and spinous towards the extremities. It, together with the anchor-headed spicule, might have existed in *T. dactyloidea* (*ib.* 1869, vol. iii. p. 15); but, unfortunately, I had given the specimen to Dr. Bowerbank before I saw the desirableness of examining it more minutely.

So the presence of this minute spicule would appear to be characteristic of the Tethyadæ generally; for it is mentioned by Schmidt in *Tetilla polyura* (Atlant. Spong. Faun. 1870, p. 66), although it is unnoticed in his passing observations on *Tetilla euplocamus* (Spong. Algier. 1868, p. 40, and Atlant. Spong. Faun. p. 66), which came from Desterro, on the coast of Brazil, and, having no separate description allotted to it, may have had no special examination.

Why Schmidt should have changed the name of *Tethya* to *Tetilla* (Atlant. Spong. Faun. p. 60, *Tetilla cranium*) and have retained it for the sponges of which *Tethya lyncurium* is the type, I am at a loss to conceive.

*

Nomenclature of the Tethyadæ.

In 1750 Donati* introduced the word "Tetie" for that sponge to which, among others, Lamarck, in 1802, gave the name of *Tethya lyncurium* †.

Risso, in 1826, first used the name of *Tethya cranium* ‡, which was applied to the British species by Fleming in 1828§. In 1833 Nardo introduced the term of *Donatia aurantium* for

* Nat. Mar. dell' Adriat. 64, tav. 9. fig. A, B, &c. (*ap.* Johnston).
† Ann. du Mus. t. i. p. 71. no. 5 (*ap.* Blainville, Man. Actinol.).
‡ L'Europ. Mérid. vol. v. p. 364 (*ap.* Johnston).
§ Hist. Brit. An. p. 519 (*ibidem*).

Tethya lyncurium *; and in Deshayes and Milne-Edwards's edition of Lamarck (1836–45) *Tethya lyncurium* and *T. cranium* are still continued under the head of *Tethya* †. In 1867 Dr. J. E. Gray adopted Nardo's name of *Donatia* in part for the genus of *D. aurantium* ‡; and in 1870 Schmidt called *Tethya cranium* by the name of *Tetilla cranium* §, adding it to his genus *Tetilla* of 1868 ||, but still retaining the name of *Tethya* for *Tethya lyncurium*.

Thus Nardo would change *Tethya lyncurium* to *Donatia aurantium*, and Schmidt retain the former but change *Tethya cranium* to *Tetilla cranium*, while Dr. Gray adopts Nardo's name for *T. lyncurium*, and continues *Tethya* for *T. cranium*.

Now, in the 'Annals' of 1869 (*l. c.*), I have described and illustrated *Tethya arabica* (which is almost identical with *T. cranium*) in conjunction with *Tethya lyncurium*, partly for the purpose of contrasting the differences between them; and any one who chooses to refer to this will at once see the wisdom of Nardo in giving a new name (that is, "*Donatia aurantium*," called after Donati, the first describer) to *Tethya lyncurium*; while any one referring to Dr. Gray's proposed arrangement, may equally see the wisdom of retaining the term "*Tethya*" for the Tethyadæ of which *T. cranium* is the type specimen, since so great are the differences between *Tethya lyncurium* and *T. cranium*, that it was impossible for these two sponges to be long continued under the same generic distinction.

Nardo, then, changed the name of *T. lyncurium* to *Donatia aurantium* in 1833, and Gray adopted this in 1867, still retaining the name of "*Tethya*" for the Tethyadæ of which *T. cranium* is the type specimen; and there, I think, Schmidt would have done well to have left it, instead of not only reversing Nardo's change, but of introducing a new term, viz. that of "*Tetilla*," for the Tethyadæ of which *T. cranium* is the type, in 1868.

An *après-moi-le-déluge* system of adding new names to objects of natural history unnecessarily is most undesirable. If it be necessary to change the name when two totally different species have been placed under the same generic heading, this change, when once effected, should be considered inviolable; and this precedence and propriety give in favour of Nardo.

Hence I shall continue, with Dr. Gray, to use the term

* Isis, 1833, p. 522 (*ib.*).

† Lamarck, Anim. sans Vert. vol. ii. p. 592.

‡ "Notes on the Arrangement of Sponges," Proc. Zool. Soc. May 1867, p. 541.

§ Atlant. Spong. Faun. p. 66.

|| Spong. Küste Algier, p. 40.

"*Tethya*" for the sponges of which *Tethya cranium* is the type, and adopt Nardo's name of "*Donatia*" for those of which *Tethya lyncurium* is the type—thus applying the former to Schmidt's *Tetilla euplocamus* and *T. polyura*, which are genuine species of the group of *Tethya cranium*, and to the four others which I have described and illustrated in the 'Annals' under the specific designations of *dactyloidea*, *arabica*, *atropurpurea*, and *casula*.

EXPLANATION OF PLATE IV.

Fig. 1. *Tethya casula*, n. sp., natural size: *a*, head or body; *b b*, conical expansion, which, *in situ*, is imbedded in the sand; *c*, fringe or ciliated border; *d*, sand.

Fig. 2. The same, portion of surface of body, magnified, to show polygonal arrangement of lines of projecting spicules, indicating:—*a*, pore-areas; *b*, vents.

Fig. 3. The same, cilium or free extremity of radiating bundle of spicules in conical expansion, magnified, showing:—*a a a*, bundles of spicules constricted at the margin; *b*, continuation of bundle in a cylindrical form; *c*, free extremity a little expanded, consisting *exclusively* of the forked ends of the long trifid spicule; *d*, agglutinated grains of sand still adhering to the bundles.

Fig. 4. The same, trifid end of forked spicule of cilium, magnified, on the scale of 1-12th to 1-6000th of an inch: *a*, neck, slightly constricted; *b*, axial canal.

Fig. 5. The same, spicules magnified fourteen times their natural *length*, relatively: *a*, trifid forked spicule of bundles of conical expansion; *b*, straight, long, fusiform, acerate spicule of the same; *c*, thick, short, curved spicule of the body-substance; *d*, *e*, *f*, *real* lengths of the same respectively.

Fig. 6. The same, specimen of each form of spicule, magnified, on the scale of 1-12th to 1-1800th of an inch, to show their *relative thicknesses* respectively: *a*, trifid forked spicule of bundles of conical expansion; *b b*, half-length of straight, fusiform, acerate spicule of the same; *c c*, half-length of thick, short, curved, acerate spicule of the body; *d*, unequal-armed, minute, trifid spicule of the sarcode of the body; *e*, minute, bihamate, contort, C- and S-like spicules of the same.

N.B. Part of the half-spicule has been taken out in the figures *b b* and *c c*, for convenience.

Figs. 7 & 8. The same, minute forms of spicule in fig. 6, *d*, *e*, magnified, on the scale of 1-12th to 1-6000th of an inch.

Fig. 9. The same, head of large, trifid, forked spicule of body-substance, magnified, on the same scale, to contrast with the trifid head at the circumference of the conical expansion, fig. 4.

N.B. In the body, besides the minute spicules with which the sarcode is densely charged (fig. 6, *d*, *e*), there are straight acerate and trifid spicules, similar to those of the conical expansion, of various lengths and sizes, together with slight variation in the form of the trifid heads, but all much shorter in the shaft.

XIII.—*On the Agamic Reproduction of a Species of* Chironomus, *and its Development from the Unfecundated Egg.* By Oscar von Grimm.

[Concluded from p. 45.]

III. *The Development of the Embryo in the Unfecundated Ovum.*

The embryonic development of *Chironomus* in the fertilized ovum has already frequently been investigated and described by various observers, such as Kölliker, Kupfer, Weismann, Metschnikow*, and Melnikow; but the development from the unfecundated ovum, as, indeed, even the ovum itself, has hitherto been unknown.

We shall see hereafter that the development of the embryo from the fecundated and unfecundated ovum perfectly agrees, so that we might content ourselves with describing the points of divergence between our investigations and those of other observers, if it were not that we intended publishing a more detailed memoir on the development of the histological elements and organs. But, as I have already made some investigations in this direction, and will, as soon as possible, lay the results of this work before the reader, I regard it as necessary to give here a short summary of the course of development, especially as, in some cases, I have arrived at different results from Weismann, who, however, has most completely investigated the embryology of *Chironomus*.

I must, however, remark that I shall here rarely refer to authors, as I regard this chapter as a preface to my future work.

As we already know that in *Chironomus* the second, asexually produced generation is developed from ova, we need not discuss the opinion of Wagner† and Meinert‡ upon the genesis of the Cecidomyid larvæ from the fatty body of the parent larva (to which, moreover, Meinert ascribes peculiar properties), since the supposition of Pagenstecher§ that the larvæ originate independently of the fatty body has been proved by

* Prof. Metschnikow's most recent investigation upon the embryology of *Chironomus* is unfortunately only partially known to me, as it is not yet published.

† "Beitrag zur Lehre von der Fortpflanzung der Insectenlarven," Zeitschr. für wiss. Zool. 1863, Bd. xiii. p. 522.

‡ "Weitere Erläuterungen über die von Prof. Wagner beschriebene Insectenlarve," &c. Zeitschr. für wiss. Zool. Bd. xiv. p. 395.

§ "Die ungeschlechtliche Vermehrung der Fliegenlarven," Zeitschr. für wiss. Zool. Bd. xiv. p. 410.

the investigations of Leuckart*, Ganin†, and Metschnikow‡, as they have detected the ovaries in the Cecidomyid larvæ, and studied the genesis of the larvæ from the ova. Indeed Prof. Wagner himself afterwards recognized his error.

When a certain number of ova have attained maturity within the organism of the parent pupa, the pupa expels them, through the above-mentioned orifices situated in the penultimate ventral segment, in the form of two cords consisting of a homogeneous mass, in each of which there are from 20 to 50 ova. These newly laid ova are elongated oval, egg-shaped, with an obtuse and an acute pole. In the former the head of the embryo is afterwards situated; and it is therefore indicated as the cephalic pole, whilst the opposite one is named the caudal pole. The ova are 0·22 millim. in length and 0·09 millim. in breadth. They are filled with a brownish-yellow vitellus, which contains a quantity of rather large oil-drops. At the upper or cephalic pole the chorion forms an impression, on the margins of which is affixed an extremely elegant lobule (Pl. III. fig. 12, *l*) which formerly united the ova with one another. Whether there is a micropylar orifice in this impression I do not know.

In the preceding chapter we have seen that in the ovum when still incompletely developed but already half filled with the yelk, and changed from the conical to the oval form, the germinal vesicle was already present, although the germinal spot could not be found in it. From this circumstance alone we might come to the conclusion that the germinal vesicle exists in the perfectly developed and deposited ovum; nevertheless all my endeavours to discover the germinal vesicle were without result, although I resorted to the most various reagents and methods of investigation. Notwithstanding this, however, I was firmly convinced that the so-called germ-nuclei are developed in the ovum of *Chironomus*, as indeed of all insects, by the division of the germinal vesicle. We know that the germinal vesicles have originated by the division of the nucleus of the ovarian tube. This circumstance alone leads us to assume that the germinal vesicle also divides and thus produces the germ-nuclei, but not that it is destroyed; for in agamic reproduction the fecundation which ought to cause this destruction of the germinal vesicle is wanting. And in fact, after I had in vain examined many hundred ova with this

* "Die ungeschlechtliche Fortpflanzung der Cecidomyienlarven," Arch. für Naturg. 1865, p. 290.

† Zapiski Imp. Ak. Nauk, 1865, vol. vii. p. 46.

‡ Zhurnal Mni. Nar. Pr. 1865: Embryologische Studien an Insecten, p. 20.

view, I was so fortunate a few days ago as to detect, quite unexpectedly, what I had so long sought in vain. I laid the abdomen of a pupa containing well-formed ova in glycerine, and in the course of a few days, when I remembered this preparation, I examined the ova under the microscope. My delight may be imagined when I saw very distinctly the germinal vesicle in a series of ova (fig. 12, *g v*), and with them an ovum with the germinal vesicle engaged in division. The germinal vesicle was 0·045 millim. in diameter. Its division takes place in a direction transverse to the ovum. These two objects seem to prove prefectly that the germinal vesicle by no means disappears, but by dividing becomes converted into the germ-nuclei. But the circumstance that so many admirable observers (as Weismann, for instance) could not find it, and thought themselves compelled to assume a free formation of the germ-nuclei, was probably caused by the opacity of the yelk, and the difficulty of investigation dependent thereupon.

We may now therefore assume that the union between the germ-nuclei and the germinal vesicle, and also between the different generations, actually exists, and therefore that *omnis cellula e cellula*.

The first alteration in the deposited ovum consists in the contraction of the contents in the direction of the longitudinal axis of the ovum. In consequence of this contraction a polar space is formed in each end of the ovum, of which the lower one, or that in the caudal pole, is larger than the opposite one.

We then observe an alteration in the periphery of the yelk: there is formed here a homogeneous, limpid blastema-layer, the so-called blastema of the blastoderm (*Keimhautblastem*, Weism.), which appears to be thickest in the region of the inferior pole of the ovum. This blastema is nothing but a homogeneous mass, which has separated from the yelk; it is therefore a part of the vitellus, and may probably be regarded as the formative vitellus of insects, whilst the yelk enclosed in this functions as the nutritive vitellus. Soon after the separation of the formative vitellus a germ-nucleus makes its appearance in the inferior pole of the ovum, and, surrounded by a portion of the formative vitellus, passes as the so-called polar cell into the inferior polar space; here the membraneless cell divides into two cells, each of which again divides, so that we finally obtain four polar cells. Frequently, however, the nucleus of the first polar cell divides while still lying in the layer of formative vitellus, so that two polar cells appear at once in the polar space. During the appearance of the first polar cell we see many germ-nuclei, formed by the division of the germinal vesicle, pass from the nutritive vitellus into the layer of formative vitellus, at the same time continually dividing. Here each germ-nucleus is surrounded by a layer of the formative vitellus, so that the germ-nuclei are converted into cell-nuclei, and the layer of formative vitellus becomes a cell-layer, which may be described as the blastoderm. The development of the blastoderm commences, however, in the lower pole of the ovum; that is to say, the germ-nuclei make their appearance in the inferior polar space sooner than in the superior. The cells of the blastoderm, the nuclei of which, as is well known, are strongly refractive, divide in the direction of the radii of the ovum, so that the blastoderm soon appears as a layer of elongated, cylindrical cells. After the completion of the longitudinal division of these cells they divide transversely, so that from the originally one-layered blastoderm we get a two-layered structure. The cells of the lower blastodermic layer now formed continue dividing in the same direction, so that this layer soon appears as a multistratified cell-mass, the outer layer retaining its original character and its cells not dividing. In consequence of this the boundary between these two blastodermic layers is easily recognized.

Having now briefly described the formation of the blastoderm, we venture to raise the question whether this is not identical with the so-called segmentation of the vitellus in other animals? We know that two kinds of ova are distinguished among animals,—those which only contain the formative vitellus being designated *holoblastic*, and the others, which have both the formative and the nutritive vitellus, *meroblastic* ova. The insect-ovum, however, possesses at first only one sort of vitellus, which subsequently divides into the nutritive and the formative vitellus. Hence the insect-ovum may be regarded first as holoblastic, and afterwards as meroblastic. The insect-egg, therefore, unites these two kinds of ova with each other, representing a transition form. We know, further, that the segmentation of the ovum is either total, as in the holoblastic ova, or partial, as in the meroblastic ova. Both consist in the division of the first *sphere of segmentation* (in which there is a nucleus with a nucleolar corpuscle, which must probably be regarded as the germinal vesicle*) into a great number of small spheres; this process is most properly interpreted by Kölliker † as "a kind of cell-multiplication process." Does not this take place also in insects? Have we not seen the division of the germinal

* According to Johannes Müller, Gegenbaur, and Leydig.

† Entwickelungsgeschichte des Menschen und der höheren Thiere, p. 30.

vesicle into germ-nuclei, and the envelopment of these by the formative vitellus, and the formation of the blastodermic cells, which certainly appear to be the analogues of the spherules of segmentation? Is it, then, possible to overlook the identity between the process of segmentation and the formation of the blastoderm? It is true that in the insect-ovum numerous cells (representing spherules of segmentation) are formed at once, after the germinal vesicle, which lies in the nutritive vitellus, has divided into numerous germ-nuclei; but this is caused by the circumstance that the insect-ovum is neither holoblastic nor meroblastic; and the later separation of the formative vitellus is also a consequence of this anomaly in the development of the spherules of segmentation as we may call it.

Claparède*, Leuckart†, and Metschnikow‡ have, indeed, already expressed the opinion, in opposition to Weismann, that the formation of the blastoderm is a process analogous to segmentation; but to me these two processes appear to be perfectly identical, and I have therefore ventured to dwell at some length upon this question.

The inner blastodermic layer, which has become converted, in consequence of the transverse division of its cells, into a finely cellular, many-layered cell-mass, now thickens, but chiefly in the region of the convex side of the ovum.

In consequence of the formation and thickening of the blastoderm, the size of the total contents of the ovum increases, and they now occupy the polar spaces. The four polar cells consequently become immersed in the blastodermic layer, from which, however, they shine forth very distinctly. Their metamorphosis into the ovaries we have already witnessed, and therefore we refer to them no further.

In consequence of the continuous division of the cells the blastoderm has become converted into a finely cellular, strongly refractive mass surrounding the nutritive vitellus on all sides. Immediately after this we observe the formation of the *germinal streak*, which is formed by a thickening of the inner blastoderm in the ventral surface of the ovum. The development of the germinal streak consists first of all in the formation of the so-called caudal pad. At the same time the primitive caudal furrow appears; but this soon disappears, having no further consequences. The form of the caudal pad may be best recognized from the form of the nutritive vitellus.

* Recherches sur l'évolution des Araignées.

† "Die Fortpflanzung und Entwicklung der Pupiparen," Abhandl. naturf. Gesellsch. zu Halle, iv. p. 210.

‡ Embryologische Studien an Insecten, pp. 93–95.

On examining the ovum at this period from the ventral surface, it is easy to perceive that the nutritive vitellus has acquired a form different from the original one; it has become attenuated at each end and gibbous in the middle, and at the same time much lighter in its posterior half, where the caudal pad is situated, which is caused by its less thickness, because here, as has been said, the pad of the germinal streak has consumed it. Then, whilst the caudal pad is constantly enlarging, the opposite cephalic ridge is formed.

As the caudal pad becomes elongated, it ascends nearly to the middle of the ovum, *i. e.* approaches the cephalic end of the ovum. At this time there rises upon its dorsal surface a transverse elevation, the margin of which is turned towards the inferior pole of the ovum. This elevation, growing, becomes converted into a fold which covers half the caudal pad. This is the so-called *caudal fold.*

As regards the whole blastodermic mass, this thickens in the ventral side of the head, and becomes attenuated in the opposite or dorsal side. At the time when the dorsal blastoderm has attained its minimum thickness, a curved dark streak is to be seen, from the dorsal surface of the ovum, upon the nutritive vitelline mass; its dark colour is due to the more considerable vitelline mass here placed, or to the blastodermic layer being most attenuated here. This streak very soon acquires more distinct limits and a still darker colour. At this time occurs the so-called bursting of the blastoderm, upon which Weismann has established that type of development which he designates by the name of "regmagene."

During this bursting, the caudal fold has already grown far downward, and at the moment of bursting it embraces the caudal pad in its whole thickness.

The whole embryo moves 180° upon its longitudinal axis; so that its belly comes to lie in the flat side of the ovum, and its back in the convex one.

Somewhat later we observe a diminution of thickness in the nutritive vitelline mass lying in the cephalic extremity, *i. e.* a thickening of the cephalic portion of the germinal streak, the formation of the cephalic hood. Here a fold is then formed, the margin of which is directed towards the superior pole of the ovum. It grows much more rapidly than the caudal fold, so that the margins of these two folds reach the middle of the embryo at the same time. As their margins grow together, they now form only one fold, which covers the whole dorsal surface of the embryo. With the growth of this fold (*i. e.* the embryonal envelope) the place of origin of the caudal fold has moved far up, and it soon occupies the free space formed by the cleaving of the blastoderm, contracting the vitellus constantly more and more.

The embryonal envelope is at this time bent round the extremities of the embryo, and now shows only one small foramen, the margins of which may be very well seen from the ventral side of the embryo. The vertical laminæ are also already to be seen.

A little after the stage of development just described, a longitudinal furrow, the *median vitelline ridge* of Weismann, becomes perceptible on the inner surface of the germinal streak, dividing the whole germinal streak into two *germinal pads*. This is accompanied by the complete closure of the embryonal envelope, so that now the oval foramen is no longer to be seen. The walls of this embryonal envelope, which have even previously begun to divide, now, after the union of their free margins, form two envelopes separated from each other. One of these envelopes, which lies immediately beneath the chorion, forms a complete capsule, in which the embryo lies freely. This capsule, which has been formed from the outer wall of the embryonal envelope, is Metschnikow's *amnion insectorum*, Kupfer's *embryonal envelope*, and Brandt's *external embryonal envelope*; the other wall of the entire embryonal envelope forms Metschnikow's *covering lamella* (Deckblatt), Kupfer's *folded lamella*, and Brandt's *inner embryonal envelope**.

Somewhat later the germinal pads become segmented in the middle of the length of the ovum; the three pairs of primitive jaws are formed. During this process the inner embryonal envelope is ruptured at the head, and the fore part of the head shows itself through the ruptured place. While this rupture of the inner embryonal envelope enlarges, the germinal pads also increase in length, so that the furrow separating them from each other now reaches only to the fore part of the head; hence the so-called cephalic pad may now be distinguished. The vertical plates, which must be regarded as the foundation of the inner embryonal envelope, give off the primitive antennæ. Then we also observe the further development of the jaws, but especially of the mandibles, which now appear as pointed irregular segments. They have their points turned upwards.

Now also occurs the constriction of the cephalic segments, the three pairs of jaws moving towards the upper half of the ovum. The abdominal furrow, also, which is not unlike those seen at the commencement of the development, now becomes visible.

* The two together form the folded lamella of Weismann.

By the growth of the vertical plates, the fore part of the head is bent forwards. The vitelline streak situated in the fore part of the head becomes diminished, and finally disappears altogether. The inner embryonal envelope now covers only the dorsal surface of the embryo, having removed by its rupture, which commenced at the head, from the ventral surface and the two extremities of the embryo.

The constriction of the cephalic parts goes on, and at this time also the vertical plates separate by a transverse furrow from the caudal pad, by which means the head acquires a distinctly limited form. Immediately after the limitation of the head, the formation of the ventral segments commences, first three and then the rest of the segments being formed.

During the constriction of the cephalic parts, the embryo for the second time revolves round its longitudinal axis, and again by 180°, so that it gets to lie again in its original position; *i. e.* its ventral surface moves again into the convex side of the ovum.

The further development of the head consists in the mandibles occupying the place of the antennæ, whilst the latter move on to the sides of the fore part of the head. At this time the intestinal tube is seen.

After the constriction of the vertical plates from the germinal pads is completed, the embryo draws itself together, which, indeed, has really caused this constriction. The contraction is indicated by the downward movement of the abdominal extremity. At the same time commences the curvature of the mandibles and the lateral movement of the first pair of maxillæ, which become converted into the palpi; the second pair of maxillæ, however, become united by their median margins. On the lower surface of the thoracic segment a transverse fold is formed; and this is afterwards converted into the anterior legs.

Finally, we see that the abdominal extremity has passed entirely into the inferior pole of the ovum. The anal orifice, formed previously by inversion, is now clearly visible. The walls of the intestinal tube consist of a layer of large, oval cells.

In consequence of the constriction of the head and the downward movement of the abdomen (or contraction of the embryo) the vitelline mass, of course, passes outward and lies immediately beneath the inner embryonal envelope. During the whole contraction of the embryo, the lateral walls formed by the rupture of the blastoderm grow into thin processes, which gradually overgrow the vitelline mass, and finally close the back of the embryo, as was quite correctly observed by

Melnikow. The anal orifice is now bounded by four elevations, which subsequently become developed into the finger-like processes. The posterior pair of legs is formed by a furrow, which divides the last ventral segment from beneath into two elevations. Three claws appear upon the two pairs of feet. At the same period the larval eyes and eleven consecutive ganglia are to be seen, occupying the lower space of the ventral cavity. The yelk-sac has now become immersed, and no longer appears as a separate structure; its walls have become considerably thicker.

Lastly, the antennæ and then the palpi become segmented. The body of the embryo becomes much elongated; and as it lies in the envelope of the ovum, it draws this out, so that the ovum now measures 0·27 millim.; the envelope, however, is still so strong that it bears this pressure; and thus the gradually elongating larva is compelled at first to lie in irregular folds, and then to twist itself into a spiral of $2\frac{1}{2}$ turns. Even at the commencement of this process, movements of the larva are perceptible; but when the larva has rolled itself up, the contractions become very lively. It also now works with its fore feet and mandibles, which are now perfectly developed and have become brown. Contractions are also observable in the walls of the stomach.

The ovum now bursts; and the larva, which is 0·47 millim. in length, creeps about in the cavity of the homogeneous cord until, in the course of a few hours, it breaks through this membrane also.

The whole process of development, from the deposition of the ovum to the exclusion of the larva, lasts, in spring, from eighty to ninety hours.

I now conclude this short description of the embryonic development of the species of *Chironomus* under investigation, and reserve it for some future day to describe the development of the histological elements and organs, and also to discuss the question of the lamellar theory of insect-development.

EXPLANATION OF PLATE III.

Fig. 1. The string of ova laid by the pupa: *a*, homogeneous mass.

Fig. 2. The newly hatched larva; its stomach is still filled with the remains of the vitellus.

Fig. 3. A larva, 3 millims. in length, in which the pupa is developing, some of its parts being already visible, such as the tracheæ, eyes, wings, and legs. *Fig.* 3 *a*, antenna of the same larva, strongly magnified.

Fig. 4. Ovigerous pupa; its wings are bent downwards, and only one of them is to be seen.

In figs. 2, 3, & 4, the lettering is as follows:—*a*, antennæ;

e, eye; *pe*, pupal eye; *f*, finger-shaped processes; *ff*, fore foot; *hf*, hinder foot; *pf*, pupal feet; *s*, stomach; *pv*, proventriculus; *mx*, maxillæ; *md*, mandibles; *p*, palpi; *ms*, muscles; *tr*, tracheæ; *fb*, fatty bodies; *tf*, terminal filament; *o*, ova; *sb*, stigmatic branchiæ; *cb*, chitinous band; *go*, genital orifice; *ao*, anal orifice; *pn*, pronotum; *w*, wing.

Fig. 5. A portion of an ovum. The blastoderm has acquired several layers; and in its mass are the polar cells, the diameter of which is 0·012 millim.

Fig. 6. The same, rather later; the polar cells have separated into two groups: *a*, furrow.

Fig. 7. The developing ovary removed from a larva contracted in folds; diameter 0·031 millim.: *ec*, embryonal cells; *n*, nucleus of the ovarian tube.

Fig. 8. An ovary removed from a perfectly developed larva; six embryonic ovarian tubes are visible in it, containing nuclei; diameter 0·057 millim.: *ec*, embryonal cells; *ot*, ovarian tubes; *n*, nucleus.

Fig. 9. Ovarian tube from a young larva: *vc*, vitelligenous cells; *ep*, epithelium; *n*, nucleus.

Fig. 10. Part of an ovarian tube (magn. 475 diams.). The left side of this figure represents the object seen on the surface, and the right side the optical transverse section. The ovum (*o*) will soon be detached. The vitelligenous cells (*vc*) are only indicated, and are too small; *tf*, terminal filament; *tc*, terminal chamber; *ep*, epithelial cells; *ep'*, epithelial cells as seen at the surface; *gc*, germ-chamber; *od*, oil-drops; *gv*, germinal vesicle; *gs*, germinal spot; *vc*, vitelligenous cells; *v*, vitellus. Diameter of the ovum (*o*) 0·085 millim., of the germinal vesicle 0·0432 millim., of the vitelligenous cells 0·0250 millim., of the epithelial cells 0·0224 millim., of the germinal spot 0·0078 millim.; length of the germ-chamber 0·044 millim.; length of the terminal chamber 0·922 millim., diameter of its nuclei 0·0085 millim.; thickness of the terminal filament 0·0060 millim.; diameter of the oil-drops 0·0048 millim.

Fig. 11. Portion of an ovarian tube at the moment of its division into chambers, the contents being already divided, and the nucleus in course of division; magn. 630 diams. The lettering as in fig. 10.

Fig. 12. A perfectly developed ovum in which the germinal vesicle is visible, preserved in glycerine; diameter of the germinal vesicle (*gv*) 0·045 millim.: *l*, lobule surrounding the micropyle.

XIV.—*Notes on the* Berardius *of New Zealand.* By Dr. J. E. Gray, F.R.S. &c.

Dr. Hector kindly sent me an early impression of Dr. Knox's and his own paper on the *Ziphiidæ*, illustrated with five plates, which is to be published in the third volume of the 'Transactions of the New-Zealand Institute.' It contains a figure of the animal of *Berardius*, various parts of the skeleton, and the details of two skulls. From it I give the following character to the animal of this genus, which was previously known only from the skull; and the two skulls evidently belong to two different species.

Berardius.

Head beaked; the beak short, thick; forehead rounded; pectoral fins moderate, acute, on the sides of the chest; dorsal fin small, rather more than two-thirds of the length from the head; tail forked; cervical vertebræ separate. The scapula triangular, broader than long, with very long coracoid and acromion processes, both flat and truncated at the end; the forearm-bone about as long as the upper one, separated by a straight groove. (See Trans. New Zeal. Instit. vol. iii. tab. 13.)

Dr. Hector and Dr. Knox describe and figure two skulls of this genus.

The skull of the third or larger specimen killed at the entrance of Port Nicholson in January 1870, which was 27 feet long.

Dr. Hector gives the length of the skull as 59½ inches, of the dental groove 15 inches, of lower jaw 43 inches; width at notch 14·5 inches, at orbits 24·5 inches, of blowhole 7 inches, of nose 5 inches; height at occiput 19·5 inches.

According to the figure the brain-cavity of this specimen is very short, and the maxillary bones are much expanded on the sides; the beak is much broader than in the other figure; it is broad at the base, and gradually attenuated to the tip. The intermaxillary bones are broad, linear, and flat, the beak being very little more than two-thirds the entire length of the head; the intermaxillaries and vomer, as seen in the palate, are broad, lanceolate. The lower jaw is gradually rounded on the front half of the lower margin, without any distinct gonys; the symphysis is short, not quite one quarter the entire length of the jaw. This skull is figured on the 16th and 17th plates of the Trans. of the New Zeal. Instit. vol. iii. p. 128.

These figures agree with Duvernoy's and Gervais's figure of the skull of *Berardius Arnuxii* (Ostéog. Cetacés, tab. 23). Dr. Hector observes that the form of the tooth is more tumid than in the other specimens; but the variety is probably due to age, this animal being said to be full-grown.

The smaller or second specimen of Dr. Knox was killed in Tatai Bay, Cook's Straits, in January 1866. It was only 9¼ feet long; its skull is figured on tabs. 14 and 15, and is said to be 2 feet long. The figure shows that it has a very slender beak, three-fifths the entire length of the head; the expansion of the maxillary bone is great, and the nostrils or blowers are hooded behind by the development of the intermaxillaries. The beak is rather broad at the base, but suddenly narrows and becomes one-third of its width, and tapers to a small point; the intermaxillaries and vomer, as seen in the palate, are linear. The lower jaw is attenuated in front, with a regular, angular gonys under the hinder part of the symphysis, which is elongate and one-third the entire length of the jaw in extent.

The differences of the skull are too great to depend on the age or sex of the specimens; and there is very great difference of size between the two animals, the one being 27 and the other only 9 feet long; and the most perfectly developed skull belongs to the smaller specimen. I therefore propose to give the name of *Berardius Hectori* to the smaller specimen of Dr. Hector, figured on plates 14 and 15 of the Trans. New Zeal. Inst. vol. iii. p. 128.

This skull has some affinity to the typical *Ziphius*, but is at once known to be a *Berardius* by the anterior position of the teeth.

P.S. Dr. Hector, in a note accompanying the third volume of the 'Transactions of the New Zealand Institute,' just received, observes:—"It is curious that the most commonly found Cetacean bone in the old alluvial deposit is the skull of *Berardius*, although now so rare. I have seen six subfossil, and only heard of three in the recent state, including that mentioned by Dr. Haast and the one that is, or was, in Paris. They are usually dug up and sent as Moa skulls! Not long ago I was made referee in a controversy on this subject between the newspapers."

XV.—*On* Euchelymys, *a new Genus and two new Species of Australian Freshwater Tortoises.* By Dr. J. E. Gray, F.R.S. &c.

In my paper on "Australian Tortoises" in the 'Proceedings of the Zoological Society,' 1856, p. 371, and in the 'Annals and Magazine of Natural History' for 1863, vol. xii. p. 98, I mentioned there being two distinct varieties of *Chelymys macquaria*, both having a distinct nuchal shield.

Having had occasion to examine some specimens of Tortoises in spirits in the Museum for the purpose of identification, I found that what had been considered a variety of *C. macquaria* were provided with a distinct pair of beards in front of the chin; and on more carefully examining the stuffed specimen we received in 1856 from Mr. Stutchbury, I found it had the same peculiarity, which had been overlooked in the dried state. The three specimens in the Museum (one in spirit, another stuffed, and a third a thorax only) all agree in colour, sculpture, and general external appearance, and are certainly a species which I did not distinguish, and combining the characters of *Chelymys* and *Elseya*. I propose to name the group

EUCHELYMYS.

Thorax convex, solid; cavity contracted in front; nuchal shield narrow, well developed; vertebral shields broad, the fifth as broad as or broader than the others; marginal shields dilated behind. Head covered with continuous skin and a hard smooth surface behind; temples and over the ears with numerous small polygonal plates; chin with two distinct beards. Fore legs with large transverse scales in front, and with keeled scales on the outer margin. Upperside of neck more or less warty.

This genus is known from *Chelymys* by its having two distinct beards, by the harder crown to the head, and by the size of the fifth vertebral plate, which in *Chelymys* is scarcely as broad as the other vertebral ones.

Euchelymys sulcifera.

Dark olive-brown, marbled with white below; vertebral shields irregularly longitudinally sulcated, with a central continued longitudinal groove; neck dark olive, with a white streak from the angle of the mouth under the ear on each side, slightly warty above; crown of the head covered with a smooth skin; occiput not broader than the temples, with an oval smooth plate on each side.

Chelymys macquaria, var., *Gray, P. Z. S.* 1856, p. 371; *Ann. & Mag. N. H.* 1863, xii. p. 98; *Suppl. Cat. Shield Reptiles*, p. 75.

Hab. North Australia (*Stutchbury*, 1856).

Euchelymys spinosa.

Thorax brown varied with black above, pale brown marbled with black beneath; head and neck olive; upper surface of neck darker, with rows of large, elongate, conical spines; crown hard, rather irregularly grooved; occiput dilated behind, broader than the temples, hard and polished.

Hab. North Australia (1866).

This species is very different from the former in the large size of the head, covered above with a hard horny surface, and in the back of the neck being so distinctly spinose.

XVI.—*Description of an apparently new Species of Pheasant belonging to the genus* Argus. By D. G. Elliot, F.L.S., F.Z.S., &c.

The form of *Argus*-Pheasant to which I desire to call the attention of ornithologists is founded merely upon a few feathers of the wing and tail; but meagre as my materials may be, they are sufficient to establish the species, should the rest of the plumage of the bird hereafter be ascertained to accord with the feathers we now have, in presenting and continuing those characteristics which cause these to differ from the other known species of *Argus*. To suppose that such would be the case is not by any means a great stretch of the imagination; and it is no more difficult to establish a species upon a single feather than it is to reconstruct a skeleton from a single bone, which has frequently been accomplished with the happiest results. The species I now describe is represented in the Paris Museum by four feathers, one long central one of the tail and three of the wing, differing altogether in colour and markings from all others with which I am acquainted. They have been known for some considerable time to naturalists as *Argus ocellatus*; but although the name has been frequently used in different ornithological works, no description of these feathers has ever been published—an omission I now propose to supply.

Argus ocellatus.

Argus ocellatus, J. Verr. MS.; Bon. Compt. Rend. t. xlii. p. 878 (desc. null.); Sclat. Proc. Zool. Soc. (1863), p. 124; Gray, List Gall. (1867), p. 26.

Hab. —— ?

The largest primary is dark brown upon the outer portion of the outer web, and for about two-thirds of its length from the tip is barred with blackish brown, and also mottled with the same, chiefly in the centre of the web. The base of the feather and also both sides of the shaft are light rufous buff, unspotted, the outer margin of the inner web being brown faintly dotted with dark brown. The buff colour of the base extends the whole length of the feather, becoming darker at the tip. The smallest feather differs from the one just described by only having the base and a line along the shaft of the inner web for half its length bright buff, the remainder being dark brown barred and mottled with blackish brown on the outer web, and only faintly dotted with dark brown on a small portion of the inner web from about halfway from the base towards the tip. The shaft is yellowish white for about half its length from the base, with a line of dark brown along the side next to the inner web, becoming generally darker brown as it approaches the tip.

The general colour of the tail-feather is dark ashy grey, becoming reddish on the outer and brownish on the inner web, dotted throughout with small white spots. Along both webs, near the shafts, extending from the base for two-thirds the length of the feather, are numerous rather large reddish spots with black centres, generally of an oblong form, but lengthened out into lines towards the margins; near the tip these reddish markings disappear entirely. The shaft is reddish, blackish brown on the side of the outer web. The feather is very broad, graduating to a sharp point at the tip; its total length is about 4½ feet.

These feathers do not resemble in any particular that of the *A. bipunctatus* described lately by Mr. Wood. I shall give full-size representations of all the feathers in my Monograph of the Phasianidæ, now publishing.

XVII.—*On the Constitution of Milk and Blood.* By M. Dumas*.

During the most troubled years of the first French revolution, the old Academy of Sciences of Paris having been suppressed, its members none the less continued their patriotic cooperation in the labours required by the new necessities of the country. History has given them credit for this. It associates the names of the principal of them with those of the illustrious administrators and generals, who then caused the integrity of the French soil to be respected.

The editors of the 'Annales de Chimie,' who had been compelled to suspend their publication under the reign of Terror, on resuming it had the happy thought of collecting, in two volumes, all the memoirs or reports with which the Academicians had been charged. In running through these we appreciate at a glance the importance of the questions which were addressed to them, the insufficiency of the means at their

* Translated by W. S. Dallas, F.L.S., from the 'Bibliothèque Universelle,' 15 June 1871, Archives des Sciences, pp. 105–119. This paper has been extracted from the 'Philosophical Magazine' for August, as, although its subject does not strictly belong to natural history, some of the author's observations will be of interest to naturalists at the present time.

command during those troublous times, and the merits of the practical solutions which they presented to the country, as the fruit of their previous studies, or of their improvised experiments.

Saltpetre, gunpowder, steel, weapons, gun-metal, potash, soda, soaps, paper, assignats, and many other objects implicated in the defence of the country, the working of its manufactures and the necessaries of life, gave occasion to investigations and discoveries of which the factories have not yet forgotten the tradition.

The siege of Paris by the Prussian army could not, it was said, be sufficiently prolonged to raise any questions of the same kind; but nevertheless it has been necessary, as in the time of our fathers, to seek for nitrated earths, to produce gunpowder, to manufacture and work up steel, to obtain bronze and cast cannon; we also have been in want of paper, and of a great number of useful objects.

Considerable, although rapid, investigations have been accomplished; and it will be useful as well as just not to allow their memory to be lost. I have busied myself in collecting the materials for this publication, which I shall carry out as soon as circumstances will permit.

Among the privations which our forefathers did not know in their most cruel intensity, those which caused the most decided sufferings to the existing population, relate to the want of combustibles, which was rendered intolerable and most destructive by an exceptionally rigorous winter—to the scarcity of milk and eggs, the certain cause of the premature decease of a great number of young children—and, finally, to the exhaustion of the supplies of corn, flour, and meat, which, rendering the capitulation of Paris inevitable, marked the precise day for it.

Three questions, which have occupied the mind of every man curious to foresee the future of science, were thus incessantly presented to the meditation of the scientific men shut up in Paris, not as far-away dreams in which the imagination delights and disports itself, but as the despairing prayers of a people in utter extremity:—

1. To obtain available heat, without combustibles;
2. To reconstruct food with mineral materials, without the cooperation of life;
3. To reproduce, at least, the essential food of man with non-alimentary organic materials.

Man, in warming himself by means of combustibles furnished either by the existing vegetation, or by the remains of the ancient vegetation of the globe, and in nourishing himself by means of products obtained from plants and animals, demands every thing from life; but could he dispense with life in obtaining his combustible and his nutriment? Would the forces of science alone suffice to assure to him, in this urgent need, those satisfactions which he could no longer demand from the forces of living nature?

This was the question. If put in a time of peace and in the midst of abundance, it would probably have received more than one response in the affirmative. The progress of the physical sciences has been so brilliant! One is so much disposed to exaggerate their power! Electricity opens up such seductive perspectives! Synthesis has produced so many marvels in the hands of chemists!

If the necessity had not been so pressing, so that the question might have been raised as a philosophical thesis, and we could have said to the physicists and chemists, Could you not, if it were necessary, furnish man with heat and food without having recourse to plants and animals? how many, without saying *yes*, would, at least, have answered with one of those smiles which do not say *no*.

But in a crisis where it was necessary to realize immediately what would have been left to hope, people showed reserve; radical solutions were adjourned, and there was no question either of heating Paris without combustibles, or of feeding it without organic aliments.

But could organic materials usually disdained be converted into aliments, so as to replace, by means of clever combinations, those natural products which could no longer be procured?

It is not my design to notice what viands were served at table, or what resources we were led to seek in the blood and offal of the slaughter-houses which are usually thrown away, the bones, feet, and even the skins of the cattle slaughtered. Nor will I examine how the butter and lard, which were speedily exhausted, were replaced. Of these improvised arts some have disappeared with the circumstances which gave them birth, whilst others have left some useful teachings.

I shall treat only of a special question, the solution of which involved certain principles which it seems to me to be important to guard. Was it not possible to come to the assistance of new-born children by replacing the milk, which could no longer be got, by some saccharine emulsion? In this case there was no question of creative chemistry, but only of culinary chemistry. Recipes were not wanting, all reproducing an albuminous liquid, sugar, and an emulsion of a fatty body.

As a provisional succedaneum this artificial milk deserved to be welcomed. But sometimes there was such a conviction in the authors of these propositions, that one was forced to dread for the future the effects of their faith. This was of a nature to make too many proselytes, to the great injury of the children at nurse, and the great profit of the dealers in milk. How could the latter have the least scruple when they were taught to manufacture an emulsion which they saw recommended to the consumers, and even to mothers, as the real equivalent of milk?

The services rendered by concentrated milk during the siege were too important to render any excuse necessary in the country which produces it, when we insist upon the preference always due to natural milk, as also upon the characters which at present do not permit us to confound any artificial milky liquid whatever with the truly secreted product.

Natural milk forms a liquid containing salts, sugar, caseum in solution, and fatty globules in suspension. Let us first see whether we can imitate these fatty globules by dividing or making an emulsion of an oily or fatty matter in a viscous liquid.

I believe that I experimentally demonstrated the contrary some years ago by showing that the globules of fatty matter of milk are protected from certain physical or chemical reactions by a true membranous envelope. Admitted by some, and disputed by others, the existence of this membrane seeming to me to be real and proven, there could be no question, in my opinion, about confounding an artificial emulsion with naked fatty globules with milk from the mammæ, presenting fatty globules enveloped by a membrane, true free cells, filled with butter, analogous to the agglutinated cells of adipose tissues.

The existence of this membrane may be proved by two chemical experiments.

The first depends upon the property possessed by sulphuric ether of dissolving fatty matters and collecting together those which are suspended in liquids, provided that they are free. Now if, after shaking together in a tube fresh milk and ether, they are left to rest, the ether floats on the surface without having dissolved any thing, and the milk resumes its place below the ether without having lost any thing of its appearance, or yielded any of its buttery matter.

But when subjected beforehand to the action of acetic acid, which is able to dissolve the envelopes of its fatty globules, milk, when shaken up with ether, loses its opacity, and yields its butter to that liquid, in which it may be found.

An inverse test leads to the same conclusions. A neutral salt, such as sulphate of soda, added to milk, enables us to filter it, and to retain upon the filter the globules of butter, whilst the serosity flows off perfectly limpid and clear. If the washings with saline water be continued, these globules may be freed from all the soluble products of the serum. Now if the butter consisted of simple fatty globules, there would then remain with them no trace of albuminous or caseous matter. But whatever care may be taken to prolong the washings, we always find with the fatty matter such a proportion of albuminized substance that there can be no doubt that it has remained there in the form of those envelopes or cells which constitute the globules of butter.

The microscope, moreover, shows plainly the constitution of the globules of butter, and reveals the constant presence of the envelopes. It is sufficient to crush the globules of milk by means of the compressor, to obtain a conviction that, after the spreading of the fatty matter, the butter-cell still retains its form and outline, thus showing that the contents and the container have each their distinct existence.

For these reasons, and for many others (for no conscientious chemist can assert that the analysis of milk has made known all the products necessary to life which that aliment contains), we must renounce, for the present, the pretension to make milk, and especially abstain from assimilating any emulsions to this product.

Besides we cannot have too much reserve where we have to pronounce upon the identity of two products, one natural, the other artificial, if they are not crystallizable or volatile—that is to say, definite. We can never affirm that we have reproduced a mineral water, or sea-water for example. When manure for plants, or aliments for man and animals are in question, is not the same reserve still more imperative?

These indefinite natural mixtures contain substances which the coarsest analysis discovers, with others less strongly characterized or less abundant, which are only revealed by delicate chemistry, and others again, and perhaps the most essential, which still escape us, either because they exist in infinitesimal proportions, or because they belong to the category of bodies which have not hitherto been distinguished from other chemical species.

It is therefore always prudent to abstain from pronouncing upon the identity of these indefinite mixtures employed in the sustenance of life, in which the smallest and most insignificant traces of matters may prove to be not only efficacious, but even indispensable. In proportion as science extends her domain, we are sure to see the demonstrations of the appropriateness of this reserve multiplied.

Among the fine investigations executed in France by those who have continued the labours which occupied the life of the illustrious Théodore de Saussure, the important thesis of M. Raulin upon the vegetation of *Aspergillus niger* will always be placed in the foremost rank. All the conditions of the life of this Mucedinean have been so well determined by that author that it may be cultivated with precision in a soil formed of definite chemical species, as if we had to do with the formation of a compound; and the soil once sown, we may follow the transformation or the employment of each of the elements necessary to its life, just as if we had to do with the development of an ordinary chemical equation.

Now, who could have foreseen that the *Aspergillus niger*, which has just made its appearance, for example, upon a slice of lemon exposed to the air, required for the fulness of its existence traces of *oxide of zinc*? How, after this, can we doubt, in the case of plants of a higher order and especially of animals, that, besides their coarsely appreciable aliments, they require also traces of many other aliments, more delicately used but not less necessary?

Milk has often been compared to eggs, both from a chemical and a physiological point of view. Their mission is equally to furnish the young animal with the nourishment of its earliest age; and they have as a common character that they present in union a fatty matter, an albuminoid substance, a saccharine or amylaceous matter, and salts.

But the egg possesses a vitality, an organization, of which chemistry furnishes no evidence, and which the most minute anatomy would be powerless to reveal. If fecundation had not rendered manifest, by the rapid phenomena of segmentation which take place in it, that the mass of the yelk of an egg is endowed with life, and that it obeys the impulsion of the living germ which takes possession of it, we should still be ignorant that the yelk of the egg is not a mere emulsion of inert fatty matter.

Is not milk in the same case? One is led to think so when we see that the yelk of the egg and milk have the same destination and the same configuration, and that, if the yelk obeys the action of the germ which is nourished by it, milk, for its part, proves to be singularly ready to receive and nourish germs of more than one kind, which, on reaching it, become developed and live at its expense.

The power of synthesis of organic chemistry in particular, and that of chemistry in general, have therefore their limits.

The siege of Paris will have proved that we have no pretension to make bread or meat from their elements, and that we must still leave to nurses the mission of producing milk. If some illusions upon this point have found their way into the minds of persons ill-informed as to the true state of science, they are due to the dangerous play of words to which the expressions *organic chemistry* and *organic substances* lend themselves, when applied as these are indifferently to definite compounds such as alcohol or citric acid, which are unfitted for life, and to indefinite tissues, the seat of life.

The former (foreign to life, and true chemical species) are the only ones that synthesis has reproduced. The latter, which can be formed only under the impulse of a living germ, and which receive, preserve, and transfer the forces of life, are not definite species; the synthesis of the laboratories does not reach them. The only synthesis which has hitherto been observed in the case of the chemical materials which constitute living tissues, is that determined in brute matter by the presence and impulse of the living germ itself.

All those chemical syntheses, otherwise so worthy of interest, which have been indicated as reproducing organic matters, have therefore in reality reproduced only matters unfitted for life—that is to say, mineral matters. Thus, of every living matter or matter that has lived, we must still, whether we speak as chemists or as physiologists, say what was said of it formerly: *omne vivum ex ovo*—that which is not life has brought nothing to life.

With regard to the constitution of milk, the phenomena presented by the clarifying of butter have been sometimes employed either to demonstrate or to dispute the existence of the membranes which envelope the butyrous globules; I cannot at present regard these phenomena as having any value in this respect.

It has been said, for example, that the separation of butter was the result of the formation of lactic acid arising from the action of the air, favoured by churning. Numerous experiments effected in my laboratory upon a practical scale, have shown that butter separates equally promptly, and at least equally abundantly, from a milk to which a large amount of bicarbonate of soda has been added, as from natural milk. The alkaline reaction of the former, which is maintained during the operation and after its completion, has no influence either upon its duration or its result. The proportion of butter, far from being diminished, seems even to have been increased by it.

The formation of lactic acid is therefore not necessary for the separation of butter, which appears to me to be due to purely mechanical causes. Such, at least, is the feeling that one experiences on examining by the microscope milk submitted to churning whilst the operation is going on. The first test-drops present nothing peculiar; the globules of butter retain their form, dimensions, and aspect. Soon we see appear irregular butyrous islands in the midst of globules remaining unaltered. These islands of butter increase in number and extent in proportion as the operation proceeds. They form a snow-ball, uniting with each other and becoming agglomerated so as to constitute, at last, the mass of butter which is the object of the operation.

The agglomeration of the butyrous globules into a block of butter would be a true regelation if there were no membrane surrounding them. The existence of this compels us to admit that it must be broken, and that this is the object of the repeated shocks which we make the liquid undergo, in order that the diffused butter may unite with the fatty parcels and agglomerations which it meets with on its road.

If it is true that the separation of butter is a purely mechanical phenomenon, it is not the less so, as I shall hereafter show, because chemistry can give rules to render this operation more rapid and more efficacious, and to produce from it a better clarified and less alterable butter.

I conclude this communication with some details upon phenomena of another nature, towards which the hygienic situation of the inhabitants of besieged Paris turned one's thoughts only too naturally. What took place in the tissues of this population deprived of fresh vegetables, fruits, milk, fish, and fresh meat? What changes did the blood undergo under the influence of this diet? and how must they manifest themselves?

Some years ago I had prepared some experiments the object of which was to ascertain whether exchanges by exosmose and endosmose take place between the internal liquids contained in the globules of the blood and the liquids of the serum. If these exchanges were easy and rapid, their existence might be ascertained. To demonstrate them would be to ascertain by what means the constitution of the globules of the blood may be altered and vitiated, reestablished, or regenerated.

I never completed these experiments; but I have often depended upon the views which guided me, in order to make my auditors in my courses at the faculty of medicine understand how certain alterations of the blood might be interpreted.

It is necessary, perhaps, to explain what stopped me.

Nothing is easier than to compare the serum and globules of a normal blood with the serum and globules of the same blood modified by the intervention of a substance capable of changing the direction or the intensity of the powers of endosmose between the globules and the serum.

In the blood of a living animal the globules suspended in the liquid may absorb or lose some of their elements, if we succeed in changing the constitution of the serum; but how long will the phenomenon last? If the substance added be mischievous it will be eliminated; the veins on their part will absorb liquids destined to reestablish the equilibrium, and the experiment will soon be so altered that the little differences that we have to measure will disappear, vanishing before great complications.

On the contrary, if we withdraw the blood from the body of the animal and divide it into two parts of equal weight, one destined to furnish the term of comparison, and the other to receive the substances modificative of the power of endosmose, coagulation and what I have called the asphyxia and death of the globules will soon do away with any hope of arriving at certain results.

It was therefore necessary to receive the blood into a vessel, to oppose its coagulation, and to replace towards it the action both of the heart and lungs—that is to say, to keep the blood in movement and to present it in a very divided state to the action of oxygen or of the air. I arranged an apparatus which fulfilled these conditions, and allowed one to ascertain how alcohol, neutral salts of soda or potash, sugar, &c. act when added to the serum, and how the interior liquids contained in the globules may become modified under their influence either in quantity or in nature.

While I followed out these views, preoccupied by the evident invasion of scurvy in the general state of health of the inhabitants of Paris towards the close of the siege, and whilst I sought to make up by applicable means for the absence of all fresh vegetables and of all fruit in their habitual diet, a foreign doctor, Dr. J. Sinclair, by following out the ideas which he had heard me teach upon this subject, was led to seek in them the explanation of the first symptoms of alcoholism, a state which he designates by the name of dypsomania.

Just as scurvy would have as its primary cause an impoverishment of the serum in potash-salts and a surcharge of salts of soda (which favours the exosmose of the potash of the globules and consequently their destruction), so alcoholism would have as its starting-point the presence of alcohol in the serum of the blood and its effects on the globules.

Alcohol added to the serum causes a movement of exosmose from the interior of the globules to the serum. The globules lose a part of their constituent liquids; and this alteration, which brings on others, is no doubt reproduced in the cells of the various tissues which are bathed by alcoholized liquids.

What it is now my intention to prove is, that in the blood in particular, and in every living organism of analogous constitution (that is to say, formed by cells or utricles filled with a liquid and floating in or bathed by a liquid), it is sufficient to alter, even slightly, the chemical composition of the exterior liquid to cause that of the interior liquid to become modified by endosmose or exosmose.

As soon as I am enabled to resume possession of my laboratory, if I should ever see it again, I propose to follow out the development and application of this principle, either to demonstrate the effects produced by the action of common salt, alcohol, &c. upon the blood, or to show how rapid is that of some agents, of which I have already examined the action, upon the constitution of the globules.

In the mean time I have yielded to the wishes of your eminent President, and I lay upon the table the exposition of those investigations which time may cause to fructify either in my own or more worthy hands. It is a homage that it is a pleasure to my old age to offer to that kind Society which, having, in 1816, guided my youth and the first steps of my career, offers me for the second time, in 1871, after an interval of half a century, the asylum of its friendly hospitality under grievous circumstances to my country.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

May 11, 1871.—General Sir Edward Sabine, K.C.B., President, in the Chair.

"Action of Heat on Protoplasmic Life." By F. Crace-Calvert, F.R.S.

Those investigators of germ-life who favour the theory of spontaneous generation have assumed that a temperature of 212° Fahr., or the boiling-point of the fluid which they experimented upon, was sufficient to destroy all protoplasmic life, and that the life they subsequently observed in these fluids was developed from non-living matter.

I therefore made several series of experiments, in the hope that they might throw some light on the subject.

The first series was made with a sugar solution, the second with an infusion of hay, the third with solution of gelatine, and the fourth with water that had been in contact with putrid meat. The hay and putrid-meat solutions were taken because they had often been used by other investigators; sugar was employed, being a well-defined organic compound free from nitrogen which can easily be obtained in a state of purity; and gelatine was used as a nitrogenized body which can be obtained pure and is not coagulated by heat.

To carry out the experiments I prepared a series of small tubes made of very thick and well-annealed glass, each tube about four centimetres in length, and having a bore of five millimetres. The fluid to be operated upon was introduced into them, and left exposed to the atmosphere for sufficient length of time for germ-life to be largely developed. Each tube was then hermetically sealed and wrapped in wire gauze, to prevent any accident to the operator in case of the bursting of any of the tubes. They were then placed in an oil-bath, and gradually heated to the required temperature, at which they were maintained for half an hour.

Sugar Solution.—A solution of sugar was prepared by dissolving 1 part of sugar in 10 parts of water. This solution was made with common water, and exposed all night to the atmosphere, so that life might impregnate it. The fluid was prepared on the 1st of November, 1870, introduced into tubes on the 2nd, and allowed to remain five days. On the 7th of November twelve tubes were kept without being heated, twelve were heated to 212° Fahr., twelve to 300°, and twelve to 400° Fahr.

The contents of the tubes were microscopically examined on the 1st of December, twenty-four days after heating.

Sugar solution not heated.	Heated for half an hour at 212° Fahr.	Heated for half an hour at 300° Fahr.	Heated for half an hour at 400° Fahr.	Heated for half an hour at 500° Fahr.
There were about 30 animalcules under each field of the microscope, principally *small black vibrios*, 2 or 3 microzymes swimming slowly about, 3 or 4 *ordinary swimming vibrios*, and a few Bacteria.	A great portion of the life had disappeared, no animalcules were swimming; still this temperature had not completely destroyed life. 4 or 5 *small black vibrios* were observed moving energetically to and fro; 2 or 3 *ordinary vibrios* were also observed moving energetically in the same position of the field; that is, without swimming about.	The sugar was slightly charred, but the life was not entirely destroyed, as 1 or 2 *ordinary vibrios* and 1 or 2 *small black vibrios* were observed in motion under the field of the microscope.	The sugar was almost entirely decomposed; no trace of life was observed.	No life observed.

Remarks.—The black vibrios here referred to are far more opaque than the other varieties of vibrios, and are the most important of all, as I have found them to resist not only very high temperatures, but all chemical solutions. I shall, in my paper on putrefaction and the action of antiseptics, describe the various vibrios and give drawings of them.

Hay Infusion.—An infusion of hay was made by macerating it in common water for one hour, then filtering the liquor, and leaving it exposed to the atmosphere all night, when it was sealed in the small tubes, twelve of which were used for each experiment. The infusion was made on the 4th of November, sealed in tubes on the 5th, and heated on the 7th.

The results were examined on the 1st of December, 1870, twenty-four days after being heated.

Hay infusion not heated.	Heated for half an hour at 212° Fahr.	Heated for half an hour at 300° Fahr.	Heated for half an hour at 400° Fahr.	Heated for half an hour at 500° Fahr.
Fungous matter was observed growing on the surface of the fluids in two of the tubes. On subjecting the contents of some of the tubes to examination, from 20 to 25 animalcules were observed under each field of the microscope. This kind of life resembled small dots moving energetically to and fro; 1 or 2 ordinary vibrios were also present.	No fungous matter was noticed on the surface in any of the tubes. A few small black vibrios present in the original solution were also present in this.	No fungous matter present, but some of the small black vibrios were still present, although in less numbers.	No fungous matter observed. The fluid was filled with irregular masses of coagulated matter, and life had disappeared.	No life present.

Gelatine Solution.—A solution of gelatine, prepared of such strength that it remained liquid on cooling, was exposed for twenty-four hours to the atmosphere. It was then introduced into the small tubes, and the tubes sealed. The solution was made on the 4th of November, the tubes sealed on the 5th, and subjected to the different temperatures on the 7th.

The fluids were examined on the 1st of December, 1870, twenty-four days after being heated.

Gelatine solution not heated.	Gelatine solution heated for half an hour at 100° Fahr.	Heated for half an hour at 212° Fahr.	Heated for half an hour at 300° Fahr.	Heated for half an hour at 400° Fahr.
There were 7 or 8 animalcules under each field, 5 or 6 of which were quite different to any thing observed in the other fluids. They had long thin bodies, swimming with a peristaltic motion. 1 or 2 ordinary swimming vibrios were also present; but the small black vibrios were absent.	Life seemed to have only slightly decreased, and none of the animalcules were swimming. The peculiar animalcule mentioned in the first column appeared to retain still its peristaltic motion, but not sufficient power to move across the field, a few ordinary vibrios being also observed moving to and fro.	A very decided diminution in the quantity of life present was noticeable.	No life present.	No life present.

Putrid-Meat Fluid.—Water was placed in an open vessel, and a piece of meat suspended in it until it became putrid and contaminated with myriads of animalcules. This fluid was placed in the usual tubes, which were sealed on the 7th of November, and heated on the same day.

The contents of the tubes were subjected to examination on the 1st of December, or twenty-four days after having been heated.

Not heated.	Heated for half an hour at 100° F.	Heated for half an hour at 212° F.	Heated for half an hour at 300° F.	Heated for half an hour at 400° F.	Heated for half an hour at 500° F.
A large quantity of life was present, namely, microzyma and several distinct species of vibrios, among which were a number of the small black ones frequently mentioned.	This temperature had but slightly affected the life present, the animalcules being as numerous as in the liquid not heated, and moving as usual. However, one species of very long vibrios appeared to be considerably affected, as they were much more languid in their movements.	This liquor differed from all the others in being turbid and coagulated. Life was still present; and although heat had deprived the animalcules of the power of locomotion, still they retained a sufficient amount of vital force to place it beyond a doubt that life was not destroyed.	The liquid was quite clear, the albumen (which is coagulated at 200°) appearing to be redissolved. A large quantity of the life in the fluid was destroyed, but some vibrios still remained, the small black ones being the most numerous.	All life had disappeared.	All life had disappeared.

The results recorded in the above Tables show that protoplasmic life is but slightly affected by a temperature of 212° F., and that even at a temperature of 300° F. it is not entirely destroyed, excepting in the case of gelatine. In all the other fluids a temperature of 400° F. is necessary to completely destroy the life. These experiments, therefore, clearly show that the life found by previous experimenters in fluids which have been submitted to heat was not due to heterogenesis, but to life which had remained in the fluids, as I have seen no experiment reported where the temperature to which the fluids were exposed exceeded 300° F.*

I am the more justified in making this statement, as I have repeatedly examined the contents of tubes which had been submitted to a temperature of 400° F., both immediately after cooling and at all periods up to thirty days, and was unable in any instance to detect the slightest trace of life.

This important result corroborates those recorded in my previous paper, and proves that the spontaneous-generation theory is not yet by any means established.

It occurred to me that it might be interesting to examine the influence on pure albumen of the putrid-meat fluids that had been heated, and note whether they still possessed the property of propagating life. A solution was prepared by mixing the albumen of a new-laid egg with pure distilled water free from life (prepared as described in my previous paper). Equal volumes of this solution were placed in six small test-tubes, which had been cleansed with hot vitriol and well washed with pure water. To one tube two drops were added of the putrid-meat solution that had been heated to 100° F., to a second two drops of that heated to 212° F., to a third two drops of that heated to 300° F., to a fourth an equal bulk of fluid heated to 400° F., and to a fifth the same quantity heated to 500° F. In the sixth the albuminous solution, without any thing added, was kept for comparison.

The tubes were sealed, and kept from the 1st of February to the 9th.

Results of Examination.

Albumen solution.	Albumen solution, with putrid-meat liquor, heated to 100° F.	Albumen solution, with putrid-meat liquor, heated to 212° F.	Albumen solution, with putrid-meat liquor, heated to 300° F.	Albumen solution, with putrid-meat liquor, heated to 400° F.	Albumen solution, with putrid-meat liquor, heated to 500° F.
In each drop 2 or 3 small black vibrios, moving to and fro.	Abundance of life.	Abundance of life.	Much less life than in the two fluids previously examined.	In each drop 2 or 3 small black vibrios, moving to and fro.	In each drop 2 or 3 small black vibrios, moving to and fro.

* It is with pleasure that I find these experiments to confirm the suggestion of Dr. Beale, in his work entitled "Disease-Germs, their supposed Origin," page 50 (which I read a few weeks ago), that "living forms might live though exposed, under certain conditions, to a temperature of 350° F."

These results clearly show that, at the temperatures of 100°, 212°, and 300° F., life and its germs had not been destroyed, whilst at 400° F. they had; for the results of the examination were in this case exactly identical with those of the albumen solution itself; and the life found was doubtless introduced in the preparation of the solution, and was not due to any life having remained in the fluids that had been heated.

Although perfectly aware of the interesting researches of Professor Melsens, proving that the most intense cold does not destroy the active power of vaccine lymph, still I thought it desirable to ascertain the effect of a temperature of 15° F. on well-developed germ-life, similar to that which had been subjected to the action of heat.

Some putrid-meat liquor, therefore, containing a large quantity of microzyma and vibrios, was subjected for twenty hours to the influence of a temperature ranging between the freezing-point of water and 17° below that point, when the ice was melted and the liquor examined. The animalcules retained their vitality, but appeared very languid, and their power of locomotion was greatly decreased.

Two hours after melting the ice the liquor was again examined, when the animalcules appeared to be as energetic as before.

June 15, 1871.—General Sir Edward Sabine, K.C.B., President, in the Chair.

On the Organization of the Fossil Plants of the Coal-measures.—Part II. *Lepidodendra* and *Sigillariæ*. By W. C. Williamson, F.R.S., Professor of Natural History in Owens College, Manchester.

The *Lepidodendron selaginoides* described by Mr. Binney, and still more recently by Mr. Carruthers, is taken as the standard of comparison for numerous other forms. It consists of a central medullary axis composed of a combination of transversely barred vessels with similarly barred cells; the vessels are arranged without any special linear order. This tissue is closely surrounded by a second and narrower ring, also of barred vessels, but of smaller size, and arranged in vertical laminæ which radiate from within outwards. These laminæ are separated by short vertical piles of cells, believed to be medullary rays. In the transverse section the intersected mouths of the vessels form radiating lines; and the whole structure is regarded as an early type of an exogenous cylinder; it is from this cylinder alone that the vascular bundles going to the leaves are given off. This woody zone is surrounded by a very thick cortical layer, which is parenchymatous at its inner part, the cells being without definite order; but externally they become prosenchymatous, and are arranged in radiating lines, which latter tendency is observed to manifest itself whenever the bark-cells assume the prosenchymatous type. Outside the bark is an epidermal layer, separated from the rest of the bark by a thin bast-layer of prosenchyma, the cells of which are developed into a tubular and almost vascular form; but the vessels are never barred, being essentially of the fibrous type.

Externally to this bast-layer is a more superficial epiderm of parenchyma, supporting the bases of leaves, which consist of similar parenchymatous tissue. Tangential sections of these outer cortical tissues show that the so-called "decorticated" specimens of *Lepidodendra* and of other allied plants are merely examples that have lost their epidermal layer or had it converted into coal, this layer, strengthened by the bast-tissue of its inner surface, having remained as a hollow cylinder when all the more internal structures had been destroyed or removed.

From this type the author proceeds upwards through a series of examples in which the *vessels* of the medulla become separated from its central *cellular* portions and retreat towards its periphery, forming an outer cylinder of medullary vessels, which are arranged without order and enclose a defined cellular axis; at the same time the encircling ligneous zone of radiating vessels becomes yet more developed, both in the number of its vessels and in the diameter of the cylinder relatively to that of the entire stem. As these changes are produced, the medullary rays separating the laminæ of the woody wedges become more definite, some of them assuming a more composite structure, and the entire organization gradually assuming a more exogenous type; at the same time the cortical portions retain all the essential features of the Lepidodendroid plants. Commencing with the *Lepidodendron selaginoides* just described, we pass on to *L. Harcourtii*, in which there is a distinct cellular axis to the medulla, surrounded by a ring of medullary vessels, external to which is the second or radiating cylinder of vessels, from which alone, as M. Brongniart has very correctly shown, the bundles of vessels supplying the leaves are derived. Then we reach the more highly organized of the forms which Mr. Binney has described under the common name of *Sigillaria vascularis*, in which the woody cylinder is more extensively developed. This conducts us to a series of varieties from which the cells of the medulla have disappeared, but in which there is a very distinct inner cylinder of large barred vessels not arranged in radiating order, and an outer and much more ample cylinder of smaller ones arranged on the exogenous type. In these examples the line of demarcation between the vessels of the medulla and those of the ligneous zone is sometimes straight, and at others boldly crenulated. In the latter examples the outside of the vascular medullary cylinder, detached from its surroundings, exhibits the fluted appearance of a Calamite, for which it might be mistaken, but it lacks the transverse nodal constrictions of that genus. It is to some of these more highly organized *Lepidodendra* just referred to that Corda has applied the name of *Diploxylon*, and Witham that of *Anabathra*, both of which correspond in the closest manner with the *Sigillaria elegans* of M. Brongniart. We are thus brought, by the evidence of internal organization, to the conclusion that the plants which Brongniart has divided into two distinct groups, the one of which he has placed amongst the vascular Cryptogams, and the other amongst the Gymnospermous Exogens, constitute one great natural family.

Of this family numerous other modifications are described. Thus *Ulodendron* and *Halonia*, very closely allied, if not identical genera, have a structure closely corresponding with that of *Lepidodendron Harcourtii*, since they possess a very distinct cellular medullary axis enclosed within the ring of medullary vessels, and, besides, exhibit the enclosing ligneous zone at its minimum stage of development. The remarkable scars of *Ulodendron* and the tubercles of *Halonia* appear to have had their most prominent surfaces composed of the true bark-layer deprived of its epidermal bast and parenchymatous layers, which surround these structures but do not wholly enclose them. These characteristic structures are believed to have supported special organs, into which the epidermal layer of the stem has been prolonged, and which the author believes to have been reproductive cones. *Favularia* corresponds very closely, so far as its cortical layer is concerned, with those already described; and as Brongniart's *Sigillaria elegans* is an unquestionable *Favularia*, the entire series of this subgenus is brought into the closest relationship with the plants described. But the author has further met with some important examples, showing that the stem supported verticils of organs that were neither leaves nor branches, but which are believed to have been cones, thus bringing to light an additional indication of affinity between *Favularia*, *Halonia*, and *Ulodendron*.

Well-marked examples have also been obtained from the Lancashire Lower Coal-measures, the source whence all the specimens described have been obtained, of the outer cortical layers of true *Sigillariæ*. These specimens demonstrate that the bark of these plants is of the true *Lepidodendron* type. No example of an unquestionable *Sigillaria* in which the central woody axis is preserved has yet been seen by the author.

Stigmaria is shown to have been much misunderstood, so far as the details of its structure are concerned, especially of late years. In his memoir on *Sigillaria elegans*, published in 1839, M. Brongniart gave a description of it, which, though limited to a small portion of its structure, was, as far as it went, a remarkably correct one. The plant now well known to be a root of *Sigillaria*, possessed a cellular pith without any trace of a distinct outer zone of medullary vessels, such as is universal amongst the *Lepidodendra*. The pith is immediately surrounded by a thick and well-developed ligneous cylinder, which contains two distinct sets of primary and secondary medullary rays. The primary ones are of large size, and are arranged in regular quincuncial order; they are composed of thick masses of mural cellular tissue. A tangential section of each ray exhibits a lenticular outline, the long axis of which corresponds with that of the stem. These rays pass directly outwards from pith to bark, and separate the larger woody wedges which constitute so distinct a feature in all transverse sections of this zone, and each of which consists of aggregated laminæ of barred vessels disposed in very regular radiating series. The smaller rays consist of vertical piles of cells, arranged in single rows, and often consisting of but one, two, or three cells in each vertical series; these latter are very numerous and intervene between all the numerous radiating laminæ of vessels that constitute the larger wedges of woody tissue. The vessels going to the rootlets are not given off from the pith, as Goeppert supposed, but from the sides of the woody wedges bounding the *upper* part of the several large lenticular medullary rays, those of the *lower* portion of the ray taking no part in the constitution of the vascular bundles. The vessels of the region in question descend vertically and parallel to each other until they come into contact with the medullary ray, when they are suddenly deflected, in large numbers, in an outward direction, and nearly at right angles to their previous course, to reach the rootlets. But only a small number reach their destination, the great majority of the deflected vessels terminating in the woody zone. A very thick bark surrounds the woody zone. Immediately in contact with the latter it consists of a thin layer of delicate vertically elongated cellular tissue, in which the mural tissues of the outer extremities of the medullary rays become merged. Externally to this structure is a thick parenchyma, which quickly assumes a more or less prosenchymatous form and becomes arranged in thin radiating laminæ as it extends outwards. The epidermal layer consists of cellular parenchyma with vertically elongated cells at its inner surface, which feebly represents the bast-layer of the other forms of Lepidodendroid plants. The rootlets consist of an outer layer of parenchyma, derived from the epidermal parenchyma. Within this is a cylindrical space, the tissue of which has always disappeared. In the centre is a bundle of vessels surrounded by a cylinder of very delicate cellular tissue, prolonged either from one of the medullary rays or from the delicate innermost layer of the bark, because it always accompanies the vessels in their progress outwards through the middle and outer barks.

The facts of which the preceding is a summary lead to the conclusion that all the forms of plants described are but modifications of the Lepidodendroid type. The leaf-scars of the specimens so common in the coal-shales represent tangential sections of the petioles of leaves when such sections are made close to the epidermal layer. The thin film of coal of which these leaf-scars consist, in specimens found both in sandstone and in shale, does not represent the entire bark, as generally thought, and as is implied in the term "decorticated" usually applied to them, but is derived from the epidermal layer. In such specimens all the more central axial structures (viz. the medulla, the wood, and the thick layer of true bark) have disappeared through decay, having been either destroyed or in some instances detached and floated out; the bast-layer of the epiderm has arrested the destruction of the entire cylinder, and formed the mould into which inorganic materials have been introduced. On the other hand, the woody cylinder is the part most frequently preserved in *Stigmaria*, doubtless because, being subterranean, it was protected against the atmospheric action which destroyed so much of the stem.

It is evident that all these Lepidodendroid and Sigillarian plants must be included in one common family, and that the separation of the latter from the former as a group of Gymnosperms, as suggested by M. Brongniart, must be abandoned. The remarkable development of exogenous woody structures in most members of the entire family indicates the necessity of ceasing to apply either to them or to their living representatives the term Acrogenous. Hence the author proposes a division of the vascular Cryptogams into an exogenous group, containing *Lycopodiaceæ*, *Equisetaceæ*, and the fossil *Calamitaceæ*, and an endogenous group, containing the ferns,—the former uniting the Cryptogams with the Exogens through the *Cycadeæ* and other Gymnosperms, and the latter linking them with the Endogens through the *Palmaceæ*.

MISCELLANEOUS.

On the Skulls of Manidæ.

(In a letter to Dr. J. E. Gray.)

Dear Sir,—In the 'Annals and Magazine of Natural History' for last month I observe a note of yours "On the Malar Bone in the Skulls of Manidæ;" and, as bearing on the explanation you offer regarding the absence of a zygomatic arch in most of the skulls you have seen, I beg to say that in the skeleton of a very young *Manis*, from Western Africa, contained in the Haslar Museum, the arch is formed by a thin band of cartilage connecting the zygomatic processes on the maxilla and squamosal.

I am, dear Sir,
Yours truly,
Charles Barron.

R. N. Hospital, Haslar.
July 3, 1871.

On the Development of the Teeth in Phacochœrus æthiopicus. By Dr. J. E. Gray, F.R.S. &c.

The British Museum has lately received the skulls of two young *Phacochœrus æthiopicus* from Abyssinia. These skulls can scarcely be distinguished from those of the genus *Sus* by their dentition, as the grinders are not worn, and the large permanent grinder is not developed, but are known by the dilatation and the spreading out of the hinder part of the base of the lower jaw. The younger, which is $4\frac{1}{4}$ inches long, has only the second deciduous grinder developed in the upper jaw and the first and second in the lower jaw. The canines are slender and conical, curved downwards and outwards. The pulp of the two upper cutting-teeth is visible; but they are not cut. The canines of the lower jaw are slender; and the outer cutting-teeth are alone visible.

The larger skull, which is $6\frac{1}{4}$ inches long, has the small conical first and the second and third larger deciduous molars well developed, as are also the two upper cutting-teeth; and the canines are, like those of the smaller skull, bent down, but the alveolar part of the base rather more produced. The lower jaw has the three deciduous grinders and the six cutting-teeth all well developed, the two middle ones being much the longest. The canines are, as in the smaller skull, slender and curved; the lower jaw is much more developed, extended in front, and broader and much more expanded below, approximating it more closely to the shape of the jaw of the adult animal.

I give these particulars, as I think they show the order in which the teeth are developed, more especially as attention has lately been called to this subject.

It appears probable that having cutting-teeth in the upper and lower jaws is the normal condition of the dentition; but, as is well shown in M. de Blainville's plates in his 'Ostéographie,' the upper cutting-teeth vary considerably in form and size, sometimes being broad and transverse, and at others circular, and often falling out entirely; and this is more likely to be the case as the same kind of variation occurs in the cutting-teeth of the lower jaw: sometimes it is the middle tooth, sometimes the intermediate, and at others the outer that is the broadest; and in other specimens all the teeth are either very small or entirely wanting, especially in the animals which have approached the adult state. The series of jaws in the Museum exhibit the same variations in the size and absence of these teeth.

The size, form, and hairiness of the ear, which has been supposed a specific character for the Abyssinian specimens, I have no doubt depends on the age of the animal examined, more especially as Wolf's admirable figures of two specimens, said to have been fifteen months old, living in the Gardens, from Natal, represent them as having small oval hairy ears (see P. Z. S. 1850, p. 78, tab. xvii.).

Development of Spirorbis nautiloides, *Lam.*

By Dr. R. von Willimoes-Suhm.

Spirorbis nautiloides occurs in the Bay of Kiel and in the Sound in very great abundance, especially on *Fucus vesiculosus*, which it frequently covers closely in association with *Membranipora*. Like its allies *S. Pagenstecheri*, Quatref., and *S. spirillum*, Gould, it is an hermaphrodite, the yellowish-red ova lying in the anterior, and the seminal filaments (which are furnished with a knob) in the posterior part of the body. The process of development of the young within the pedicle of the operculum described by Pagenstecher* as occurring in a Mediterranean species, does not take place in *S. spirillum*. In this, according to A. Agassiz, the ova, imbedded in gelatinous cords, are deposited in the shell of the parent, and there undergo their development. This is the case also in *S. nautiloides*, the beautifully coloured ova of which may be found, at the beginning of June, in a biserial gelatinous cord within the calcareous shell with the parent animal.

* Zeitschr. für wiss. Zool. Bd. xii. p. 486, pls. 38 & 39; *l. c.* p. 318, pl. 7.

Segmentation takes place here in the manner stated by Claparède and Mecznikoff: the smaller spherules of segmentation grow round the larger ones; and after complete segmentation an embryo is developed *within the egg-membrane*, bearing a ciliary girdle, and in its anterior part two eye-spots. The posterior end shows a delicate coat of cilia. It now rotates in its capsule like the embryo of a mollusk, until its egg-membrane is absorbed and it can move more freely in the gelatinous envelope. The animal is still quite opaque, when we observe on each side of it two lanceolate setæ, and a pad which projects like a handle at the sides and surrounds the animal; this is the rudiment of the neck-frill. At the formation of the third pair a subulate seta associates itself with the other setæ, the neck-pad becomes elongated with the animal, and a more distinct separation between the fore and hind body appears. At the extremity of the latter we still observe a band of cilia striking downwards; and at the cephalic extremity, on which tentacles are now sprouting, we see a small tuft of cilia, which soon falls off. In other respects I may refer for the further development to Agassiz's description of the process in *S. spirillum*, as any thing I could say would be only an unnecessary repetition of what he has said.—*Zeitschr. für wiss. Zool.* Bd. xxi. p. 394.

On presumed American Specimens of Pelomedusa. By Dr. J. E. Gray, F.R.S. &c.

The British Museum lately received, along with a collection of fish in spirits, from Dr. Wucherer, from Bahia, a very large specimen of *Pelomedusa subrufa*, which is a common South-, East-, and West-African species. Is this another instance of an African tortoise having colonized, like *Kinixys* in South America? It is considerably larger than any other specimen we have received, but I cannot see that it differs in any other respect.

Cornalia described a species of *Pelomedusa*, which is entirely an African genus, under the name of *Pentonyx americana*; and his description will fit young specimens of this species. He says that it comes from New York. Can that have been from an introduced specimen of *P. subrufa* brought by the negroes from Africa, as *Kinixys* is also supposed to have been?

Note on Trimerella acuminata. By E. Billings.

The genus *Trimerella* was founded by me on two species (*T. grandis* and *T. acuminata*); but of the latter I had only the rostral half of the ventral valve of a small specimen. I therefore named it provisionally, and stated that it differed "from *T. grandis* in having the spiral extremity much more pointed, and the longitudinal septa running all the way to the beak." (The septa here alluded to are the walls between the tubes mentioned below.) Within the last few days, Mr. T. C. Weston, of our Survey, discovered several new specimens, among which are two exhibiting the casts of both valves in connexion. It then immediately became evident that several separate dorsal valves in our collection belonged to the same species. I have therefore now abundant material to illustrate the species, which I shall do soon, but in the mean time propose to notice its leading characters briefly.

The ventral valve, in young specimens, is somewhat straight along the median line, but becomes more and more arched as the size increases. It is ovate, rounded in front, widest a little in advance of the mid-length, thence tapering with nearly straight sides to the beak, which is narrowly rounded, almost acute. In the substance of the shell there are two large tubes, which extend from about the mid-length to the beak. These are joined in the beak by two others, one on each side. All of these tubes are open anteriorly, but closed at their terminations in the beak. The area is large, concave, and transversely striated. The dorsal valve is much shorter than the ventral, more convex, and has its beak very strongly incurved; it has two tubes, which extend nearly to the apex of the beak. The shell is marked with coarse concentric accretion-ridges of growth. Length of the largest specimen $3\frac{1}{2}$ inches, width 3 inches.

The above is sufficient to show that this species is quite distinct from *T. grandis*. If a section were to be made across the beak of a perfect shell of *T. acuminata*, it would show four perforations arranged in a curve, exactly as in the similar section of the Swedish species figured by Dr. Lindström. But if the beak of *T. grandis* were to be cut across, it would show only two orifices, and they would be the homologues of the two lateral perforations in the section of *T. acuminata*, because in *T. grandis* the two central tubes do not extend into the beak, but terminate before they reach it.—*Silliman's American Journal*, June 1871.

On the Skull of the Madoqua (Neotragus Saltianus) *from Abyssinia.* By Dr. J. E. Gray, F.R.S. &c.

The British Museum has just received the skull of a female *Neotragus Saltianus* from Abyssinia. It is peculiar for being short and broad, with orbits very prominent and the nose much compressed; suborbital fissure small, triangular; concavity in front of the orbit very large, deep behind; the nose-hole very large, more than half the length of the nose; the intermaxillary bones very long and slender, slightly dilated and expanded outward in front, much broader and truncated behind; the nasal bones very short, broad, as broad as long, deeply notched on each side of the margin. Lower jaw very slender, elongate, straight, with a well-produced hinder angle. The chin compressed, keeled.

In the size of the nose-hole it is most allied to the genus *Procapra*, and in some respects to *Saiga*.

Note on Spongia linteiformis *and* S. lycopodium, *Esper.* By Dr. J. E. Gray, F.R.S. &c.

There is in the British Museum a specimen of a sponge-like body which was received from the Philippine Islands. Mr. Carter, on examining it with the microscope, determined it to be an alga nearly allied to *Cladophora*, with elongated tubular joints, and having an ovate-acute terminal joint. It agrees so well with the figure and description of *Spongia linteiformis* of Esper's 'Pflanzenthiere,' Supplement i. p. 205, t. 58, which he received from the Missionary John, from Tranquebar, that I have no doubt it is the same alga. The original type of Esper's species does not appear to be preserved with several of the others in the University Museum at Erlangen; at least Dr. Ehlers does not refer to it in his account of the examination of Esper's type-sponges in that museum, published in 1870.

Esper, in his description, refers to *Spongia lycopodium* (p. 269, t. 43), from the Mediterranean, as being like *S. linteiformis*, but differing from it in texture and form. It is very like our specimens, but the branches do not coalesce so as to form an anastomosing mass. The type specimen of this species is in the Erlangen Museum; and, according to Dr. Ehlers, Dr. Kraus has decided that it is a specimen of *Cladophora spongiomorpha*.

Spongia linteiformis from the Philippines is a different species from any of the specimens of *Cladophora spongiomorpha* that I have seen, and may be called *Cladophora linteiformis*.

On the Development of an Appendiculate Distoma *. By Dr. R. von Willimoes-Suhm.

A free-living, asexual *Distoma* is, so far as I know, still unknown; and yet one is very frequently to be observed, both in the Baltic and in the Sound, from the middle of June onwards. As will hereafter appear, it is a *Distoma* of the appendiculate group, which, at the time when it has passed through the *Cercaria*-state but does not yet possess the introverted tail, probably migrates out of a mollusk and for a time leads a free predaceous life. It adheres firmly by suction to the larvæ of worms and Copepoda, and gradually eats them entirely out; for one half of its body is often immersed in a *Cyclops* whilst the other half sticks out. It then rolls itself up and wanders about with the dead envelope, but does not become encysted in it, as Prof. Möbius, who long since observed the animal, seems to suppose. It now grows rapidly; the tail (which shows the group to which it belongs) becomes introverted, the excretory organ is most distinctly recognizable, and the rudiments of the genitalia begin to show them-

* The name *Distoma appendiculatum*, Rud., refers, as Wagner especially has shown, to various forms, which are found in many species of fishes.

selves. Probably it now migrates directly into fishes, which must certainly often swallow these parasites in abundance with *Cyclopes* and worm-larvæ. There it attains its full maturity. Prof. Möbius thinks that it is *Distoma ocreatum*, Rud., of the herring.

Besides the last-mentioned observer, who has published nothing upon it, this animal is also mentioned, as I am told by Prof. Kupffer, by a Russian naturalist in a publication at Moscow. This, however, having appeared in the Russian language, is inaccessible to me.—*Zeitschr. für wiss. Zool.* Bd. xxi. p. 382.

On Halicryptus spinulosus, *Von Sieb.*
By Dr. R. von Willimoes-Suhm.

As early as the beginning of April, I captured in the Bay of Kiel several specimens of *Halicryptus spinulosus*, to which I assigned as a dwelling-place a large porcelain pan with mud and flowing sea-water. I soon added more to them, and quickly had some sixteen *Halicrypti*, which usually buried themselves at once in the mud, and lay quiet during the day, but at night always wandered to a greater or less distance. The specimens which I captured towards the middle of the month became very tumid: dissection showed strongly inflated ovaries, with ova ready to separate, in the females; but in the males mature spermatozoa were not yet to be found. I soon determined to make experiments in artificial impregnation, and cut up females and males in the same vessel, but without causing any further development of the ova, which were apparently mature. I ascribed this at that time to the circumstance that the breeding-season had not arrived for the males. As I only possessed a few specimens now, I could not make use of any more for dissection; but I observed the animals all the more carefully, and remarked, towards the end of April, that all the specimens which had previously been strongly inflated, now suddenly appeared thin and collapsed. From this I concluded that the ejection of the sexual products had probably taken place; and now, as also throughout the whole month of May, I examined the mud most zealously, but without finding the least trace of ova. But that an ejection must have taken place towards the end of April, I conclude from the finding, in the towing-net, of a young *Halicryptus*, only 8 millims. in length, on the 14th of June. It already possessed perfectly the form of the older individuals, except that the sexual glands did not yet show any differentiation. A small, hitherto undescribed appendicular gland, however, could be distinctly detected in it; and this also occurs upon the middle of the genital tube in the adults. This gland, which also exists in *Priapulus*, consists of very small vesicles with granular contents arranged in a raceme; and these pour their secretion through a very short efferent duct into the genital tube.

The *Halicrypti* lived nearly three months in my vessels, without my being able to come upon any trace of their earlier stages of development. I could add nothing to what is already known as to their mode of life, except that at the end of May I found one of the animals, still living, quite loose in its chitinous envelope. This (together with the whole dentary armature of the œsophagus) was completely thrown off; and the animal therefore regularly moulted. —*Zeitschr. für wiss. Zool.* Bd. xxi. p. 385.

On Priapulus caudatus, *Linn.* By Dr. R. von Willimoes-Suhm.

Priapulus was obtained by me more rarely than *Halicryptus*; in fact I only captured six specimens in all, which buried themselves very briskly as soon as I put them into the pan. They worked onward by quickly extending the proboscis and retracting it equally rapidly, usually keeping the caudal appendage close to the body. But their movements soon became slower, and in a few days their muscular power seemed lost; for they lay still for a long time with the caudal appendage extended, and then died. *Priapulus* also will probably pass through its first stages of development at the end of April or the beginning of May; for as early as the middle of June I captured several very small and still quite transparent animals in the towing-net. The smallest of them was 6 millims. in length, and moved just like the adult, which it also perfectly resembled, even to the tail, in its external form. The denticulation of the œsophagus and the divisions of the nutritive canal were distinctly recognizable. Near the anus the sexual glands opened; and on them the same appendicular gland was perceptible that I observed in *Halicryptus*.

In *Priapulus* the caudal appendage, as is well known, is a continuation of the body-cavity, in which, as in the latter, the cells of the body-fluids circulate freely. At the external end there is a pore, through which perhaps water is received into the body. The appendage, which, like the covering of the body, possesses a longitudinal and transverse musculature, was, in one young animal, constricted only in three places. Those "points" of the subcuticle which Ehlers* has described project into the chitinous membrane in much greater numbers than in the true body of the animal. These points also exist in abundance on the papillæ which, in the adult *Priapulus*, cover the whole appendage like berries. In our young animal these papillæ only exist at the upper part, and in small number; below they are entirely wanting. The young animal is thus distinguished from the adult.

According to an oral communication from Dr. Lütken, of Copenhagen, I may mention the Œresund as a habitat of *Priapulus*, as it is found, although not abundantly, near Helleback.—*Zeitschr. für wiss. Zool.* Bd. xxi. p. 386.

* Ueber die Gattung *Priapulus*, p. 21.

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XVIII.—*On the Nomenclature of the Foraminifera.* By W. K. Parker, F.R.S., T. Rupert Jones, F.G.S., and H. B. Brady, F.L.S., F.G.S.

[Continued from vol. iv. p. 392.]

Part XIV.—*The Species enumerated by D'Orbigny in the 'Annales des Sciences Naturelles,'* 1826, vol. vii.*

IV. *The Species founded upon the Figures in Soldani's 'Testaceographia ac Zoophytographia.'*

[Plates VIII.–XII.]

With all its faults, and they are neither few nor small, the 'Tableau Méthodique' by Alcide Dessalines D'Orbigny † must be regarded as the alphabet of the nomenclature of the Foraminifera. It is true that a considerable number of the specific names therein enumerated, and accepted by naturalists, are derived from treatises of earlier date (a few from Linné, Batsch, Walker, and Montagu; a larger series from Fichtel and Moll, Lamarck, and Defrance): but these specific terms were mostly picked out, one here, another there, from figured associates with which they have no real relationship. From this statement we might except Fichtel and Moll's beautifully illustrated memoir, all the figures in which, save the first, refer to the Foraminifera ‡, and Batsch's 'Sechs Kupfertafeln,' which are exclusively devoted to the same family §; but it is to be remembered that the former is only an instalment of an

* Continued from Ann. Nat. Hist. ser. 3. vol. xvi. p. 41.
† See Ann. Nat. Hist. ser. 3. vol. xii. p. 429.
‡ See Ann. Nat. Hist. ser. 3. vol. v. pp. 98–116, and pp. 174–183.
§ *Ibid.* vol. xv. pp. 225–232.

unfinished work, and the latter represents, in all, something less than a score of species without arrangement or reference to each other.

In the 'Tableau Méthodique,' however, not only are the Foraminifera separated (though on wrong grounds) from their supposed congeners, but all the species known up to the time of its publication are grouped in a perfectly intelligible though artificial way. It is, in point of fact, a classified index to about 550 species, with copious references to figures and descriptions given by earlier writers, and illustrated by seven excellent plates of well-selected typical forms.

In two previous papers (Parts X. and XII. of the present series; see Ann. Nat. Hist. Dec. 1863 and July 1865 respectively) some portions of the 'Tableau' have been critically reviewed, namely:—1st, the species (sixty-three in number) adopted from earlier authors, with four others named by D'Orbigny from previously published figures (except Soldani's); 2ndly, the twenty-six species of which drawings are given in the plates appended to the memoir (Ann. Sci. Nat. vol. vii. plates 10–17*); and, 3rdly, species, a hundred in number, illustrated by models †. Our present task, the longest and most difficult, perhaps also the most important, is to give the result of a critical examination of the species based upon the figures in Soldani's 'Testaceographia.'

For reasons which will appear as we proceed, the Soldanian forms named by D'Orbigny have never received proper recognition from naturalists; we are glad therefore to be able to append to the present synopsis a set of outlines, carefully reduced from the figures in the 'Testaceographia' referred to in the 'Tableau Méthodique,' which, as there is often a difficulty in obtaining access to the originals, may form a useful basis for future students.

A few words at the outset on the work itself and its author can scarcely be out of place.

Of Soldani's personal history we know but little, and that

* Ann. Nat. Hist. ser. 3. vol. xii. p. 438 &c. In this critical notice, one species (No. 11, *Heterostegina depressa*, p. 305. no. 2, pl. 17. figs. 5–7) was inadvertently omitted.

† See Ann. Nat. Hist. ser. 3. vol. xvi. pp. 15 *et seq.*, pls. 1–3. The four livraisons of 100 models seem to have been followed by another livraison (5me), which we have not seen. It is referred to in the 'Monograph of the Foraminifera of Cuba,' p. xxi, *note*; and Modèle No. 113, livr. 5 (*Citharina*), and Modèle No. 114, livr. 5 (*Hauerina*) are mentioned at p. xxxvii and p. xxxviii respectively. A second edition of the models is noticed as having been brought out, in 1843, by Prof. W. C. Williamson, in the bibliographic list, p. 103, of his "Monograph Rec. Brit. Foram." (Ray Soc.).

chiefly from the biographical article* by De Angelis in the 'Bibliographie Universelle,' Supplement, vol. xliii. 1825.

Of the two works with which Soldani's name is chiefly connected, the smaller and less important was published first. It is entitled 'Saggio orittografico ovvero Osservazioni sopra le Terre nautilitiche ed ammonitiche della Toscana,' is dedicated to the reigning Grand Duke of Tuscany, and dated from Sienna, 1780. This was but preliminary to the greater effort; and as the principal part of the volume and nearly all the plates were reprinted as an Appendix to the 'Testaceo-

* Soldani (Ambroise), naturalist, born at Prato-Vecchia, in Tuscany, about 1736. Entered the order of St. Romuald, and, whilst pursuing his religious duties, found time to devote himself to geological research, particularly in respect to microscopic shells and the evidences they appeared to afford of ancient changes in the earth's surface. Boys and Walker in England, Fichtel and Moll in Germany, and Bianchi (Janus Plancus) in Italy, had already begun to appreciate the importance of this branch of natural history; and, impressed with the same view, Soldani began early to study the minute organisms which exist in myriads in the strata of the hills about Sienna and Volterra. His first work on the subject obtained for him, on the one hand, the protection of the Grand Duke of Tuscany, who nominated him to the Professorship of Mathematics in the University of Sienna, and, on the other, the criticism of certain savants, who reproached him with want of order and exactitude in the classification of his fossils and the localities set down for them. These reproaches were but little deserved, as his avowed object had been to collect materials only, leaving the question of systematic arrangement to others, having been discouraged by the imperfection of the old systems from adopting any of them. The classification of Linné was not sufficiently detailed to embrace the new species, and that of Müller, based on the organization of the Mollusca, presented obstacles in its application to animals of which, though similar in some points of external appearance, the anatomy was still very imperfectly understood.

Soldani, however, was not deceived as to the real wants of geology; and he prepared to accumulate facts, with the intention of publishing his geological descriptions on the plan adopted by Cuvier and Brongniart for the environs of Paris. Why this project was relinquished, after having been partially carried out, is not known.

In 1794, his talent for observation was turned in another direction by a shower of aërolites which fell in that year near Sienna, and he devoted himself to the study of the phenomena of aërolites, volcanoes, and earthquakes. His publications on these meteorological subjects brought him into collision with the leading physicists of his day, though in the end he did not fail to secure the admiration of his fellow-labourers in science and the esteem of the religious fraternity to which he belonged. The former nominated him as Perpetual Secretary to the Academy of the "Fisiocritici" of Sienna; the latter advanced him to the dignity of General of the Order of the Camaldules. He died in Florence, July 14, 1808; and his funeral *éloge* was pronounced by his fellow-worker Bianchi.

It is needless to add the list of his works, of which eight are mentioned by De Angelis: the first two alone, the 'Saggio orittografico' and the 'Testaceographia ac Zoophytographia' are concerned in the subject of the present paper.

graphia,' and subsequent references to them are made in this relation, we need not dwell further upon it.

The book with which we are at present concerned, the *magnum opus* of the author, is the 'TESTACEOGRAPHIA.' This monument of patient labour and accurate observation consists of two folio volumes*, illustrated by 228 plates engraved on copper†. It was published at Sienna between the years 1789 and 1798, and is now extremely rare. We have heard that a considerable portion of the edition was burnt as unsaleable, but we cannot vouch for the truth of the statement. Of its scarcity at the present day, however, there can be no doubt. Eight or ten years ago, the late Dr. Falconer purchased in Italy the copy now in the library of the Royal Society; and more recently the Literary and Philosophical Society of Newcastle-upon-Tyne has obtained from a German source a fine copy that appears to have been presented by Soldani to one of his friends. These are the only perfect examples ‡ of the work which we know of in this country; and we would here express our thanks to the Council of the Royal Society and to the Committee of the Literary and Philosophical Society of Newcastle for the protracted loan we have enjoyed of their respective copies during the preparation of the present paper.

The following is a brief summary of the contents of this

* Usually found in *four* volumes, the *first* having been issued in three parts, separate, but consecutively paged.

† The elegance of the engraved dedications and subsidiary titlepages deserves remark; and we must draw attention to the vignettes No. 1 (by Cyrus Sanctius) at page 1 of vol. i.; No. 2, on the titlepage of part 2. vol. i. (repeated in part 3); and No. 3, on the titlepage of vol. ii., not only as pictures of the reverend naturalist and some of his friends and acquaintances, and as illustrations of the costumes and magnifying-glasses of the last century, and of the internal arrangements of Soldani's own cabinet, with the artist at work and congenial friends around (in No. 1), but also as depicting characters and habits of far greater persistence than the individuals and furniture surrounding the enthusiastic microscopist of Sienna. In No. 2 especially has the artist fixed with the strongest lines of satire the earnest patience of the enlightened and willing teacher,—the dullness of the would-be learner, clever by nature, but blunted by years of respectable ignorance of every thing but diplomacy or trade,—the politely masked but almost utter *insouciance* of the well-to-do nobody,—and the self-satisfied, contemptuous, blank ignorance of the ecclesiastic. No. 3 illustrates a group of gentlemen more or less interested in the minutiæ shown them in the microscope by perhaps Soldani himself. Their interest in the matter varies much: one is willingly attentive; one almost repents of his having come; and the third is making his adieux with real or feigned admiration of the little curiosities he leaves upon the table.

‡ Two parts only (vol. i. parts 1 & 2) are in the British Museum.

rare work, with the titles of the volumes exactly as they stand in the original:—

Vol. i. part 1. Testaceographiæ ac Zoophytographiæ parvæ et microscopicæ tomus primus, in quo minuta et minima testacea ac zoophyta maris nativa in tres classes distributa vasculis inclusa æneisque tabulis insculpta describit et explicat Ambrosius Soldani in regio Senarum lycæo matheseos professor. Accedit supplementi loco analysis marini sedimenti ex diversis locis collecti, quæ omnia novum veluti Museolum conficiunt. Senis, MDCCLXXXIX. Super. Perm. In typographia Francisci Rossi. Prostat Florentiæ apud Josephum Molini.

Index rerum quæ hoc volumine continentur, p. xxxi.

Classis prima: Testæ Univalves non polythalamiæ.

Caput I. Cochleæ, cum quibusdam earum Operculis; ubi de Turbinibus, ut dicunt, sinistrorsum versis. Pp. 1 &c. Pl. 1–22. [Young Gasteropods and a few Foraminifera.]

Cap. II. Patellæ, Auris Marina, aliæque Testæ Univalves in se complicatæ. Pp. 26 &c. Pl. 23–25 (part). [Limpets &c.]

Cap. III. Testæ Tubuliticæ ac Vermiculares, etiam cochleatæ pseudoparasiticæ. Pp. 29 &c. Pl. 25 (part)–32. [Pteropods, Dentalia, Serpulæ, Nubeculariæ, &c.]

Classis secunda: Testæ polythalamiæ et uniloculares minimæ.

Cap. IV. Nautili et Hammoniæ ("Ammoniæ" in the text). Pp. 35 &c. Pl. 33–63. [Foraminifera. Fossil specimens in pl. 55–63.]

Cap. V. Exuviæ Marinorum Vermium Nautiliformes et Hammoniformes, seu Nautilis et Hammoniis persimiles. (Aliæ Testæ Hammoniformes, seu exuviæ marinorum Vermium memoratis Nautilorum et Hammoniarum generibus similes. Ubi de testis pseudoparasiticis, et Pediculis Pinnarum.) Pp. 69 &c. Pl. 64–93. [Foraminifera.]

Vol. i. part 2. Testaceographiæ &c., tomi primi pars altera, in qua &c. insculpta describere et explicare pergit Ambrosius Soldani in regio Senarum lycæo matheseos professor. Senis, MDCCXCI. Super. Perm. &c.

Caput VI. De Orthoceratiis * diversæ speciei ac formæ. Pl. 94–108. [Foraminifera: "Orthoceratia."]

Cap. VII. Testæ Multiloculares, vel Uniloculares minimæ, pleræque vitreo-lucidæ; figura cordiformes, globosæ, subglobosæ, globuliferæ, item ovales, piriformes, fusiformes, &c. (Polymorpha, seu Testæ Cordiformes, Subcordiformes, Sphæricæ, Oviformes, Oliviformes, Pyriformes; item Tuberosæ, Globuliferæ, &c., Polythalamiæ, vel Monothalamiæ; fere omnes minimæ.) Pp. 101 &c. Pl. 109–133. [Foraminifera. "Testæ polymorphæ," pl. 109–131; "Polymorpha," pl. 132, 133.]

Dissertatio geologica de Agro Clusentinate et Valdarnensi. Pl. 134–141 ("Fossilia Dissertationis"); pl. 142, "Lapicidina Fessu-

* The word "Orthoceratium" (as well as the word "Orthoceras") is used as a nominative noun by Soldani; and the plural nominative of both words is with him *Orthoceratia*.

lana." [Pl. 134–137, mostly Foraminifera; 138–141, fossil wood, corals, &c.]

Vol. i. part 3. Testaceographiæ &c. tomi primi pars tertia, in qua &c. describit et explicat Ambrosius Soldani &c. Accedit Supplementum analysim continens marini sedimenti. Senis, MDCCXCV. Super. Perm. In typographia Francisci Rossi. Prostant Florentiæ apud Josephum Molini fasciculi octo.

Classis tertia. Testæ Bivalves, sive Conchulæ; item Echini; Frumentaria; Corpuscula maris dubia; ac Zoophyta.

Caput VIII. Testæ Bivalves, sive Conchulæ; ubi de Echinis, eorumque Aciculis minimis. Pp. 209 &c. Pl. 143–151. [Pl. 147 & 148 (part), Ostracoda; pl. 149 (part), 150, 151 (part), Brachiopods.]

Cap. IX. Frumentaria diversæ speciei ac formæ. Pp. 223 &c. Pl. 152–160. [Pl. 152–159, 160 (part), *Miliola*; pl. 160 (part), *Cornuspira.*]

Cap. X. Corpuscula maris *Dubia* et *Incerta*: item Zoophyta vel Lithophyta quædam, eorumque partes. Pp. 235 &c. Pl. 161–179. [Foraminifera, Polyzoa, Echinoderms, &c.)

Supplementum Analysim continens Marini Sedimenti.

Cap. XI. De Limo, qui latet in fundo Maris. Pp. 252 &c.

Cap. XII. De Concretionibus Zoophyticis, earumque testaceo pulvere. Pp. 261 &c.

Cap. XIII. De Sedimine Maris litoreo, ejusque arenulis. Pp. 265.

Index. Pp. 275 &c.

Vol. ii. Testaceographiæ ac Zoophytographiæ parvæ et microscopicæ tomus secundus, in quo minutas Testas maris fossiles, item lacustres, earumque varietates Iconibus ære insculptis exprimit, ac geologicis et oryctographicis Animadversionibus illustrat Ambrosius Soldani, in Regia Senensi Universitate Matheseos Professor. Accedit ad majorem totius operis Illustrationem Appendix, quæ est in fine Opusculi *Saggio orittografico** olim editi, cum ejusdem Tabulis æneis XXIII. Senis, MDCCXCVIII. Super. Perm. In Typographia Francisci Rossi et Filii. Prostant Florentiæ apud Josephum Molini.

Sectio prima. De Testis fossilibus, ac Sedimentis origine marinis.

Caput I. De argilla Sanquiricensi, ejusque testis minutis. Pp. 1 &c. Pl. 1–6. [Foraminifera.]

Cap. II. De terra prope Senas locis dictis *i Donnini* et *il Cerajolo*:

* Saggio orittografico, ovvero Osservazioni sopra le terre Nautilitiche ed Ammonitiche della Toscana. Con Appendice o Indice Latino Ragionato de' piccoli Testacei, e d'altri fossili d'origine marina per schiarimento dell' Opera. Dedicato &c. dal Padre D. Ambrogio Soldani, Abbate Camaldolese. In Siena, MDCCLXXX. (Pp. 146, tabb. 25.)

This edition has two more plates (Bovine Bones &c.) than above indicated; and the text of the Appendix in the 1780 edition has seven additional paragraphs of description besides those in the reprint in 'Testaceographia,' vol. ii., besides having much fuller details.

ubi de Abysso Maris. Pp. 26 &c. Pl. 7–16. (Mollusks, Ostracods, Foraminifera, Polyzoa, &c.]

Cap. III. De terra lateritia loco dicto *S. Lazzaro*; ubi de Stratis. Pp. 42 &c.

Cap. IV. De terra plastica l. d. *Borro Cieco*, ac de Frumentariis. Pp. 48 &c. Pl. 17–20. [Foraminifera.]

Cap. V. De terra arenaria l. d. *Costa Fabri*; ubi de locis olim submarinis. Pp. 55 &c.

Cap. VI. De terra calcareo-arenaria conchylifera, l. d. *Laterino* (prope Senas extra portam dictam *di Laterino*). Pp. 62 &c.

Cap. VII. De glareis (in collibus Florentiam inter et Senas,—prope castrum S. Quirici; non longe e monte Radicofanensi; in Clusentino; in superiore valle Arni; extra portam *Ovile* Senarum; extra portam *Pisini* Senarum, &c.); ubi de stratis conchyliferis. Pp. 69 &c. Pl. 21, 22 (*Q*). [Foraminifera, Ostracoda, Polyzoa, &c.]

Cap. VIII. De vertice Montis Volterrarum, ejusque arenulis conchyliferis. Pp. 77 &c.

Pl. 22 (part), 23, 25 (*C, D*). [Pl. 24, *Perna*. Pl. 25. figs. *E, F, G*, are Liassic Ammonites from Dorsetshire ("Devon" by mistake in the text), England, given to Soldani by William Thomson. Polyzoa, Echinoderms, Mollusks, *Chara*, Foraminifera, &c.]

Cap. IX. De inferiore parte ejusdem Montis, ac de rupe Echinorum. Pp. 81 &c.

Cap. X. De quatuor in Etruria Conchyliorum fossilium generibus prorsus exoticis. Pp. 90 &c.

Cap. XI. De Arenulis terrisque phosphorescentibus. Pp. 95 &c.

Sectio secunda. De Lacubus, eorumque hodiernis et antiquis sedimentis.

Cap. XII. De Lacubus in genere. Pp. 104 &c.

Cap. XIII. De fossula perennis aquæ in Clusentino, ac de *Spirovulis* et *Lenticulis* petrefactis. Pp. 106 &c. Pl. 25 (*H–M*), 26 (*N, O, P*).

Cap. XIV. De Testis in aquis thermalibus ac palustribus in vicinia Civitatis Massæ. Pp. 112 &c.

Cap. XV. De Lacu Blentinensi, ejusque limo. Pp. 115 &c.

Cap. XVI. De antiquo Lacu in Valle Arni superiore, ejusque Conchyliis fossilibus; ubi de Ossibus Elephantinis. Pp. 118 &c. Pl. 26 (*Q, R*).

Cap. XVII. De antiquo Lacu inter *Staggia* et *Poggibonsi*, ac de limo maris inferiori. Pp. 124 &c. Pl. 26 (*S, T, V, X*).

Cap. XVIII. De antiquo Lacu Sarteanensi. Pp. 129 &c.

Cap. XIX. De Sedimento lacustri prope Civ. Collensem, ejusque tartareis Concretionibus. Pp. 131 &c.

Cap. XX. De terra lacustri l. d. *Badia all' Isola*. Pp. 135 &c.

Sectio tertia, seu Appendix *, quæ Testas ac Fossilia in Vasculis 288 contenta præsertim minima exhibet, et eorum Icones explicat. Pp. 137 &c.

* This is a *Catalogue raisonné* reprinted, in an abstract form, and with a condensed introduction, from the Appendix to the 'Saggio orittografico' above mentioned.

We now turn to the 'Tableau Méthodique' and the Soldanian figures cited therein as illustrations of D'Orbigny's views in respect to species.

The carelessness with which the references were made has been a cause of many difficulties and some uncertainty: our corrected copy of D'Orbigny's memoir shows upwards of fifty errors of reference, more or less important, besides the numerous clerical mistakes which disfigure its pages. We have therefore in some instances had to depart from the literal reading of the text in seeking an intelligible basis for our notes. Where the corrections admit of little or no doubt, they are adopted without any special remark; but in a few cases, in which the clue to the author's intention is not so manifest, the fact is duly noticed in its place in the following pages. In the 'Tableau' the parts of the 'Testaceographia' are alluded to almost invariably as vol. 1, 2, 3, & 4; in the 'Cuba' Monograph and other of D'Orbigny's papers, the original designations are given, namely, Vol. I. part 1, part 2, part 3, and Vol. II. This latter mode of reference, having advantages alike of correctness and uniformity, has been used throughout these notes.

The plates appended to the present paper consist of carefully reduced copies of Soldani's figures *in outline*. Where reference is made by D'Orbigny to several figures, the best example has been selected. No attempt has been made to improve upon the originals; nor, except in a few cases in which figures, upside down (according to present ideas), have been reversed, has any alteration whatever been intentionally made in respect of them. In Soldani's plates the drawing is often rugged, sometimes rude; but it is always nervous and expressive, and, up to his knowledge, characteristic. He does not often attempt to have the *texture* of the shell represented by his artists, being unaware of its importance; and he frequently omits to indicate the position or form of the aperture: but, notwithstanding these drawbacks, he seldom leaves his meaning in doubt; and the student of the Rhizopoda of the Italian peninsula, whether of the living fauna of the Adriatic or of the fossil microzoa of the Sub-Apennine strata, may recognize in his figures a very large proportion of the organic forms met with at the present day. Soldani's sagacity, too, in grouping together the genera of nearest alliance is markedly shown. Indeed D'Orbigny might have drawn much more largely than he did on the stores of the 'Testaceographia' with advantage to science.

It appears to us that, in using Soldani's engraved figures as published representations of certain Foraminifera, D'Orbigny rarely, if ever, recorded any one of them as illustrative of a typical form under the impression that it deserved special notice and name. In general, if not always, he selected the figures because they seemed to him to be good or fair illustrations of specimens that he himself obtained from the several recent and fossil sea-sands enumerated at pages 249, 250 of the Ann. Sc. Nat. vol. vii. as having been given to him by his friends. Among these communications were fossil sands from Sienna and other parts of Italy, some packets of which had been given by *Soldani* to M. Fleurian de Bellevue. In recording the "localities" of the species illustrated in the 'Testaceographia,' D'Orbigny seems to have ignored Soldani's account of their finding-places and habitats altogether. We have compared the localities recorded by the two writers; and when Soldani's and D'Orbigny's statements do not coincide, we have added Soldani's in brackets; and in these cases so much is added to our knowledge of the distribution of these Foraminifera. It is occasionally impossible to get the exact habitat for the Soldanian figures, as they were drawn from individuals of a mixed group of supposed or real allies, taken from two or more places, especially (for instance) from both the Adriatic and the Tuscan sea.

In quoting Soldani's descriptive appellations of the forms selected afterwards by D'Orbigny as types of binomial species (or, rather, as published representations of Foraminifera that he met with in recent or fossil sea-deposits from various parts of the world), we have either taken the general name Soldani gave to the set that he grouped together (and then it appears for the most part in the *plural*), or, whenever possible, we have taken the term that he applied to the individual shell (and then it is in the *singular*). As Soldani did not, however, use the Linnean mode of nomenclature, the terms applied by him to individuals and groups would not necessarily have been adopted by D'Orbigny even if he had studied the text with the intention of learning Soldani's views.

1. *Nodosaria* (*Glandulina*) *lævigata*, D'Orbigny. Pl. IX. fig. 34.

"Polymorpha *Sphærulæ vitreæ læves*;" Soldani, Testac. vol. i. pt. 2. p. 115, pl. 118. fig. *E*. D'Orbigny, Ann. Sc. Nat. vol. vii. p. 252. no. 1.

"*Hab.* Recent in the Adriatic; fossil near Sienna." (Mediterranean [?], *Soldani*.)

This has been noticed in a previous paper on some of D'Orbigny's species (Ann. Nat. Hist. ser. 3. vol. xii. p. 439). It represents a good subtype of the *Nodosarinæ*. Soldani's figure is from a somewhat ill-grown specimen, with large open aperture.

2. *Nodosaria ovicula*, D'Orb. Pl. IX. fig. 36.

"Orthoceras *Farcimen*;" Soldani, Testac. vol. ii. p. 35, pl. 10. figs. *h–m*. D'Orb. *op. cit.* p. 252. no. 6.

"*Hab.* Fossil near Sienna."

A delicate moniliform *Nodosaria*, with long elliptical distinct segments. Our outlines are copied from figures *h* & *k*.

3. *Nodosaria hirsuta*, D'Orb. Pl. IX. fig. 45.

"Orthoceratia quasi *hispida*;" Soldani, Testac. vol. ii. p. 15, pl. 2. fig. *P*.
"Orthoceratia *hispida*;" ibid. p. 36, pl. 11. figs. *n–z, A, B*. D'Orb. *op. cit.* p. 252. no. 7.

"*Hab.* Recent in the Adriatic; fossil near Sienna." (Fossil at Donnini and Cerajolo, *Soldani.*)

A straight, few-chambered Nodosarian, having its surface studded with acicular exostoses. D'Orbigny subsequently (1846, For. Foss. Vienne, p. 35, pl. 1. figs. 24, 25) changed the trivial name to that originally given by Soldani; it therefore now stands as *Nodosaria hispida.* Of our two outlines (fig. 45) the first represents Soldani's "quasi-hispid," the second his "hispid" variety.

4. *Nodosaria orthocera*, D'Orb. Pl. IX. fig. 32.

"Tubulus *anulatus*;" Soldani, Testac. vol. i. pt. 1. p. 33, pl. 27. figs. *xx, yy*. D'Orb. *op. cit.* p. 252. no. 8.

"*Hab.* Mediterranean."

We cannot follow D'Orbigny in referring these figures to *Nodosaria.* They differ one from the other; both are indeterminable, although fig. *xx* (figured) has an appearance much like that of the Clavuline forms of *Valvulina*, "*Clavulina clavulus*," Ann. N. H. ser. 3. vol. v. p. 469.

5. *Nodosaria semistriata*, D'Orb. Pl. IX. fig. 38.

"Orthoceras;" Soldani, Testac. vol. i. pt. 2. p. 92, pl. 96. fig. *T*. D'Orb. *op. cit.* p. 252. no. 9.

"*Hab.* Fossil near Sienna." (Mediterranean [?], *Soldani.*)

This is but a subvariety of *N. radicula*, Linn., its claim to distinction resting upon a number of obscure short striæ or costæ on the upper portion of the chambers. Soldani makes no special mention of the figure in his description of the plate: and it has probably been adopted by D'Orbigny from its corresponding with specimens which occurred in his own investigations.

6. *Nodosaria dubia*, D'Orb. Pl. IX. fig. 30.

"Orthoceratia *Zoophytica* minuscula," Soldani, Testac. vol. i. pt. 2. p. 93, pl. 98. fig. *A*. D'Orb. *op. cit.* p. 252. no. 10.

"*Hab.* Fossil, near Sienna." (Mediterranean, *Soldani.*)

This is a short-jointed variety of *Lituola Soldanii*. The description of the specimen, not less than the figure, indicates the arenaceous structure of the test. It may be convenient to reserve the trivial name for the short, many-chambered, orthocerine *Lituolæ*.

7. *Nodosaria interrupta*, D'Orb. Pl. IX. fig. 51.

"Orthoceratia *Baculi*;" Soldani, Testac. vol. i. pt. 2. p. 96, pl. 102. fig. *B*. D'Orb. *op. cit.* p. 252. no. 11.

"*Hab.* Fossil near Sienna." (Mediterranean, *Soldani.*)

A somewhat irregular, limbate *Dentalina*, analogous to *Nodosaria limbata*, D'Orb., in the straight series. The sutural limbation is given by Soldani as a zigzag line of clear shell-substance.

8. *Nodosaria glabra*, D'Orb. Pl. IX. fig. 35.

"Orthoceratia *Arthrocenæ*;" Soldani, Testac. vol. ii. p. 15, pl. 2. fig. *N*.
"Orthoceras *Baculus*;" ibid. p. 16, pl. 2. figs. *V*, *X*. D'Orb. *op. cit.* p. 253. no. 12.

"*Hab.* Fossil at Sienna." (Near Sienna, *Soldani.*)

Fig. *N* is a narrow *N. radicula*. Fig. *V* differs from *N. radicula* only in the increased number of chambers and their regular size, the specimen being long and subcylindric; whilst fig. *X* is rather less regular and somewhat curved. Soldani's figures have from seven to thirteen smooth globular chambers of nearly equal size. The name may be useful as a sub-varietal term for specimens with these characters; but no greater significance can be attached to it. (Fig. *N* is copied.)

9. *Nodosaria pyrula*, D'Orb. Pl. IX. fig. 37.

"Orthoceras *Monile*;" Soldani, Testac. vol. ii. p. 35, pl. 10. figs. *b*, *c*. D'Orb. *op. cit.* p. 253. no. 13.

"*Hab.* Fossil at Sienna." (Near Sienna, *Soldani.*)

Soldani's figures represent smooth-shelled, few-chambered *Nodosariæ*, with globular (fig. *b*) or elliptical (fig. *c*) segments connected by cylindrical tubes. Professor Williamson's drawing of the same species (Rec. For. Gt. Br., pl. 2. fig. 39), in which the stoloniferous tube is formed by the gradual tapering of the segments, shows the form as it more commonly occurs. (Fig. *b* is copied.)

10. *Nodosaria filiformis*, D'Orb. Pl. IX. fig. 48.

"Orthoceratia filiformia aut capillaria;" Soldani, Testac. vol. ii. p. 35, pl. 10. fig. *e*. D'Orb. *op. cit.* p. 253. no. 14.

"*Hab.* Fossil at Sienna." (Near Sienna, *Soldani.*)

The curvature of the axis being recognized as a divisional character, this should be *Dentalina filiformis*. It is a fair representative of the attenuated forms of *Dentalina*, having very numerous, distinct, elliptical segments.

11. *Nodosaria scalaris*, D'Orb. Pl. IX. fig. 39.

"Orthoceratia;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 94. fig. *V*. D'Orb. *op. cit.* p. 253. no. 18.

"*Hab.* Recent in the Adriatic."

This may be fairly placed under *N. raphanus*, Linn. The name "*scalaris*" had been previously adopted by Batsch for a somewhat different form.

12. *Nodosaria sulcata*, D'Orb. Pl. IX. fig. 40.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 118, pl. 127. fig. *C*. D'Orb. *op. cit.* p. 253. no. 21.

"*Hab.* Recent in the Adriatic; fossil at Leognan, near Bordeaux, and at Castel-Arquato, Italy." (Mediterranean [?], *Soldani.*)

This is a short *Nodosaria raphanus*, but with an extraordinary lateral chamber, overriding the first two chambers. How specimens with so odd a malformation should have turned up under circumstances so diverse as indicated by the localities quoted by D'Orbigny, we cannot explain. It is quite possible that D'Orbigny ignored the malformation, whilst Soldani was led by it to associate his specimen with others that we recognize as *Uvigerinæ*.

13. *Nodosaria rapa*, Lamarck*. Pl. IX. fig. 41.

"Orthoceratia;" Soldani, Testac. vol. i. pt. 2, p. 91, pl. 94. fig. *T*. D'Orb. *op. cit.* p. 253. no. 27.

"*Hab.* Recent in the Adriatic, near Rimini." (Mediterranean or Adriatic†, *Soldani.*)

This is *Nodosaria raphanistrum*, Linné, sp. (Ann. N. H. ser. 3. vol. iii. p. 478). D'Orbigny refers to figures in the

* There is no "*N. rapa*" recorded by Lamarck (Ann. N. H. ser. 3. vol. v. pp. 287–289); but this name occurred to D'Orbigny probably through the intermediation of the French word "*rave*," which has reference to both of the latin terms "*raphanus*" and "*rapa*."

† A large group of different Foraminifera are in this as in other instances described as having been obtained from the two seas; and as only one specimen has been selected, it is impossible to localize it exactly.

works of Gaultieri, Planeus, and Montagu. An extended synonymy of the species will be found in our "Monograph of the Foraminifera of the Crag" (Palaeontographical Society).

14. *Nodosaria longicauda*, D'Orb. Pl. IX. fig. 42.

"Orthoceratia *Flosculi*;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 95. figs. *B–M*. D'Orb. *op. cit.* p. 254. no. 28.

"*Hab.* Fossil near Sienna." (Mediterranean, *Soldani*.)

A common recent form, well figured by Professor W. C. Williamson under the name *Nodosaria radicula* (Rec. For. Gt. Br. pl. 2. figs. 36–38); but, as we have before stated, Batsch's name *N. scalaris* takes precedence. Soldani also refers to pl. 5. figs. 3, *A*, *B*, *C*, *D*, in his 'Appendix,' as being the same (fossil at Coroncina).

Soldani's figured specimens have from two to five segments, and vary in the relative size, proportional enlargement, and approximation of the segments. Fig. *L*, with its eccentric stolon-tube, and its produced and somewhat hooked first chamber, approaches *Marginula falx*, J. & P., with which also pl. 96. fig. *P*, and pl. 102. fig. *C*, have relationship. See Quart. Journ. Geol. Soc. vol. xvii. p. 302.

15. *Nodosaria cancellata*, D'Orb. Pl. IX. fig. 33.

"Orthoceratia *Flosculi*;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 95. fig. *A*. D'Orb. *op. cit.* p. 254. no. 29.

"*Hab.* Fossil near Sienna." (Mediterranean, *Soldani*.)

It is a matter of extreme difficulty to judge between the occasional double-celled specimens of *Lagena* and the arrested *Nodosariæ**. The transverse as well as longitudinal markings on Soldani's figure leave us with little doubt that he has met with a double specimen of *Lagena melo*. The reticulate ornament, however, is becoming better known as a Cristellarian (Nodosarine) ornament by the discoveries of our German fellow-workers. The spiral ornamentation of the neck occurs in both *Nodosaria* and *Lagena*, though more frequently in the latter.

16. *Nodosaria Soldanii*, D'Orb. Pl. IX. fig. 43.

"Orthoceras *Rapistrum* (num *Raphani* vel *Raphanistri* species?);" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 104. fig. *I*. D'Orb. *op. cit.* p. 254. no. 10.

"*Hab.* Fossil near Sienna." (Mediterranean or Adriatic, *Soldani*.)

A straight Nodosarian, with few, globular, semisulcate or semicostate chambers; the grooves (or ribs?) commence at the

* With increased examination, more and more double *Lagenæ* turn up (in Grignon sands especially).

base of the chambers, and extend above the middle of each. The worthy Tuscan naturalist's collection seems to have been rich in ornamental and odd-growing varieties. The specimen he has here chosen for delineation has a little abortive terminal chamber, like a pinnacle, surmounting those formed on the normal plan. *Nodosaria Soldanii* differs from *N. semistriata* in having the upper third of the chambers smooth, whilst the latter has its costæ confined to the upper portion.

17. *Nodosaria nodosa*, D'Orb. Pl. IX. fig. 55.

"Orthoceratia filiformia aut capillaria:" Soldani, Testac. vol. ii. p. 35, pl. 10. figs. *f*, *g*. D'Orb. *op. cit.* p. 254. no. 31.

Hab. "Fossil near Sienna."

A Dentaline or curved Nodosarian, long, slender, and many-chambered. The segments are regular and elliptical, and are furnished on their exterior with delicate parallel longitudinal striæ. (Fig. *f* is copied.)

18. *Nodosaria flexuosa*, D'Orb. Pl. IX. fig. 53.

"Orthoceratia *filiformia*;" Soldani, Testac. vol. ii. p. 35, pl. 10. fig. *d*. D'Orb. *op. cit.* p. 254. no. 32.

Hab. No locality given by D'Orbigny. (Fossil near Sienna, *Soldani*.)

It may be worth while to recognize this variety as *Dentalina flexuosa*. The figure represents a very slightly curved, deep-sutured, semistriate form, the striæ marking the upper third of each chamber.

19. *Nodosaria nitida*, D'Orb. Pl. IX. fig. 44.

"Orthoceratia *Arthrocenæ*," Soldani, Testac. vol. ii. p. 15, pl. 2. fig. *O*. D'Orb. *op. cit.* p. 254. no. 33.

"*Hab.* Fossil at Coroncina, Italy." (San Quirico, *Soldani*.)

A small striate *Nodosaria*, deeply constricted at its septa, and having few, distinct, oval or fusiform segments. A less robust form than *N. scalaris*, and less neatly finished as to base and terminal neck than that species generally is.

20. *Nodosaria* (*Dentalina*) *communis*, D'Orb. Pl. IX. fig. 46.

"Orthoceras Farcimen;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 105. fig. *O*. D'Orb. p. 254. no. 35.

"*Hab.* Recent in the Adriatic." (Mediterranean or Adriatic, *Soldani*.)

The common smooth type of the subgenus, equally abundant in the recent and fossil condition. We have endeavoured to tabulate the names under which it has been alluded to by various authors, in our 'Monograph of the Foraminifera of the Crag.' The oldest name given to this variety was Lamarck's "*Nodosaria dentalina*," and apt enough with that quasi-generic prefix; but the inconvenience of the trivial being the same as the subgeneric name, and the wide acceptance of D'Orbigny's term, have induced us to retain the latter.

21. *Nodosaria* (*Dentalina*) *obliqua*, D'Orb. Pl. IX. fig. 47.

"Orthoceras *intortum*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 105. fig. *V*. D'Orb. *op. cit.* p. 254. no. 36.

"*Hab.* Recent in the Adriatic." (Mediterranean or Adriatic, *Soldani.*)

See note on the same variety in our paper on the "Models" (Ann. N. H. ser. 3. vol. xvi. p. 19). We ought to have there added that the trivial name had been preoccupied by Linné for the Dentaline form of *N. Raphanus* (= *D. Cuvieri*, D'Orb.). D'Orbigny's reference to another of Soldani's figures (pl. 107. fig. *ff*) is obviously an error.

22. *Nodosaria* (*Dentalina*) *arcuata*, D'Orb. Pl. IX. fig. 49.

"Orthoceras *intortum mammillare*;" Soldani, Testac. vol. i. pt. 2. p. 92, pl. 97. fig. *ee*. D'Orb. *op. cit.* p. 254. no. 38.

"*Hab.* Recent in the Adriatic." (Mediterranean, *Soldani.*)

A much-curved, smooth *Dentalina*, with the chambers set on very obliquely; the chambers inflated and distinct on the convex side of the shell, but gradually thinning towards the concave margin. In Soldani's figure the shell appears to be bordered by a smooth even carina on the concave side.

23. *Nodosaria* (*Dentalina*) *carinata*, D'Orb. Pl. IX. fig. 50.

"Orthoceras *obliquum*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 105. fig. *N*. D'Orb. *op. cit.* p. 255. no. 39.

"*Hab.* The Adriatic Sea." (Mediterranean or Adriatic, *Soldani.*)

A somewhat similar variety to the last (*D. arcuata*); indeed, if we do not place the two under the same trivial name, it is only from the desire to give our author the benefit of a doubt. It is a long, slender *Dentalina*, with a large number of very oblique chambers, and an apparently well-defined carina of considerable width running the whole length of the concave side.

24. *Nodosaria* (*Dentalina*) *scorpiurus*, Montfort. Pl. IX. fig. 29.

"Orthoceras?" Soldani, Testac. vol. i. pt. 3. p. 239, pl. 162. fig. *K*. D'Orbigny, *op. cit.* p. 255. no. 40.

"*Hab.* Recent in the Adriatic." (Mediterranean, *Soldani.*)

Soldani is manifestly in great doubt about the nature of this arenaceous form. He puts it in a plate amongst "Dubia ac Zoophyta;" and in his descriptive text we find this note:—"Quæ supersunt reliqua, *I* & *K*, mihi ignota prorsus sunt, nisi fortassè *K* ad Orthoceratis speciem aliquam pertineat."

D'Orbigny, in accordance with his system of classification, had no alternative but to place it amongst the *Dentalinæ*, and rightly enough gave to it Montfort's specific name, that author having copied Soldani's figure, with the name *Reophax scorpiurus*. It belongs, however, as we have long ago shown, to an entirely distinct family of Foraminifera, and finds its natural place in the genus *Lituola*. This species has been already alluded to in a review of the Foraminifera named by Denys de Montfort, Ann. Nat. Hist. ser. 3. vol. vi. p. 346. no. 61; see also *ibid.* vol. v. p. 297.

25. *Nodosaria* (*Dentalina*) *aciculata*, D'Orb. Pl. IX. fig. 52.

"Orthoceras *Cuspis*;" Soldani, Testac. vol. i. pt. 2. p. 98. pl. 105. fig. *L*. D'Orb. *op. cit.* p. 255. no. 41.

"*Hab.* Adriatic Sea." (Mediterranean or Adriatic, *Soldani*.)

A variety of *Dentalina* not very commonly met with, but occurring sometimes in habitats favourable to the genus. Its peculiarity consists in the very short longitudinal costæ on the constricted portions of the test between the chambers, the prominent parts of the test being smooth. *D. intermittens* of Roemer and *D. Buchi* of Reuss also possess these features.

26. *Nodosaria* (*Dentalina*) *Cuvieri*, D'Orb. Pl. IX. fig. 57.

"Orthoceras varietas *Raphani* vel *Raphanistri*:" Soldani, Testac. vol. i. pt. 2. p. 97, pl. 103. fig. *I*. D'Orb. *op. cit.* p. 255. no. 45.

"*Hab.* Recent in the Adriatic." (Mediterranean, *Soldani*.)

A somewhat irregular shell, with a large number of short, compact, cylindrical chambers, marked by a series of stout, unbroken, longitudinal ribs. This is the *Nodosaria obliqua*, Linné, sp. (Ann. N. H. ser. 3. vol. iii. p. 477), coming, of course, under the *Dentalina* division of the genus, owing to its curvature. There is another "*D. obliqua*" (see No. 21, a subvariety of *D. communis*); but we prefer to keep "obliqua" for Linné's Dentaline variety of *N. raphanus*, as above stated, as an early and apt name.

27. *Nodosaria* (*Dentalina*) *substriata*, D'Orb. Pl. IX. fig. 54.

"Orthoceras;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 94. fig. *S*. D'Orb. *op. cit.* p. 255. no. 46.

"*Hab.* Fossil at Coroncina." (Mediterranean or Adriatic, *Soldani*.)

A neat substriate variety, the striæ springing from the base of each chamber and extending about three-fourths the way to its summit.

28. *Nodosaria (Dentalina) cornicula*, D'Orb. Pl. IX. fig. 56.

"Orthoceras *Corniculum*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 105. fig. *K*. D'Orb. *op. cit.* p. 255. no. 47.

"*Hab.* Fossil, Coroncina." (Mediterranean or Adriatic, *Soldani.*)

This may be accepted as a convenient subvarietal term for a Dentaline *N. raphanus* (*D. obliqua*), having a smooth globose primordial segment, larger than those that immediately follow. The later chambers rapidly increase in size; the last, or tenth, is nearly twenty times as long as the second.

29. *Frondicularia alata*, D'Orb. Pl. X. fig. 66.

"Nautili *caudiformes*;" Soldani, Testac. vol. ii. p. 13, pl. 1. fig. *C*. D'Orb. *op. cit.* p. 256. no. 2.

"*Hab.* The Adriatic." (Fossil near Sienna, *Soldani.*)

A very short wide *Frondicularia*; the lower ends of the chambers irregular and pointed. We doubt the locality given by D'Orbigny for *Frondicularia* in a recent state (see Quart. Journ. Geol. Soc. vol. xvi. p. 300). If *Frondicularia* were found by him in the shallow lagoons of the Adriatic, they must have been derived from Tertiary clays. Soldani speaks of this species as common in the fossil state in the clays of San Quirico, Monte Ilco, and the neighbourhood of Sienna.

30. *Frondicularia striata*, D'Orb. Pl. X. fig. 67.

"Orthoceras *Cuspis*;" Soldani, Testac. vol. ii. p. 34, pl. 9. figs. *Q*, *R*. D'Orb. *op. cit.* p. 256. no. 3.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

A striate variety of the normal form of *Frondicularia*. (Fig. *R* is copied.)

31. *Frondicularia pupa*, D'Orb. Pl. X. fig. 64.

"Orthoceras *Cuspis*;" Soldani, Testac. vol. ii. p. 34, pl. 9. fig. *S*. D'Orb. *op. cit.* p. 256. no. 4.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

This appears to be a passage-form between *Frondicularia* and *Lingulina*. Such specimens are not uncommon; and it may be convenient, therefore, to retain the name.

32. *Frondicularia digitata*, D'Orb. Pl. X. fig. 65.

"Orthoceras *Cuspis*;" Soldani, Testac. vol. ii. p. 34, pl. 9. fig. *P*. D'Orb. *op. cit.* p. 256. no. 6.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

A long *Frondicularia*, with chambers of nearly even size; the sides almost parallel.

33. *Lingulina carinata*, D'Orb. Pl. IX. fig. 61.

"Testæ *Ovales, oliviformes, pyriformes, fusiformes*, &c.;" Soldani, Testac. vol. ii. p. 37, pl. 12. fig. *P*. D'Orb. *op. cit.* p. 257. no. 1.

"*Hab.* The Antilles, and, according to Soldani, fossil in the neighbourhood of Sienna."

Noticed previously, in treating of the Models, Ann. N. H. ser. 3. vol. xvi. p. 23.

34. *Lingulina alata*, D'Orb. Pl. IX. fig. 63.

"Orthoceratia *Zoophytica subcordiformia*;" Soldani, Testac. vol. i. pt. 2. p. 94, pl. 99. fig. *N*. D'Orb. *op. cit.* p. 257. no. 2.

"*Hab.* The Adriatic." (Mediterranean, *Soldani.*)

This is *Lingulina carinata* with the edge extended so as to produce a thin even-margined keel.

35. *Lingulina Soldanii*, D'Orb. Pl. XI. fig. 121.

"Orthoceras *Pupa*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 108. figs. *E, F*. D'Orb. *op. cit.* p. 257. no. 3.

"*Hab.* The Adriatic."

Soldani's figures are obscure; but they are probably intended to represent somewhat unusually short specimens of *Grammostomum pennatula*, Batsch, sp. (= *Vulvulina capreolus*, D'Orb.), with spiral commencement. The entire plate is devoted to varieties of this Textularian genus, mostly with the early segments spirally arranged, and some with a uniserial termination. See also Nos. 59 & 60, further on.

36. *Vaginulina striata*, D'Orb. Pl. IX. fig. 58.

"Hortoceratia *Vaginulam gladii referentia*;" Soldani, Testac. vol. ii. App. p. 141, pl. 6. figs. 44, *n, N*. D'Orb. *op. cit.* p. 257. no. 3.

"*Hab.* Recent in the Adriatic." (Fossil at Coroncina and Monte Ileo, *Soldani.*)

It is convenient to keep this trivial name for those flat *Vaginulinæ* whose surface is traversed from end to end with striæ, as distinct from the biconvex forms, with less regular costæ, comprised under the name *V. linearis* (see 'Monograph

Foram. Crag,' p. 66); nevertheless the distinction cannot be regarded as one of much morphological importance.

37. *Vaginulina marginata*, D'Orb. Pl. IX. fig. 59.

"Orthoceras, *Vaginulæ* species;" Soldani, Testac. vol. i. pt. 2. p. 97, pl. 103. fig. *M.* D'Orb. *op. cit.* p. 258. no. 7.

"*Hab.* The Adriatic." (Mediterranean, *Soldani.*)

A marginate *Vaginulina*, with peculiar limbate sutures. For a synopsis of the subgenus *Vaginulina*, see our 'Monogr. Foram. Crag,' *l. c.*

38. *Vaginulina caudata*, D'Orb. Pl. IX. fig. 60.

"Orthoceratia *Vaginula*;" Soldani, Testac. vol. ii. p. 14, pl. 1. figs. *F. G.* D'Orb. *op. cit.* p. 258. no. 8.

"*Hab.* The Adriatic." (Fossil, San Quirico, *Soldani.*)

Our outline is copied from fig. *G*, the other drawing (*F*) being somewhat doubtful and probably representing a smooth *Uvigerina.* The specimen represented is a straight Vaginuline Nodosarian, with a wide carina on the inner or concave margin, and a long spine projecting from the apex or the earliest chamber. Such forms may frequently be met with both recent and fossil, but seldom with the mucro inserted abruptly on the square end of the test, as given in the figure.

39. *Marginulina raphanus*, Linn. sp. Pl. X. fig. 72.

"Orthoceratia *Raphanus, Raphanistrum*, & *Rapistrum*;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 94. figs. *N, P, Q, R, X, Y.* D'Orb. *op. cit.* p. 258. no. 1.

"*Hab.* Recent in the Adriatic; fossil at Castel-Arquato, Italy." (Mediterranean and Adriatic, *Soldani.*)

Noticed in our review of the Models; see also our Monograph of the Crag Foraminifera, and other papers.

Amongst Soldani's figures above quoted, fig. *N* represents the true *Nodosaria raphanus*, and fig. *R* is *N. obliqua*; but plenty of intermediate grades are known to connect these with the Marginuline individuals.

40. *Marginulina hirsuta*, D'Orb. Pl. XI. fig. 125.

"Orthoceratia *Villosa* seu *rudia*;" Soldani, Testac. vol. i. pt. 2. p. 96, pl. 101. figs. *ll–oo.* D'Orb. *op. cit.* p. 259. no. 5.

"*Hab.* The Adriatic." (Mediterranean, and fossil at San Quirico, *Soldani.*)

We are not disposed to regard Soldani's figures, taking them all together, as referable to the *Nodosarinæ* at all. They appear to us somewhat unusually rugose examples of the

Textularian subgenus *Bigenerina* (such as *B. digitata* and *B. nodosaria*), running into Clavuline forms, with too little distinctive character to need a separate varietal name.

Fig. *mm* is non-segmented, but has an abnormal lateral chamber; fig. *oo* has one constriction; fig. *nn* shows three; fig. *ll* seven; and all are possibly *Lituolæ*. Some similar forms are represented on the succeeding plate 102, together with other rugose Nodosarine forms. Taking them all together, we may say that Soldani had here mingled rough dimorphous *Textulariæ* with some straight *Lituolæ*, and at least one spinous *Nodosaria*.

41. *Marginulina carinata*, D'Orb. Pl. IX. fig. 62.

"Orthoceratia *Zoophytica elongata*;" Soldani, Testac. vol. i. pt. 2. p. 92, pl. 97. figs. *hh, mm.* D'Orb. *op. cit.* p. 259. no. 8.

"*Hab.* Fossil at Coroncina." (Mediterranean*, *Soldani.*)

Of the two figures referred to we have copied only one (*mm*); for, though the arrangement of chambers is very similar in the other, the term "*carinata*" could not with any fitness be applied to it. In Mr. Parker's collection are some fine specimens of this form, taken off Sicily, which far better help an understanding of its peculiarities than the figures. The earlier chambers are coiled in a subglobular manner, embracing, and to a great extent hiding, one another; then follow a number which are merely curved; and the shell is terminated by a straight linear series, with all of the segments more or less flattened and showing a tendency to expand backwards on either edge. The concave side of the shell has a carina extending in a curved line from the centre of the first chamber to the wide portion of the terminal one.

Possibly it may be best to regard this as a dimorphous variety of *Lingulina carinata*, though it might with equal reason be assigned to the genus *Flabellina*.

42. *Marginulina sublituus*, D'Orb. Pl. X. fig. 73.

"Orthoceras *Sublituus*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 104. figs. *F, G.* D'Orb. *op. cit.* p. 259. no. 9.

"*Hab.* The Adriatic." (Mediterranean or Adriatic, *Soldani.*)

These are modifications of the typical *M. raphanus*; fig. *F* (copied) has the earlier chambers somewhat flattened and smooth.

* These and many other recent Foraminifera of the Mediterranean, off the Tuscan shore and neighbouring islands, Soldani obtained one by one, on breaking up the hard calcareous concretions of zoophytes and lithophytes, including white and red corals.

43. *Marginulina lævigata*, D'Orb. Pl. X. fig. 68.

"Orthoceratia *Lituitata*;" Soldani, Testac. vol. i. pt. 2. p. 95, pl. 100. figs. *bb, cc*. D'Orb. *op. cit.* p. 259. no. 10.

"*Hab.* The Adriatic." (Mediterranean and Adriatic, *Soldani**.)

Soldani's figure *bb* is a large and much curved *Dentalina communis* (or narrow *Marginulina lituus*); fig. *cc*, which we have copied, only differs from *Marginulina lituus* in degree of curvature and in a partial carina on the concave margin of the earlier chambers.

44. *Marginulina lituus*, D'Orb. Pl. X. fig. 70.

"Orthoceras *Serrula*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 106. figs. *aa, bb*. D'Orb. *op. cit.* p. 259. no. 11.

"*Hab.* The Adriatic." (Mediterranean or Adriatic, *Soldani.*)

A useful species, embracing the smooth, much-curved, Marginuline *Nodosariæ* that have many very oblique chambers. Soldani and D'Orbigny notice it as a recent form; but it is not uncommon as a fossil from the Liassic age onwards.

45. *Marginulina lobata*, D'Orb. Pl. X. fig. 71.

"Polymorpha *Subovalia*;" Soldani, Testac. vol. i. pt. 2. p. 115, pl. 117. fig. *p*. D'Orb. *op. cit.* p. 259. no. 12.

"*Hab.* The Adriatic." (Mediterranean, *Soldani.*)

A short, thick-set, few-chambered *Marginulina*, with a partial carina on the concave edge, and strongly limbate sutures.

46. *Marginulina consecta*, D'Orb. Pl. X. fig. 69.

"Nuclei in thalamis Orthoceratiorum nati;" Soldani, Testac. vol. i. p. 51, pl. 17. figs. *R, S*. D'Orb. *op. cit.* p. 259. no. 13.

"*Hab.* Fossil at Coroncina." (Borro Cieco, *Soldani.*)

We see no reason to doubt Soldani's statement that these, and several other specimens figured in his fourth volume, are casts (obtained by the use of acid in some cases), and not perfect fossils. On any other supposition it would be difficult to understand the drawings he refers to. These are casts of straight *Marginulinæ*.

* Figs, *bb, cc*, with other *Nodosariæ*, are described by Soldani as having been obtained from the sea-mud of the Port Ferrajo (Elba) and at the Island Giglio, from the zoophytic concretions (Tuscan Sea), and from the shore at Rimini (Adriatic); but rare at the last place.

47. *Planularia auris*, Defr. Pl. X. fig. 74.

"Orthoceras *Auris*;" Soldani, Testac. vol. i. pt. 2. p. 98, pl. 104. fig. *A*. D'Orb. *op. cit.* p. 260. no. 6.

"*Hab.* Var. *α*. Recent in the Adriatic; fossil at Castel-Arquato. Var. *β*. Recent in the Mediterranean."

This is the *Planularia auris* of Defrance. See Ann. Nat. Hist. ser. 3. vol. xii. p. 215. no. 107.

48. *Planularia crepidula*, Fichtel & Moll., sp. Pl. X. fig. 77.

"Nautili *Lituitati*;" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 58. fig. *bb*. D'Orb. *op. cit.* p. 260. no. 6.

"*Hab.* The Antilles, and, according to Fischer, the Gulf of Tuscany." (Fossil near Sienna, *Soldani.*)

[*Note.* One of the many misprints in the 'Tableau Méth. de Céphalopodes' occurs in the reference to this species. "Fig. 66" is given in D'Orbigny's text; but this, we think, can only be intended for *bb*. At p. 292. no. 11, figs. *aa*, *bb*, *cc* of this plate (all allies of *C. crepidula*) are referred to all together as *Cristellaria elongata*.]

In Ann. Nat. Hist. ser. 3. vol. v. pp. 114 & 115, Fichtel and Moll's "*Nautilus crepidula*" is defined as "a delicate, elongate, Marginuline, flattened *Cristellaria*," "which by innumerable linkings, passes into *C. calcar*," and "runs insensibly into *C. cassis* on one hand, and on the other into the Planularian section of the *Vaginulinæ*." Soldani's fig. *bb* and his fig. *aa* (D'Orbigny's *Cristellaria elongata*, no. 127) are there referred to as attenuate *Cristellariæ* similar to *C. crepidula*, F. & M. sp., but keeled. Fig. *dd*, one of the subcostate Planularian forms, has no keel, and so far satisfies the strict requirements of subvarietal collocation; but the keeled forms are no less closely related. (See succeeding note on No. 49.) We are inclined to regard them all as *C. crepidula*; and if the keeled forms are to be indicated by a name, D'Orbigny's "*Cr. elongata*"* well serves the turn, having the same relation to *C. cultrata* that *C. crepidula* has to *C. rotulata*. Soldani, Testac. vol. ii. Appendix, p. 146, pl. 18. figs. 91, *r*, *R*, represent a fine *C. crepidula* from San Quirico.

49. *Planularia rostrata*, D'Orb. Pl. X. fig. 75.

"Nautili *Lituitati Cuspides*;" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 58. fig. *dd*. D'Orb. *op. cit.* p. 260. no. 7.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

* The same as D'Orbigny's *Cristellaria lanceolata*, For. Foss. Vien. p. 89, pl. 3. figs. 41, 42.

An elegant, narrow Planularian *Cristellaria* (figs. *cc* and *dd* are subcostate) with attenuate, almost mucronate, extremities. (D'Orbigny's reference is to pl. 68—evidently an error.)

Figs. *cc* & *dd* have elongate riblets on the lower (earlier) part of the shell, better shown in pl. 59. fig. *pp*, in vol. i. The series under notice, figs. *aa–dd*, are dimorphous varieties, showing the transition from relatively broad-chambered *Planulariæ* to those with extremely narrow, elongate, and subparallel chambers, and having their original Cristellarian growth more and more definitely succeeded by subsequent chambers set on at a considerable angle, as on either side of a *Flabellina*.

50. *Bigenerina lævigata*, D'Orb. Pl. XI. fig. 124.

"Orthoceratia *Baculi*;" Soldani, Testac. vol. i. pt. 2. p. 96, pl. 103. fig. *D*. D'Orb. *op. cit.* p. 261. no. 3.

"*Hab.* The Adriatic."

This may be accepted as the Nodosarian form of *Textularia gibbosa*; that is to say, it is a short stout variety of *Bigenerina* with somewhat irregular inflated chambers.

51. *Textularia obtusa*, D'Orb. Pl. XI. fig. 115.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 118, pl. 127. fig. *H*. D'Orb. *op. cit.* p. 262. no. 1.

"*Hab.* The Adriatic." (With a variety of other Foraminifera: a few from the Adriatic, many from the Mediterranean, and some fossil from near Sienna, *Soldani*.) See note on *Textularia gibbosa*, no. 54.

52. *Textularia lævigata*, D'Orb. Pl. XI. fig. 116.

"Polymorpha *Janiformia*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 132. figs. *L, M?* D'Orb. *op. cit.* p. 262. no. 4.

"*Hab.* The Adriatic." (Mediterranean [?], *Soldani*.)

See note on *Textularia gibbosa*, No. 54. Fig. *L* has eight chambers: fig. *M* is smaller and younger, with only four chambers; but it is apiculate.

53. *Textularia punctulata*, D'Orb. Pl. XI. fig. 117.

"Nautili amphorarii vel janiformes;" Soldani, Testac. vol. ii. Appendix, p. 141, pl. 7. figs. 46, *e, E*. D'Orb. *op. cit.* p. 262. no. 4.

"*Hab.* The Adriatic."

See note on *Textularia gibbosa*, No. 54. D'Orbigny regards this figure as "vue en devant;" but it is really a minute and young shell seen edgewise, and showing only the edge of the first chamber and the aperture of the second.

54. *Textularia gibbosa*, D'Orb. Pl. XI. fig. 118.

"Polymorpha *Janiformia*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 132. figs. *I, K*. D'Orb. *op. cit.* p. 262. no. 6.

"*Hab.* Recent in the Adriatic; fossil at Castel-Arquato." (Mediterranean [?], *Soldani*.)

These also are broadly ovate edge-views of two young shells, one apiculate and the other bluntly angular at the apex. The four *Textulariæ* above enumerated may, so far as we can gather from Soldani's figures, be taken as belonging to the same group, of which *T. gibbosa* (as we know it from the Models) is the best central representative. The figures of *T. gibbosa* selected by D'Orbigny give us little or no assistance in the determination of the characters of the species; but in D'Orbigny's Model no. 28 we have the deficiency supplied. (See Ann. Nat. Hist. ser. 3. vol. xvi. p. 23, pl. 2. fig. 60.) The figure alluded to as *T. obtusa* (No. 51) shows more inflated chambers and a proportionally longer and more parallel-sided shell than in *T. lævigata* (No. 52). There is nothing in Soldani's figure named by D'Orbigny *T. punctulata* (no. 53) to found a species upon. Of these four names we propose only to accept one; and we prefer *Textularia gibbosa*, not only because the Model no. 28 seems the most trustworthy basis, but because it also presents the peculiarities developed to their full extent.

55. *Textularia sagittula*, Defrance. Pl. XI. fig. 114.

"Polymorpha *Sagittulæ*;" Soldani, Testac. vol. i. pt. 2. p. 120, pl. 133. fig. *T*. D'Orb. *op. cit.* p. 263. no. 20.

"*Hab.* Living on the shores of the Mediterranean; fossil at Castel-Arquato." (Mediterranean or Adriatic, *Soldani*.)

A good subtype; but Soldani's figure of a minute specimen is rough and inaccurate, as was frequently the case when the objects were too small for his artist's microscopical apparatus. This species is noticed in the paper on the species enumerated by De Blainville and Defrance (Ann. Nat. Hist. ser. 3. vol. xii. pp. 217, 218).

56. *Textularia echinata*, D'Orb. Pl. XI. fig. 126.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 118, pl. 127. fig. *K*. D'Orb. *op. cit.* p. 263. no. 24.

"*Hab.* The Adriatic." (Mediterranean or Adriatic, *Soldani*.)

Soldani's drawing seems rather to be intended for *Bulimina aculeata*, D'Orb.; and an adjoining figure (*I*) on the same plate confirms this view.

57. *Textularia caudata*, D'Orb. Pl. XI. fig. 120.

"Polymorphum *triangulare*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 132. fig. *G.* D'Orb. *op. cit.* p. 263, no. 25.

"*Hab.* The Adriatic." (Mediterranean or Adriatic, *Soldani.*)

This appears to be a minute abnormal *Textularia*, or some other Enallostegian form, produced at the apex into a cylindrical stem, and having on the last chamber a subcylindrical tube, or process, pointing upwards and outwards.

58. *Textularia tuberosa*, D'Orb. Pl. XI. fig. 119.

"Polymorpha Janiformia;" Soldani, Testac. vol. ii. p. 39, pl. 14. fig. *h.* D'Orb. *op. cit.* p. 263. no. 26.

"*Hab.* The Adriatic." (Fossil near Sienna, *Soldani.*)

A short, inflated, broad-mouthed *Textularia*, belonging probably to *T. gibbosa.*

59. *Vulvulina pupa*, D'Orb. Pl. XI. fig. 122.

"Orthoceratia *Pupa*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 108. figs. *vv, xx.* D'Orb. *op. cit.* p. 264. no. 2.

"*Hab.* The Adriatic." (Rimini shore, *Soldani.*)

Accepting *Grammostomum* as a Textularian subgenus, comprising the short, wide, thin-edged varieties, which are usually, though not invariably, limbate at the sutures, this may be regarded as a useful subordinate form, characterized by its well-defined carinate margin. See also No. 35, p. 162.

Soldani's remarks on the *Grammostoma* figured on his plate 108 are so strikingly illustrative of the slow progress of naturalists in the recognition and discrimination of Foraminifera, so expressive of his own patient research and of his openness to conviction by the teaching of fellow-workers, and, further, so suggestive of a broad knowledge and wise foresight as to the probable requirements of the complete study of Foraminifera, that we reproduce his own words:—

"Post diutinam super his Corpusculis observationem placuerat prius ea in album Testarum Hammoniformium referre: at post acceptam epistolam Cl. Modeerii ad Cap. IV. recensitam, ad Orthoceratia transtuli. Si cui forte magis lubeat de his novum genus conficere nec nos obstamus. Hoc tantum monere oportet, has Testas, quas pro coronide hujus capitis [Cap. VI. De Orthoceratiis] heic reponimus, esse raras; et in hoc Vase [CCXL.] contentas n. 26. Summa difficultate ab arenulis littoris Ariminensis excerptas: ac proinde testamur, in aliis littoribus omnibus, tum etiam in fundo maris [Tyrrheni], et in concretionibus zoophyticis per nos hactenus expensis, eas omnino desiderari. Ex hoc vel unico exemplo edoctus quis non dixerit, ad locupletiorem acquirendam Testarum [cognitionem], maria inter se longe dissita, diversos ejusdem maris sinus ac fundos, variasque pelagi plagas prorsus requiri?" (p. 100.)

60. *Vulvulina elegans*, D'Orb. Pl. XI. fig. 123.

"Orthoceratia *Pupa*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 108. fig. *D*. D'Orb. *op. cit.* p. 264. no. 3.

"*Hab.* ——?" (No locality is given by D'Orbigny; but Soldani's figures were taken from Adriatic specimens collected on the shore at Rimini.)

This (*Grammostomum elegans*) has a dentate margin, caused by the extension of the outer end of each segment so as to form a pointed process, which is generally somewhat curved upwards.

61. *Dimorphina tuberosa*, D'Orb. Pl. XI. fig. 108.

"Orthoceras *tuberosum*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 106. fig. *gg*. D'Orb. *op. cit.* p. 264. no. 1.

"*Hab.* The Mediterranean."

See note on Model no. 60, Ann. N. H. ser. 3. vol. xvi. p. 28, and our Monograph of the *Polymorphinæ*, Linn. Soc. Trans. vol. xxvii. p. 249.

62. *Polymorphina tuberosa*, D'Orb. Pl. XI. fig. 105.

"Orthoceratia *tuberosa*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 107. fig. *kk*. D'Orb. *op. cit.* p. 265. no. 6.

"*Hab.* The Mediterranean, on the shores of Corsica." (Tuscan shore, *Soldani*.)

Irregularly grown *Polymorphinæ*, which need not be separated from *P. compressa*. Our outline is copied from the least irregular of Soldani's figures.

63. *Polymorphina Soldanii*, D'Orb. Pl. XI. fig. 106.

"Orthoceratia *tuberosa*;" Soldani, Testac. vol. i. pt. 2. p. 99, pl. 107. fig. *nn*. D'Orb. *op. cit.* p. 265. no. 12.

"*Hab.* The Adriatic, near Rimini."

A subcylindrical variety, with chambers arranged very much as in some *Uvigerinæ*, and attenuated towards their base as alar or overlapping lobes, with a tendency to open with basal orifices along the margins. See also our Monograph of the *Polymorphinæ*, *l. c.* p. 235, pl. 40. fig. 20.

64. *Polymorphina* (*Globulina*) *ovata*, D'Orb.
Pl. XI. fig. 104.

"Polymorpha *subcordiformia* vel *oviformia*;" Soldani, Testac. vol. i. pt. 2. p. 114, pl. 112 (not. 132). fig. *gg*. D'Orb. *op. cit.* p. 266. no. 22.

"*Hab.* Living in the Adriatic, near Rimini; fossil near Bordeaux and near Beauvais."

Two figures of the opposite sides of an ovate *Polymorphina*, probably best referred to the type, *P. lactea*.

65. *Polymorphina* (*Pyrulina*) *gutta*, D'Orb.
Pl. XI. fig. 107.

"Polymorphum;" Soldani, Testac. vol. i. pt. 2 (omitted at p. 116), pl. 122. fig. *yy*? D'Orbigny, *op. cit.* p. 267. no. 28.

"*Hab.* Fossil at Castel-Arquato." (Not mentioned in Soldani's text.)

Previously noticed among the species illustrated by D'Orbigny's own plates in the 'Annales,' Ann. N. H. ser. 3. vol. xii. p. 440, and in our Monogr. *Polymorphinæ*, Linn. Trans. vol. xxvii. p. 218.

66. *Uvigerina pygmæa*, D'Orb. Pl. XI. fig. 109.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 130. figs. *ss*, *tt*. D'Orb. *op. cit.* p. 269. no. 2.

"*Hab.* Fossil in the neighbourhood of Sienna." (Mediterranean or Adriatic; and perhaps fossil near Sienna, *Soldani.*)

Our figure is copied from *ss*; the other reference is to an ill-grown arrested specimen of the same species. See notes on Models no. 67 &c., and especially Phil. Transact. vol. clv. p. 363.

67. *Uvigerina nodosa*, D'Orb. Pl. XI. fig. 110.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 118, pl. 126. figs. *xx*, *yy*, *zz*, *A*, *B*. D'Orb. *op. cit.* p. 269. no. 3.

"*Hab.* The Adriatic." (Mediterranean or Adriatic; probably fossil near Sienna, *Soldani.*)

These five figures are all *U. pygmæa*, not differing amongst themselves more than may be seen in any batch of recent specimens. (Fig. *zz* is copied.)

68. *Uvigerina nodosa*, var. *β*, D'Orb. Pl. XI. fig. 111.

"Testæ pineiformes minusculæ;" Soldani, Testac. vol. ii. p. 18, pl. 4. figs. *E*, *F*, *G*, *H*. D'Orb. *op. cit.* p. 269. no. 3.

"*Hab.* The Adriatic." (Fossil at San Quirico, *Soldani.*)

A somewhat mixed lot, not easily referable to any single species, but belonging to the Uvigerine type. All of them have smooth shells; and fig. *H* resembles *U. irregularis*. Fig. *G* is a *Sagrina* (dimorphous or Clavuline *Uvigerina*; see Ann. N. H. ser. 3. vol. v. p. 469); the others are broad smooth forms. (Fig. *E* is copied.)

69. *Bulimina trilobata*, D'Orb. Pl. XI. fig. 127.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 131. fig. *xx*. D'Orb. *op. cit.* p. 269. no. 6.

"*Hab.* The Adriatic, near Rimini." (Mediterranean or Adriatic, *Soldani.*)

This is *Bulimina aculeata*, D'Orb. See next paragraph.

70. *Bulimina aculeata*, D'Orb. Pl. XI. fig. 128.

"Polymorpha *Pineiformia*;" Soldani, Testac. vol. i. pt. 2. pp. 118, 119, pl. 127. fig. *I*, pl. 130. fig. *vv*. D'Orb. *op. cit.* p. 269. no. 7.

"*Hab.* The Adriatic, near Rimini." (Mediterranean or Adriatic, *Soldani.*)

Morphologically similar to *B. marginata*, but having a series of long spines fringing the outer margins of the segments, in place of the finely serrate edges exhibited by that species.

71. *Rosalina mediterranensis*, D'Orb. Pl. XII. fig. 141.
72. " " " Pl. XII. fig. 140.

"Hammoniæ subconicæ" &c.; Soldani, Testac. vol. i. pt. 1. p. 56, pl. 36. figs. Y, Z? D'Orb. *op. cit.* p. 271. no. 2.

"*Hab.* The Mediterranean, attached to seaweed."

These two figures represent different subvarietal forms of *Pulvinulina*. Soldani's fig. Z (our Pl. XII. fig. 140) is so little differentiated from the type *P. repanda* that it needs no distinctive name; his other figure (Y, our Pl. XII. fig. 141) may be adopted as a variety under D'Orbigny's name. For an account of *Pulvinulina repanda* and its varieties, see Phil. Trans. vol. clv. pp. 390 &c.

Figs. S, V, X all represent *Pulvinulina repanda*, var. *pulchella*, more or less modified (fig. X is *P. Boueana*, D'Orb. sp.); so also pl. 35. fig. R is *P. pulchella*: and in pl. 37, fig. A is perhaps a young *P. repanda*; fig. B is *P. concentrica*, P. & J., found at depths of 40 fathoms and more in the British seas and elsewhere; figs. C, D, F are modifications of *P. repanda*; whilst pl. 38. fig. G is a variety near *P. caracolla*; pl. 37. fig. E is *Pulvinulina auricula*, F. & M.; and pl. 35. fig. T is *Rotalia Beccarii*, var. *ammoniformis*.

73. *Rosalina Soldanii*, D'Orb. Pl. XII. fig. 144.
74. " " " Pl. XII. fig. 148.

"Hammoniæ *Trochi*;" Soldani, Testac. vol. i. pt. 1. p. 61, pl. 51. fig. *kk*?, *ll*. D'Orb. *op. cit.* p. 271. no. 9.

"*Hab.* —— ?" (Mediterranean, *Soldani.*)

These figures appear to be referable to two different types.

The first of them, *kk* (our fig. 144), is a variety of *Pulvinulina repanda*, near *P. antillarum* and *P. Karsteni* in the morphological series; the other, fig. *ll* (our fig. 148), is more like a true *Rotalia*, and, in absence of any very satisfactory data, may be regarded as an accidentally adherent specimen of the typical *R. Beccarii*.

75. *Rotalia Brongniartii*, D'Orb. Pl. XII. fig. 143.

"Hammoniæ subconicæ" &c.; Soldani, Testac. vol. i. pt. 1. p. 56, pl. 38. fig. H. D'Orb. *op. cit.* p. 273. no. 27.

"*Hab.* Fossil at Castel-Arquato." (Mediterranean, *Soldani*.)

This is *Pulvinulina auricula*, F. & M., sp.

76. *Rotalia communis*, D'Orb. Pl. XII. fig. 145.

"Hammoniæ subconicæ" &c.; Soldani, Testac. vol. i. pt. 1. p. 56, pl. 38. fig. L. D'Orb. *op. cit.* p. 273. no. 29.

"*Hab.* The Adriatic, near Rimini; the Mediterranean, near Agde" (Tuscan shore, *Soldani*); "the shores of Africa and Madagascar; fossil on the shores of the Tau lagoon" (South France).

This is a *Pulvinulina*, not differing greatly from the *P. pulchella* of the Models. It is an elongate form, not so symmetrically or neatly made as the "Model" referred to, so far as one can judge by Soldani's somewhat rude and indefinite figure.

77. *Rotalia* (*Turbinulina*) *italica*, D'Orb. Pl. XII. fig. 147.

"Hammoniæ conico-tuberculatæ;" Soldani, Testac. vol. i. pt. 1. p. 56, pl. 35 (not 26). fig. R [?]. (Mediterranean, *Soldani*).

"Hammoniæ globoso-rotundatæ;" Soldani, Testac. vol. ii. App. p. 139, pl. 2. figs. 21, *f, F, G*. (Higher pits on Mount Volterro, *Soldani*.) D'Orb. *op. cit.* p. 275. no. 43.

"*Hab.* Living in the Mediterranean at Cività Vecchia; fossil at Castel-Arquato and at Saucats."

Very ambiguous, owing to D'Orbigny's careless references. "Plate 26" is an obvious error; and if we turn to pl. 35, which tallies with the letterpress reference, we find in fig. *P* (not *R*, which is *Pulvinulina pulchella*) the tuberculate form of *R. Beccarii*, corresponding to the figs. *F, G* in the Appendix, from which our outlines are copied. The whole of these figures, however, may be properly placed with the typical *Rotalia Beccarii*, the tubercles on the under surface probably representing nothing more than a modification of the sutural granulation of this species. *Rotalia Beccarii* and its relationships are treated of in Phil. Trans. vol. clv. pp. 387 &c.

78. *Rotalia* (*Turbinulina*) *Siennensis*, D'Orb. Pl. XII. fig. 130.

"Hammoniæ *univolutæ*;" Soldani, Testac. vol. ii. App. p. 139, pl. 3. figs. 22, *h*, *H*, *I* [?]. D'Orb. *op. cit.* p. 275. no. 50.

"*Hab.* Fossil in the neighbourhood of Sienna."

This is another case of difficulty, arising from incorrect quotations. D'Orbigny has "pl. 4. figs. *K*, *L*," which represent small Gasteropods or spiral Annelids, and are further shown to be wrong by the letterpress reference. Turning to pl. 3, the first four figures, *H–L*, all seem to represent small varieties of *Planorbulina*; and as *H* & *I* correspond with *Soldani's* text-name, quoted by D'Orbigny, we have made our copy from them, and taken them as the basis for determination.

Figs. *H*, *I* are probably *Planorbulina Ungeriana*, D'Orb. sp., especially resembling its barely separable subvariety known as *Pl. Akneriana* (D'Orb.); and *K*, *L* (belonging to Soldani's "Hammoniæ *concavo-umbilicatæ*") seem to be *Pl. ammonoides*, D'Orb. sp.

79. *Rotalia* (*Turbinulina*) *elegans*, D'Orb. Pl. XII. fig. 142.

"Nautili *Ammoniformes* sive *trochiformes*;" Soldani, Testac. vol. ii. App. p. 138, pl. 2. figs. 13, *q*, *Q*, *R*. D'Orb. *op. cit.* p. 276. no. 54.

No locality given. (Fossil at Coroncina, *Soldani*.)

This is *Pulvinulina elegans*, a good representative of an important section of the genus. It is not uncommon in deep water, and is often met with as a fossil in Tertiary clays.

80. *Rotalia* (*Turbinulina*) *ammoniformis*, D'Orb. Pl. XII. fig. 149.

"Hammoniæ *Beccarii* seu *vulgarissimæ*;" Soldani, Testac. vol. i. pt. 1. p. 55, pl. 34. fig. K. D'Orb. *op. cit.* p. 276. no. 55.

"*Hab.* Fossil at Coroncina." (In the Mediterranean, and fossil at Sienna, *Soldani*.)

The large, finely made, many-chambered variety of *Rotalia Beccarii*, found at Rimini, in the Adriatic. Soldani says of it:—"Omnium hujus speciei Hammoniarum, quæ hucusque ad manus nostras venerunt, maximæ." It differs from *R. Beccarii* chiefly in its lower surface, which shows the inner turns of the spire to a considerable extent, and is free from the granulation and sutural ruggedness which are usually marked characters in the type. D'Orbigny's locality for the variety as a fossil must stand on his own authority. Soldani mentions it as a constituent of the littoral sands of the Adriatic, and as being found abundantly fossil in the sands near Sienna.

81. *Globigerina bulloides*, D'Orb. Pl. XI. fig. 112.

"Polymorpha *Tuberosa* et *Globulifera*;" Soldani, Testac. vol. i. pt. 2. p. 117, pl. 123. figs. *H, I, O, P.* D'Orb. *op. cit.* p. 277. no. 1.

"*Hab.* The Adriatic, near Rimini."

Noticed in previous papers, especially in Phil. Trans. vol. clv. pp. 365 &c.

Fig. *H* seems to be a few-celled *Globigerina*; so also fig. *M*. Indeed, excepting fig. *K* (*Cassidulina*), all the figures of pl. 123 are *Globigerinæ*, and all of pl. 124, except perhaps fig. *Z*; also all of pl. 125, and half of those of pl. 126.

82. *Globigerina elongata*, D'Orb. Pl. XI. fig. 129.

"Polymorpha *Tuberosa* et *Globulifera*;" Soldani, Testac. vol. i. pt. 2. p. 117, pl. 123. figs. *K.* D'Orb. *op. cit.* p. 277. no. 4.

"*Hab.* Recent in the Adriatic, near Rimini; fossil at Castel-Arquato." (Mediterranean, *Soldani.*)

Though these two figures of the minute specimen are rude, and, owing to the nature of the engraving, there is no indication of the texture of the shell, we have no hesitation in assigning these figures to the genus *Cassidulina*; the aperture and general arrangement of the segments equally point to this conclusion. They may perhaps be best placed with *C. oblonga.*

83. *Globigerina helicina*, D'Orb. Pl. XI. fig. 113.

"Polymorpha globulifera;" Soldani, Testac. vol. i. pt. 2. p. 119, pl. 130. figs. *pp, qq, rr.* D'Orb. *op. cit.* p. 277. no. 5.

"*Hab.* The Adriatic, near Rimini." (Mediterranean and Adriatic, *Soldani.*)

A large, many-chambered, lobular variety, which we have found convenient to retain. (Fig. *qq* is copied.) These show a tendency to have bilobate segments, whilst No. 81 shows trilobation.

84. *Gyroidina lævigata*, D'Orb. Pl. XII. fig. 150.

Soldani, Testac. vol. ii. App. p. 141, pl. 8. figs. 33, *aa, AA, BB.* D'Orb. *op. cit.* p. 278. no. 2.

"*Hab.* The Adriatic, near Rimini." (Fossil near Sienna &c., *Soldani.*)

Not separable from the *Gyroidina orbicularis* of the "Models."

The generic term *Gyroidina* is needless; all the species described by D'Orbigny are true *Rotaliæ*. These specimens are from the fossil shell-dust of Sienna and San Quirico.

85. *Gyroidina Soldanii*, D'Orb. Pl. XII. fig. 151.

"Nautilus *Melo spiralis*;" Soldani, Testac. vol. i. pt. 1. p. 59, pl. 46. figs. *rr*, *ss*. D'Orb. *op. cit.* p. 278. no. 5.

"*Hab.* The Adriatic, near Rimini." (Mediterranean, and fossil near Sienna, *Soldani.*)

See note on "Model" no. 36, Ann. N. H. ser. 3. vol. xvi. p. 25; and Phil. Trans. vol. clv. p. 389.

86. *Truncatulina tuberculata*, D'Orb. Pl. XII. fig. 136.

"Hammoniæ tuberculatæ" &c.; Soldani, Testac. vol. i. pt. 1. p. 58, pl. 45. figs. *ii*, *kk*, *ll*, *mm*. D'Orb. *op. cit.* p. 279. no. 1.

"*Hab.* Living on the shores of the Mediterranean and on the European shores of the Atlantic; fossil at Bordeaux, at Paris, and at Castel-Arquato."

This is *Truncatulina lobatula*, W. & J. sp. See note on "Model" no. 37; also Ann. N. H. ser. 3. vol. iv. p. 339, and Phil. Trans. vol. clv. p. 381.

On Soldani's pl. 41 most of the figures refer to *Tr. lobatula*; all but fig. *N* on pl. 42; all on pl. 43; most, if not all, on pl. 44; all on pl. 45. They are of irregular growth, mostly adherent, and closely embracing.

87. *Truncatulina refulgens*, Montfort, sp. Pl. XII. fig. 139.

"Hammonia *Balanus* seu *Balanoidea*;" Soldani, Testac. vol. i. pt. 1. p. 58, pl. 46. figs. *nn* [?], *oo*. D'Orb. *op. cit.* p. 279. no. 5.

"*Hab.* Adriatic, near Rimini; Mediterranean, off Corsica; South Seas, at Rawack, Madagascar, and Cape of Good Hope." (Mediterranean, *Soldani.*)

See note on Model no. 77, and particularly Ann. Nat. Hist. ser. 3. vol. vi. p. 340. Montfort's drawing of his "Genre 31" (*Cibicides refulgens*) is a bad copy of Soldani's fig. *oo*.

Both Soldani and D'Orbigny have been misled by the isomorphism which exists between the two groups *Planorbulina* (including *Truncatulina*) and *Pulvinulina*, in associating the two figures *nn* and *oo* under the same name. It is difficult to speak with certainty from engravings on copper, in a matter requiring nice discrimination with respect to shell-texture and the like; but we feel assured that the first figure (*nn*) represents a *Pulvinulina*—the *Rotalina truncatulinoides* of D'Orbigny (Foram. de Canaries, pl. 2. figs. 25–27), a subvariety of *Pulvinulina Menardii*, and near *P. Micheliniana*. *P.*

crassa, and *P. nitida* (Phil. Trans. vol. clv. p. 393). Fig. *oo* is really a *Truncatulina*.

88. *Truncatulina variabilis*, D'Orb. Pl. XII. fig. 138.

"Testæ hammoniformes, *plano-cochleatæ*, *tuberosæ*, *articulatæ*," &c.; Soldani, Testac. vol. i. pt. 1. pp. 77–80, pls. 70–92. D'Orb. *op. cit.* p. 279. no. 8.

"*Hab.* The Mediterranean."

Soldani devotes nearly twenty-four of his folio plates (pl. 93. figs. *kk–oo* might have been added by D'Orbigny) to the illustration of the outspread, irregular, and usually adherent varieties of *Truncatulina*; in all there are no less than 284 figures. Never was a subspecific form so well depicted in all its modifications.

Possibly this form in all its phases may be best placed under *Truncatulina tuberosa*, F. & M. sp. (Ann. N. H. ser. 3. vol. v. pp. 177–179). Our limits preclude the reproduction of more than one of Soldani's figures; and this, of course, gives no idea of the range of variation so laboriously and clearly exemplified by the indefatigable Soldani and his artists (Ciro Santi and A. Costa).

89. *Planulina Ariminensis*, D'Orb. Pl. XII. fig. 131.

"Ammoniæ *foliaceæ*;" Soldani, Testac. vol. ii. App. p. 140, pl. 3. figs. 25, *o*, *O*, *P*.

"Hammoniæ subrotundæ;" Id. ibid. vol. i. pt. 1. p. 61, pl. 50. fig. *ee*. D'Orb. *op. cit.* p. 280. no. 1.

"*Hab.* The Adriatic, near Rimini." (Mediterranean, and fossil at Coroncina, *Soldani*.)

Figs. *O*, *P* are copied, which have little of the sutural limbation characterizing the best-grown specimens, such as D'Orbigny's Model no. 49, and Soldani's pl. 50. fig. *ee*. Indeed it is rather D'Orbigny's *Anomalina rotula* (For. Foss. Vien. pl. 10. figs. 10–12), one of the feeblest of the neat flat *Planorbulinæ* (*Planulinæ*), that we have here before us.

90. *Planulina incerta*, D'Orb. Pl. XII. fig. 137.

"Ammoniæ *Plano-convexæ*;" Soldani, Testac. vol. ii. App. p. 140, pl. 3. figs. 26, *q*, *Q*, *R*. D'Orb. *op. cit.* p. 280. no. 3.

"*Hab.* The Adriatic." (Fossil, rare near Sienna, *Soldani*.)

Apparently a young specimen of *Truncatulina lobatula*, the upper view disclosing a little more of the interior whorl of chambers than usual in typical examples.

91. *Planulina Soldanii*, D'Orb. Pl. XII. fig. 132.

"Hammoniæ subrotundæ;" Soldani, Testac. vol. i. pt. 1. p. 61, pl. 50. fig. Z.

"Hammoniæ planæ rotundæ;" Id. ibid. p. 62, pl. 53. fig. *xx*. D'Orb. *op. cit.* p. 280. no. 4.

No locality given. (Mediterranean, *Soldani*.)

A complanate thin *Planorbulina*, differing from *P. Ariminensis* chiefly in possessing a narrow carina round the shell. One of the figures (the upper side?) comprised in the second reference has large conspicuous foramina, as also other *Planorbulinæ* in the same and in the foregoing (52) plate and elsewhere. (Pl. 53. fig. *xx* copied.)

92. *Planorbulina Mediterranensis*, D'Orb. Pl. XII. fig. 133.

"Corpuscula *plano-papillosa*;" Soldani, Testac. vol. i. pt. 3. p. 238, pl. 161. figs. *E, F, G*, pl. 162. fig. *H*. D'Orb. *op. cit.* p. 280. no. 2.

"*Hab.* The Mediterranean, growing attached to various bodies."

See note on Model no. 79, and Phil. Trans. vol. clv. p. 380.

93. *Planorbulina vermiculata*, D'Orb. Pl. XII. fig. 146.

"*Placentulæ*;" Soldani, Testac. vol. i. pt. 3. p. 237, pl. 161. figs. *A, B, C.* D'Orb. *op. cit.* p. 280. no. 3.

"*Hab.* The Mediterranean" *.

A rare, but distinct, vermiculate species of *Pulvinulina*. Phil. Trans. vol. clv. pp. 390, 393. (Fig. *B* is copied.)

94. *Soldania carinata*, D'Orb. Pl. X. fig. 83.

"*Nautili*;" Soldani, Testac. vol. ii. App. p. 145, pl. 18. figs. 91, *p, P, Q.* D'Orb. *op. cit.* p. 281. no. 1.

"*Hab.* Fossil at Coroncina." (San Quirico, *Soldani*.)

By Soldani's figure the shell appears to have a diameter of nearly one-seventh of an inch, and seems referable to *Cristellaria*, and near to *C. cultrata*. We accept it as a beautiful, explanate, keeled *Cristellaria*, orbicular, with numerous short chambers, and umbonate.

95. *Soldania spirorbis*, D'Orb. Pl. XII. fig. 153.

"Porpitæ soluti;" Soldani, Testac. vol. ii. App. p. 140, pl. 4. figs. 34, *g, G, h, H.* D'Orb. *op. cit.* p. 281. no. 2.

"*Hab.* Fossil at Coroncina." (Cormons, Forojulio, *Soldani*.)

* "Reperiuntur in fundo maris ad Portum Ferrarium et Liburnensem, et quidem copiosè, ut patet ex hoc vasculo, in quo 1662 continentur sub pondere granorum sex."

These can only be referable to *Nummulina*. Soldani's sketches, *g*, *h*, indicating the natural size, are as large as our outlines; and his other figures show some of the characters of *Nummulina exponens*.

96. *Soldania nitida*, D'Orb. Pl. XII. fig. 134.

Soldani, Testac. vol. i. pt. 2. p. 151, pl. 135. fig. *I*. D'Orb. *op. cit.* p. 281. no. 3.

"*Hab.* Fossil at Coroncina." (Fossil at Clusenti, *Soldani.*)

If D'Orbigny found the exact counterpart of this, it was curious; and if he did not, why he should have chosen a drawing of a quite indeterminable fragment as the foundation of a species, we cannot tell. Soldani explicitly states that the figure does but represent a section:—"Alterum [*I*] est Hammonia, sive potius Nautilus dimidiatus." It may possibly be a fragment of a *Planorbulina*; beyond this we can offer no suggestion.

[To be continued.]

XIX.—*On the* Alauda bimaculata *of Ménétriés*. By R. B. Sharpe, F.L.S. &c., Librarian to the Zoological Society of London.

Through the kindness of Canon Tristram and other friends, I have had a large series of Calandra Larks submitted to me lately, with a view to identify the species which belong to the European fauna. Hitherto only one species has been admitted as European, viz. the ordinary Calandra Lark, *Melanocorypha calandra* (L.); but Dr. Tristram, writing in 'The Ibis' for 1868 (p. 208), remarks, in the course of his essay on the Ornithology of Palestine:—

"Before concluding these notes on the Passerine birds of Palestine, I must state that, on going through my collection recently, in company with the editor of this Journal, we were satisfied that the Calandra Lark of Mount Hermon and Lebanon must be distinguished from the common Calandra of the plains and of Southern Europe. It is smaller and more slender, with a very decided rufous tint on the whole of its plumage; but especially the outer rectrices are without any white, while in the true *M. calandra* (L.) the outer tail-feathers are wholly white. But before describing the species as new, I am anxious to have an opportunity of examining Persian and Affghan specimens."

I am indebted to the reverend gentleman for the loan of the specimens on which the above remarks were founded, and I am at once enabled to distinguish them specifically from the ordinary Calandra. Dr. Tristram has selected two of the characters by which they may be separated; but there is yet a third, of equal importance, which he has apparently overlooked; and that consists in the entire absence of white spots along the tips of the lesser quills, which is so very evident a character in true *M. calandra*. On comparing the Palestine specimens with an example of *M. alboterminata* in my collection from Abyssinia, I find that they agree precisely as regards the characters of the wings and tail: the bill is a little stouter in the latter bird; but this is, as every one knows, a very variable characteristic in larks of the genus *Melanocorypha*. A further examination of *Melanocorypha bimaculata* of Ménétriés has induced me to believe that this, too, is not distinct from *M. torquata* of Cashmere and the North-west Provinces of India, while I am unable to separate either of these species from *M. alboterminata*; so that it will be seen that I incline to the belief that there is one species of Calandra Lark found ranging from Abyssinia to North-western India, replacing the true Calandra in these countries, and overlapping the range of the latter in Palestine and South-eastern Russia. Mr. Blyth, it is true, has written to 'The Ibis' (1867, p. 46) protesting against his *M. torquata* being united to *M. bimaculata* of Ménétriés, which latter, he says, "can be only doubtfully separated from *Calandrella brachydactyla* (L.)." But, in reply to this, it may be mentioned that Ménétriés, in his original description, gives his *A. bimaculata* as being of the size of a Calandra, which can hardly be said to be the case with the Short-toed Lark. Lastly, it may be observed that the *M. rufescens* of Pastor Brehm, which has been regarded as a synonym of *M. alboterminata*, is doubtless rightly thus identified; and this name was probably founded on a rufous-coloured specimen, for Canon Tristram's examples are more rufous than any I have seen. Whether this coloration is due to the season of the year, or whether it is acquired from the nature of the ground they frequent, I cannot at present determine, the latter, I suspect, being the reason. According to my views, therefore, the synonymy of the species will stand thus:—

Melanocorypha bimaculata.

Alauda bimaculata, Ménétriés, Cat. Rais. p. 37 (1832).
Melanocorypha calandra, Rüpp. Syst. Uebers. p. 78 (1845, nec Linn.).
—— *torquata*, Blyth, J. A. S. B. xvi. p. 476 (1847).
—— *alboterminata*, Cab. Mus. Hein. Th. i. p. 124 (1850).
—— *rufescens*, Brehm, Naumannia, 1856, p. 376.

M. similis *M. calandræ*, sed paullo minor, et remigibus minoribus haud albo terminatis, et rectricibus exterioribus brunneis pogonio externo isabellino marginato, haud albis, distinguenda.

Hab. North-east Africa (*Brehm, Heuglin*), Palestine (*Tristram*), Caucasus (*Ménétriés*), ?Persia (*Defilippi*), Turkestan (*Dode*), Cashmere (*Jerdon*), North-west India (*Blyth, Hume*).

XX.—*On a new Species of* Plesiosaurus *from the Portland Limestone**. By Harry G. Seeley, F.G.S., St. John's College, Cambridge.

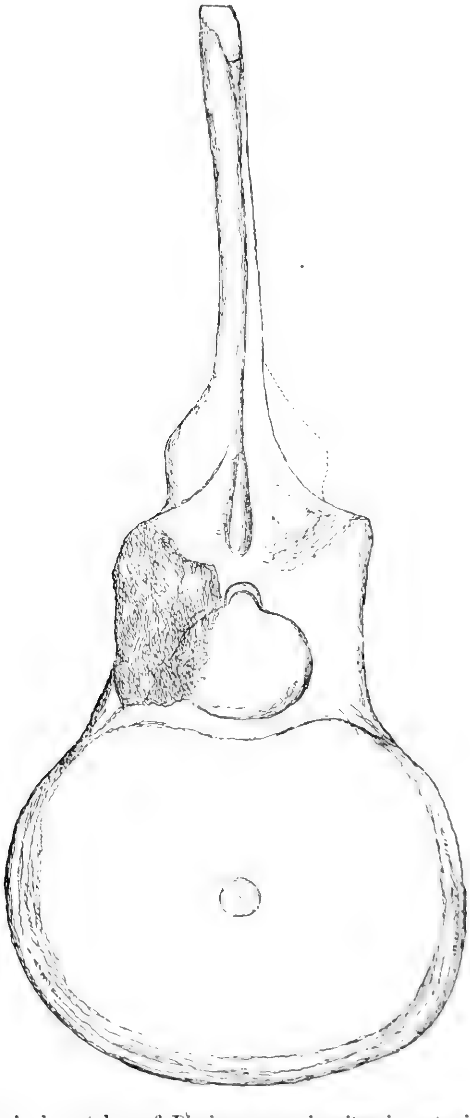
When the Index to the Reptilian Remains from the Secondary strata preserved in the Woodwardian Museum was written, an examination of many examples of Plesiosauria had shown that, with perfect specimens, good characters were available by which the overgrown genus *Plesiosaurus* might be separated into natural genera. Hence, when recording the few remains from the Portland Oolite (p. 91), finding the characters of *Pliosaurus* blended to some extent with those of *Plesiosaurus*, I did not feel it easy to volunteer an opinion on generic affinities.

Since then, Prof. Owen's memoir in the Palæontographical Society's volume (1869) on *Pliosaurus portlandicus* has been published; and in the absence of associated vertebræ showing the distinctive Pliosaurian characters of the neural arch and centrum, I cannot but feel less confidence than Prof. Owen expresses in regarding the paddle there figured as the type of the Pliosurian hind limb. In some large-headed Plesiosaurs, such as *Plesiosaurus macrocephalus* (Owen), the tibia and fibula, and ulna and radius, become shorter than in small-headed species; and although the tarsus in Prof. Owen's fossil is very similar to that of Pliosaurs from the Kimmeridge Clay, the femur is more like *Plesiosaurus*; and it is not impossible that the Portland specimen may typify a new genus. All the limb-bones from the Portland Limestone, so far as known to me, are pliosauroid, while all the vertebræ are plesiosauroid.

Therefore with some interest we received from an indefatigable correspondent, Mr. W. R. Brodie, some vertebræ which demonstrate, as conclusively as vertebræ can, the existence in the Portland Limestone of a new species of *Plesiosaurus*. They were found by Mr. Brodie at the Winspit

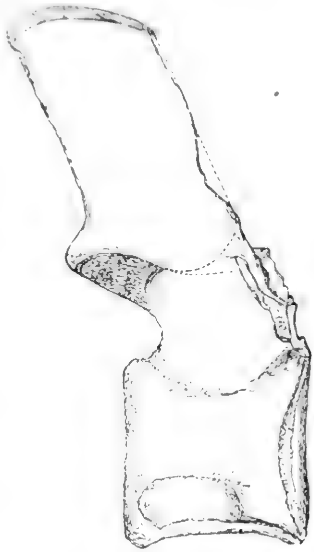
* Communicated by the author, having been read before the Cambridge Philosophical Society, May 30, 1870.

quarry, in the Isle of Purbeck, and are from the cervical and pectoral regions.



Cervical vertebra of *Plesiosaurus winspitensis*, nat. size.
Portland Oolite, Winspit, Purbeck.

Cervical vertebra.—The centrum measures 2 inches from back to front at its base, and is slightly longer under the neural arch. The articular surface of the centrum is elliptical, $2\frac{3}{8}$ inches broad, and nearly 2 inches high. It is very slightly and regularly concave, so as to appear nearly flat; and in the centre there is a small sudden depression, as in *Pliosaurus brachyspondylus* (Owen). The margin under the neural canal is concave; and the remainder of the margin of the articular surface of the centrum is obliquely bevelled, as is often seen in cervical vertebræ of Plesiosaurs. The base of the centrum is concave from back to front, in which direction there is a moderate ridge mesially, with the usual nutritive foramen on each side of it; the interspace between these foramina is a quarter of an inch. The base of the centrum is separated from the side by the articulation for the cervical rib. This articulation is transversely elliptical, $\frac{5}{8}$ of an inch high, and more than an inch long; it is deeply concave from front to back, and nearer to the posterior than to the anterior articular surface of the centrum, as is usual. On the left side of the centrum the cervical rib is preserved; it is about $\frac{3}{4}$ of an inch long, much compressed from side to side, directed downward and outward and backward, and tapering from back to front. The side of the centrum is smooth, gently concave between the back and front, where it terminates in the thickened margins of the articular surfaces; it is convex from below upward.



Side view of the same cervical vertebra of *P. winspitensis*, one-half natural size.

The suture between the neural arch and the centrum remains persistent; but the two neurapophyses are anchylosed into one mass, and do not remain distinct as in *Pliosaurus*. The whole neural arch is directed obliquely backward, much compressed from side to side; the neural spine is long, as in *Plesiosaurus*; and the arch does not articulate with the centrum by ovate pedicles as in *Pliosaurus*; so that both in the centrum and the neural arch the characters are Plesiosaurian.

The height of the neural arch from the suture to the summit of the spine, measured at the side, is $4\frac{3}{8}$ inches. The height from the base of the centrum to the posterior zygapophysis is 3 inches. These articular facets are flat, and look downward and outward. A moderately elevated transverse ridge on each side connects them with the anterior zygapophyses. The neural spine may be $\frac{3}{8}$ of an inch thick where thickest, but it is compressed to a sharp edge at both the anterior and posterior margins; towards its base it measures $1\frac{5}{8}$ inch from front to back; but it narrows to about $1\frac{1}{4}$ inch at the free end, which is truncated so as to be convex from front to back, and parallel to the base of the centrum.

The neural canal is small, ovate, broader than high, being about $\frac{1}{2}$ an inch high and $\frac{3}{4}$ of an inch broad. The greatest width of the neural arch, from side to side in front across the neural canal, is $1\frac{5}{8}$ inch.

The distance, at the side of the vertebra, from the base of the neural arch to the facet for the rib is $\frac{3}{4}$ of an inch. It is difficult to refer the specimen to its correct position in the neck; but I regard it as a late cervical, probably about the 7th from the end of the neck.

The species appears to be distinct from any yet described—though, from the uncertainty of its exact position in the neck, the specific value of its characters cannot be accurately estimated. The species to which it approaches most closely is *Pl. megadeirus*, from which it appears to differ in the centrum being longer and flatter on the articular surface, with a larger lateral margin to the articulation and a relatively shorter articulation for the cervical rib, which is placed further from the anterior margin of the centrum.

In the 31st cervical vertebra of *Pl. megadeirus* the measurements of the centrum are:—

Length of centrum at its base	2 inches.
Length of centrum through the centre	$1\frac{3}{8}$ inch.
Width of centrum over posterior articular surface	$3\frac{1}{8}$ inches.
Width of centrum in front	3 ,,
Depth of centrum	$2\frac{1}{2}$,,

The corresponding measurements of this vertebra are:—

Length of centrum	2 inches.
Width of centrum....................	$2\frac{1}{2}$,,
Depth of centrum	2 ,,

[In the 27th cervical vertebra of *Plesiosaurus Mansellii*, Mr. Hulke gives the measurements as :—

From front to back of centrum	$2\frac{1}{2}$ inches.
Width of centrum	4 ,,
Depth of centrum	$3\frac{1}{5}$,,

and in the pectoral region the distinctive proportions of width and depth become slightly more marked.

The more concave articular face of the centrum and less thickened peripheral margin of the Kimmeridge species confirm the specific distinction of the types.]

Pectoral vertebra.—The pectoral vertebra of *P. winspitensis* appears to measure—

From front to back of the centrum	$1\frac{5}{8}$ inch.
Width of centrum	$2\frac{5}{8}$ inches.
Depth of centrum	$1\frac{7}{8}$ inch.

Thus the form of the articular surface of the centrum is broader from side to side than in the neck; it is also a little flatter. The neural spine is partly broken away; but, unless it be in a slightly greater development of the vertically elongated tubercle for the rib, there is nothing specially remarkable in the neural arch.

The specimens are still partly imbedded in the matrix, and the mass shows the impressions of portions of other vertebræ of the same individual. As a means of drawing attention to a locality which is likely to reward an explorer, I would record the species as *Plesiosaurus winspitensis.*

XXI.—*On the Condors and Humming-birds of the Equatorial Andes.* By James Orton, of Poughkeepsie, N. Y.*

The condor has been singularly unfortunate in the hands of the curious and scientific. Fifty years have clapsed since the first specimen reached Europe; yet to-day the exaggerated stories of its size and strength are repeated in many of our text-books, and the very latest ornithological work leaves us in doubt as to its relation to the other vultures. No one credits the assertion of the old geographer Marco Polo, that the condor can lift an elephant from the ground high enough to kill it by the fall, nor the story of a traveller, so late as 1830, who declared that a condor of moderate size, just killed, was lying before him, a single quill-feather of which was twenty

* From a separate impression communicated by the Author.

good paces long! Yet the statement continues to be published that the ordinary expanse of a full-grown specimen is from twelve to twenty feet; whereas it is very doubtful if it ever exceeds, or even equals, twelve feet. A full-grown male from the most celebrated locality on the Andes, now in Vassar College, has a stretch of nine feet. Humboldt never found one to measure over nine feet; and the largest specimen seen by Darwin was eight and a half feet from tip to tip. An old male in the Zoological Gardens of London measures eleven feet. Von Tschudi says he found one with a spread of fourteen feet two inches; but he invalidates his testimony by the subsequent statement that the full-grown condor measures from twelve to thirteen feet.

The old names of *Vultur gryphus*, *V. magellanicus*, *Gypagus gryffus*, and *Zopilotes* are obsolete, and *Sarcoramphus gryphus* is universally adopted; but it is not yet settled that it is generically distinct from the other great vultures. Thus Sclater and Gurney put the condor alone in *Sarcoramphus*; while Gray and Strickland include the king vulture; and Vieillot and others add a third, the California vulture. The structure and habits of the condor, in our judgment, make it worthy to stand by itself. The king vulture belongs more especially to the plains; while the California species has straggling feathers on its head, builds nests in trees where it perches, and its time of incubation is only one month.

But a more important question, perhaps, is, whether there is but one species. Associated with the great condor is a smaller vulture, having brown or ash-coloured plumage instead of black and white, a beak wholly black instead of black at the base and white at the tip, and no caruncle. It inhabits the high altitudes, and is rather common. This was formerly thought to be a distinct species; but lately ornithologists have pronounced it the young of the *Sarcoramphus gryphus*. We wish this decision to be reconsidered; for there is some ground for the belief that the first impression is correct—that the "Condor pardo" (as the brown kind is called by the natives) is specifically distinct from the greater "Condor negro." They are always spoken of as separate kinds at Quito, where certainly it would be known if one were the young of the other.

Mr. John Smith, an Englishman of intelligence and acute observation, and a resident of nearly twelve years on the slope of Antisana, where both kinds abound, said to us:—"I have heard it said that the brown condor is the young of the black. It cannot possibly be, for I have seen young condors with white beaks and a few white feathers in their wings. I have also seen old condors with carbuncles on the head (which are said to come from age alone), and black beaks, and the body brown or ash-coloured all over." Bonaparte, in his 'American Ornithology,' gives a careful drawing of a young male, with a crest and with white patches on its wings—both features wanting in the brown. Lieutenant Gilliss declares, as the result of his observations on the Chilian Andes, that the brown kind is a different species. Further proof is wanted; but it is quite probable that another species must be added to the genus *Sarcoramphus*.

The ordinary habitat of the royal condor is between the altitudes of 10,000 and 16,000 feet. The largest seem to make their home around the volcano of Cayambi, which stands exactly on the equator. In the rainy season they frequently descend to the coast, where they may be seen roosting on trees; on the mountains they very rarely perch (for which their feet are poorly fitted), but stand on rocks. They are most commonly seen around vertical cliffs, where their nests are and where cattle are most likely to fall. Great numbers frequent Antisana, where there is a great cattle-estate. Flocks are never seen except around a large carcass. It is often seen singly, soaring at a great height in vast circles. Its flight is slow and majestic. Its head is constantly in motion as if in search of food below; its mouth is kept open and its tail spread. To rise from the ground, it must needs run for some distance, then it flaps its wings three or four times and ascends at a low angle till it reaches a considerable elevation, when it seems to make a few leisurely strokes, as if to ease its wings, after which it literally sails upon the air. In walking, the wings trail on the ground, and the head takes a crouching position. It has a very awkward, almost painful gait. From its inability to rise without running, a narrow pen is sufficient to imprison it. Though a carrion-bird, it breathes the purest air, spending much of its time soaring three miles above the sea. Humboldt saw one fly over Chimborazo. We have seen them sailing at least a thousand feet above the crater of Pichincha*.

Its gormandizing power has hardly been overstated. We have known a single condor, not of the largest size, to make away in one week with a calf, a sheep, and a dog. It prefers carrion, but will sometimes attack live sheep, deer, dogs, &c. The eye and tongue are favourite parts and first devoured, next the intestines. We never heard of one authenticated case of its carrying off children, nor of its attacking adults

* One of the peaks of Pichincha is called in the Inca language *cuntur guachana*, or "condor's nest."

except in defence of its eggs. Von Tschudi says it cannot carry, when flying, a weight of over ten pounds. In captivity, it will eat every thing except pork and cooked meat. When full-fed, it is exceedingly stupid and may be caught by the hand; but at other times it is a match for the stoutest man. It passes the greater part of the day sleeping, more often searching for prey morning and evening than at noon—very likely because objects are then more distinctly seen.

It is seldom shot (though it is not invulnerable as once thought), but is generally trapped or lassoed. Prescott, in his 'Conquest of Peru,' vol. i. p. 384, speaks of "the great bird of the Andes—the loathsome condor, who, sailing high above the clouds, followed with *doleful cries* in the track of the army." But the only noise it makes is a hiss like that of a goose. The usual tracheal muscles are wanting.

It lays two white eggs, three or four inches long, on an inaccessible ledge. It makes no nest proper, but places a few sticks round the eggs. By no amount of bribery could we tempt an Indian to search for condors' eggs; and Mr. Smith, who had hunted many years in the valley of Quito, was never able to get sight of an egg. Incubation occupies about seven weeks, ending April or May*. The young are scarcely covered with a dirty white down, and they are not able to fly till nearly two years. D'Orbigny says they take wing in about a month and a half after being hatched—a manifest error. They are as downy as goslings until they nearly equal in size a full-grown bird. Darwin was told they could not fly for a whole year. The white frill at the base of the neck and the white feathers in the wings do not appear until the second plumage, or until after the first general moulting, during which time they lie in the caves, and are fed by their elders for at least six months. Previously to this the frill is of a deep grey colour (Gilliss says, "light blue-black") and the wing-feathers brown.

The head, neck, and front of the breast are bare, indicative of its propensity to feed on carrion. The head is elongated, and much flattened above. The neck is of unusual size, and in the male the skin lies in folds. The nostrils are oval and longitudinal; but in the male they are not so much exposed as in the other sex, since the caruncle forms an arch over them. The olfactories, however, seem to be well developed. Yet the condor, though it has neither the smelling-powers of the dog (as proved by Darwin) nor the bright eye of the eagle, somehow distinguishes a carcass afar off. The colour of the eye

* In Patagonia, according to Darwin, much earlier, or about February.

is variously given—by Latham as nut-brown, by Cassell as purple, and by Bonaparte as olive-grey; but Gurney, in his 'Raptorial Birds in the Norwich Museum,' states it correctly as pale brown in the male, and carbuncle-red in the female—a singular difference between the sexes. In young birds the colour is dark brown, which changes with change of plumage. They are peculiarly elongated, not sunken in the head as the eagle's, and very far back, being an inch and a half behind the gape, while those of the eagle are directly over it. The bill is shorter and weaker than the eagle's, and the decurved tip of the upper mandible only one-third as long. The tongue is canaliculate, with serrated edges, which obviously assists in deglutition, as the head is never raised to swallow food. The caruncle and wattle are wanting in the female. The downy ruff is more prominent in the male, but in neither sex completes a circle. The primaries are black, the third and fourth being equal and longest—a feature wanting in the Old-World vultures. The secondaries are exteriorly edged with white. The tail is of twelve feathers, black and even. Legs feathered to the tarsus. Toes united by a small membrane; the middle one is excessively long; the third one comparatively undeveloped, by which the foot is rendered less prehensile than that of other Raptores. Claws blunt, as might be expected from its habit of standing on the rocks; nor are sharp talons wanted, as it seldom seizes living prey. The nail of the hind toe is more curved than the other three, but far less than the talons of the eagle. The female condor is smaller than the male—an unusual circumstance in this order, the feminine eagles and hawks being larger than their mates.

Our knowledge of the habits and economy of the Trochilidæ is very meagre. The relationship between the genera is not clear, and one species is no more typical than another. The only well-marked divisions we can discover are those adopted by Gould and Gray—the Phaëthornithinæ and Polytminæ. The former, popularly called "hermits," are dull-coloured and frequent the dense forests. They are more numerous on the Amazon than the other group; and I know of no specimen from the Quito valley, or from any altitude above 10,000 feet. They usually build long purse-like nests of vegetable fibres, covered with lichens and lined with silk-cotton, and hung from the extremities of leaves over watercourses.

The Polytminæ comprise the vast majority of the humming-birds, or nearly nine-tenths. They delight in sunshine; and the males generally are remarkable for their brilliant plumage.

The diversified slopes of the Andes are more favourable for their development than the uniform plains. Their head quarters seem to be in New Granada; but the precise distribution of the species is not so well known as it might be. Near the equator the species are nearly stationary; some, as the *Oreotrochilus*, are confined to particular volcanoes or an area of a few square miles. There is therefore greater need of determining the precise locality of a specimen; yet, in the best monograph on the Trochilidæ (Mr. Gould's), species are assigned to such indefinite regions as Ecuador, Peru, &c. But Ecuador ascends from the sea-coast to 20,000 feet, and is traversed by two Cordilleras and a plateau, making three very distinct districts,—the faunas of the west slope, the Quito valley, and the Napo country being, with less than half a dozen exceptions, entirely separate. Of the four hundred and thirty known species of hummers, twenty-seven are found in and around the valley of Quito, thirty-seven on the Pacific slope, and twenty on the oriental side of the Andes—making a total of eighty-four, or about one-fifth of the family, within the Republic of Ecuador. The paucity of hummers south of the equator, in comparison with the number on or just above the line, has been accounted for by the fact that the dry sterile plains of Peru and the barren pampas of La Plata are unsuited to insect, and therefore to humming-bird, life. This cannot be the whole reason; for there are myriads more of insects on the Lower Amazon than on the Andes, yet there are not fifteen species east of Egas, or the last 1500 miles. If the wanton destruction of humming-birds for mere decorative purposes continues for the next decade as it has during the last, several genera may become utterly extinct. This is evident when we consider that many a genus is represented by a single species, which species has a very circumscribed habitat, and multiplies slowly, producing but two eggs a year, and that at Nanegal, *e. g.*, a famous locality near Quito, it was possible ten years ago to shoot sixteen or eighteen per day, while now it is hard to get half a dozen.

Nidification is uniform at the same altitude and latitude. In the valley of Quito it occurs at about the close of the rainy season, or April. The nest is built in six days; but one egg is laid before the nest is finished. The usual height of the nest above the ground is six feet. Some, like that of our northern species, are cup-shaped and placed in the fork of a branch; others are hung like a hammock by threads or spiders' webs to trees or rocks; while the long-tailed *Lesbia* constructs a purse-shaped nest resembling those of the Phaëthornithinæ on the Amazon. Like the "hermit" hummers of the lowlands, the purple-eared (*Petasophora iolata*) alone of the Quito species hangs its nest over a stream of water. As to the materials of the nest, I have noticed a fact which I cannot explain: our northern hummer glues lichens all over the outside; so do a number of species in Brazil, Guiana, &c.; but in the valley of Quito, moss is invariably used, not a particle of lichen have we seen on any nest, though lichens abound*. Mr. Gould mentions a nest which, being heavier on one side than the other, was weighted with a small stone to preserve the equilibrium. A few hummers, as the *Glaucis* of the lowlands, lay but a single egg; but the usual number is two; and they are always of a pinkish hue when freshly laid. The spotted egg of a species on the Upper Amazon, noticed by Edwards, has not been seen by other observers. The time of incubation at Quito is twelve days, varying a day more or less, according to the weather. There is but one brood a year, as with *T. colubris*, in our Northern States; but in our Southern States, and in Brazil, there are generally two. Drapiez says, "sometimes four broods;" but we conjecture that this is a mistake.

No insessorial bird seeks its food at so great an elevation as the *Oreotrochilus*†. This has been seen clinging to the volcanic cliffs of Chimborazo; but no other hummer has been observed to alight on the ground, for which, in fact, their sharp, hooked nails are ill fitted. Of the sixteen genera represented in the valley of Quito, the average length of the bill is three-fourths of an inch; and the most numerous plants are the Compositæ, Scrophulariaceæ, and Labiatæ. The curved-billed *Eutoxeres* is usually seen around the fuchsias or the scales of the palms, seeking for spiders. The *Oreotrochilus* feeds its young by bringing them flowers of the myrtle; then throwing them away, it goes for more. As Bates has said, hummers "do not proceed in that methodical manner which bees follow, taking the flowers *seriatim*, but skip about from one part of the tree to another in the most capricious way." No other vertebrate has a tubular tongue, an organ adapted for gathering both insects and honey‡. No other family of birds contains so many species; nor has any other group such

* A similar variation is seen in the nests of the chimney-swallows: our species (*Chætura pelasgia*) builds of twigs glued together with saliva; while its Quito representative (*C. rutila*) builds of mud and moss.

† We have seen flies on Pichincha at the height of nearly 16,000 feet.

‡ Dr. Crisp contends that the bifid portion of the tongue is not hollow, but is composed of solid cartilaginous material. The same anatomist also asserts, in opposition to the opinion of Professor Owen, that the bones of the hummer, like those of the swallow, do not contain air.

varied forms of bill: compare the short bill of the *Ramphomicron*, one-third of an inch, and the six-inch bill of the *Docimastes*—the bill of the *Eutoxeres*, bent down into a semicircle, and that of the *Avocettula*, turning upwards. To an unequalled splendour of plumage (resembling laminæ of topaz and emerald) Nature has not added the gift of song. Their ordinary cry is a shrill *chirik*, uttered by the males in their petty quarrels. The "warbles" ascribed to the *Mellisuga* and *Oreotrochilus* need to be heard again to be credited.

XXII.—*Descriptions of two new Species pertaining to the Avifauna of Australia.* By JOHN GOULD, F.R.S. &c.

HAVING lately received from my friend F. G. Waterhouse, Esq., by permission of the Directors of the South-Australian Institute at Adelaide, a small collection of birds for identification, I find among them two previously unknown, descriptions of which I hasten to communicate to the scientific world. The first is of especial interest, inasmuch as it is a second species of the genus *Xerophila*, of which only one was previously known; and the second is an additional member of that elegant group of little Terns the *Sternulæ*.

Xerophila pectoralis, Gould.

Face and throat white, passing into greyish white on the ear-coverts; crown and nape hair-brown mottled with blackish brown, the darker tint occupying the centre of each feather; back chestnut-brown, becoming much darker and richer on the rump; upper tail-coverts hair-brown; two central tail-feathers hair-brown, with lighter edges; the five lateral feathers on each side black tipped with white; across the chest a well-defined band of cinnamon-brown; under surface white, with a mark of chestnut down the centre of each of the flank-feathers; wings dark brown, the secondaries broadly margined with dull buff; under tail-coverts buffy white; bill and feet black.

Total length $3\frac{7}{8}$ inches; bill $\frac{3}{8}$, wing $2\frac{1}{4}$, tail $1\frac{5}{8}$, tarsi $\frac{5}{8}$.

Hab. Port Augusta, South Australia.

Remark. This highly curious form reminds one of *Ephthianura*, but is distinguished from it by the bill being almost as thick as that of a finch.

Sternula placens, Gould.

Adult male. Bill yellow, with the apical third of both mandibles black, as sharply defined as if they had been dipped in ink; forehead white, advancing over each eye to near its posterior angle; lores, a narrow line above the eyes, crown and nape black; upper surface of the body and wing-coverts grey; the first primary slaty black on the outer web and along the inner web next the shaft; the shaft itself and the outer half of the inner web white; the second primary similarly but a little less strongly marked; the remainder of the primaries silvery grey, with lighter shafts; throat and all the under surface of the body silky white; tail white; feet yellow.

Total length 10 inches; bill, from the gape, $1\frac{5}{8}$, wing $7\frac{1}{2}$, tail $4\frac{3}{8}$, tarsi $\frac{3}{4}$.

Hab. Torres Straits.

Remark. Two specimens of this bird are now before me:—one, a female, which has been in my collection for many years; the other, a fine adult male, forming part of the collection above mentioned, and which had lately been received at Adelaide from the northern territory at Port Darwin.

I have carefully compared this species with the *Sternula nereis* of Australia, the *S. minuta* of Europe, and the *Sternula* of India, supposed to be identical with the latter (but this, I think, is a question). I have also compared it with all the little Terns of America, both North and South. Its nearest ally seems to be the European species; but from this it differs in having considerably longer wings, in the snow-white hue of the shafts of the primaries, and in the larger and well-defined mark of black on the tips of the mandibles; from *S. nereis* it is distinguished by having black instead of white lores.

XXIII.—*Whence comes the Nourishment for the Animals of the Deep Seas?* By Prof. Karl Möbius*.

The investigations of the greatest depths of the ocean, made in Baffin's Bay by John Ross (1818), in the Pacific Ocean by James Ross (1843), in the North-Atlantic Ocean by Wallich (1860), near Spitzbergen by Chydenius and Torell (1861), in the north-eastern part of the Atlantic by Carpenter, Jeffreys, and Thomson (1868 and 1869), and in the Gulf-stream off Florida by Pourtales (1869), have shown that the bottom of the ocean at great depths (550–3000 fathoms) consists princi-

* 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.

pally of a *fine tenacious mud* (Schlick, mud, ooze) in which a great number of animals of various classes find all the conditions of their sustenance, and therefore also the nourishment necessary for their growth and for the production of their progeny.

The grave question as to the origin of this nourishment would no longer occupy the attention of biologists if living plants, containing chlorophyll, had been also brought up from these depths. But as these are wanting, G. C. Wallich ascribes to the Rhizopoda of the deep sea the faculty of separating from the surrounding medium the elementary constituents of their bodies. (North-Atlantic Sea-bed, 1862, pp. 130–132; and Intellectual Observer, Dec. 29, 1869.)

But, according to the present state of biology, only organisms containing chlorophyll possess the power of producing albuminoid compounds from carbonic acid, water, ammonia, and nitric acid. We must therefore for the present abstain from endowing *hypothetically* any kind of beings destitute of chlorophyll with this faculty, in order to explain the mode of nutrition of the animals of the deep sea.

Nor should we make any advance towards the true solution of the question before us if we were to suppose the protoplasmic being which Huxley has described (in the 'Quarterly Journal of Microscopical Science,' 1868, vol. viii. p. 201) under the name of *Bathybius Hæckelii*, and which Häckel has further elucidated (in the 'Jenaische Zeitschr. für Med. und Naturw.' 1870, vol. v. p. 492), to be produced by continual spontaneous generation at the bottom of the sea.

So long as such notions are destitute of *actual proof*, we must, in order to keep solid ground under our feet, seek the origin of the nourishment of the deep-sea animals in the upper regions of the sea, in which plants containing chlorophyll collect supplies of organic material.

This is done by the English investigators of the deep sea, W. Thomson, Carpenter, and Jeffreys. Carpenter is inclined to accept the hypothesis proposed by Thomson, according to which the Protozoa of the deep sea are nourished by protoplasm which is diffused through the whole mass of the sea-water, renewed constantly by the plants and animals living at its surface and penetrating by diffusion even to the greatest depths ('Nature,' March 31, 1870, pp. 564, 565).

In support of this view it is remarked that nitrogenous organic masses could be recognized by chemical reagents, not only in the higher strata, but even in those of a depth of 500–700 fathoms. The *microscopic* properties of *protoplasm* have not, however, as yet been demonstrated in these nitrogenous bodies; and so long as this has not been done we must refuse them this name.

Gwyn Jeffreys derives the decomposed organic mass at the bottom of the sea from animals which have sunk down from the surface ('Nature,' Dec. 9, 1869). Maury expresses himself similarly in his 'Physical Geography of the Sea' (edition 1869, § 617):—"The Ocean," he says, "swarms with living creatures, especially between and near the tropics. The remains of their myriads are carried on and collected by the currents, and in course of time deposited like snow-flakes on the bottom of the sea. This process, going on for centuries, has covered the depths of the ocean with a mantle of organisms as delicate as hoarfrost and as light as down in the air"*.

These statements of Maury's were so far confirmed by Wallich, that, in those places where few or no Foraminifera lived, he found a thin layer of an organic deposit, measuring from half an inch to an inch in thickness (North-Atlantic Sea-bed, p. 138).

All these attempts to explain the origin of the organic material at the sea-bottom leave unconsidered another way by which certainly great masses of organic and especially vegetable nutritive material are constantly reaching the sea-bottom.

In the first volume of the 'Fauna der Kieler Bucht,' Dr. H. A. Meyer and myself have divided the bottom of this small Baltic gulf into the regions of the sandy strand, the green *Zostera*, the dead and decaying *Zostera*, the red Algæ, and the black mud. The regions of the living and decaying plants occupy the narrow slopes which fall from both shores towards the depths. The black mud is a fine pasty mass which occupies the wide deeper part of the valley of the gulf in so thick a layer that it is not possible to penetrate it entirely with dredges. The surface of the mass of mud is an almost regular plain with a slight inclination towards the opening of the gulf; near the town it is 6 fathoms below the surface, and sinks gradually in a distance of two miles to a depth of 10 fathoms. All lines drawn upon this inclined plane from one side of the bay to the other are almost entirely straight. This flatness of the bottom is caused by the constant descent of sinking materials from the slopes on each side. In this way the deep sea-bottom receives annually a fresh supply of organic matters. The plants which have grown in the higher

[* This source of the nutriment of deep-sea animals was indicated as the most probable one by the Translator, in a notice of Dr. Wallich's 'North-Atlantic Sea-bed,' Ann. & Mag. Nat. Hist. 1862, ser. 3, vol. x. p. 383.]

regions sink to the bottom after they have died, gradually break up into smaller and smaller portions, and finally glide down into the greatest depth that they can attain. The same course is taken, as I know from personal observation, by the vegetation in the bay of Heligoland, at those places where no strong currents of ebb and flow prevent the deposition of organic masses.

This organic and chiefly vegetable mass, in the particles of which we may often still recognize cellular structure and demonstrate the presence of cellulose by iodine and sulphuric acid, is what renders the mud-region inhabitable by a great number of animals—in the first place, by those which feed upon decaying matters, and then for others which devour the dirt-eaters. In this way we find it easy to explain the quantities of individuals, at the first glance quite astonishing, which may be got out of the mud of the greater depths; for the mass which serves them as a dwelling-place at the same time contains an enormous store of nourishment for them.

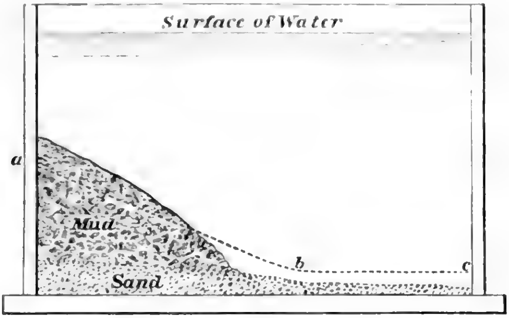
The same thing must take place in all seas. In the shallower regions which immediately surround continents and islands, great masses of Algæ grow wherever there are rocks and stones. In the warmer seas there is an enormous floating Sargasso-life. Only a small portion of these plants is directly eaten by animals or thrown upon the shore. Most of them die where they have lived, or, after they have been carried away by currents and winds, lose the gases which make them lighter than sea-water, sink down, and finally become decomposed into a soft mass. In such a state as this Wallich found considerable quantities of dead plants, in depths which extended beyond 500 fathoms (North-Atlantic Sea-bed, p. 130).

With the sinking organic materials are, of course, intermixed the remains of Testacea and the fine inorganic soil-constituents of the higher regions, which the currents of flood and ebb and the waves are unceasingly triturating. This muddy mixture must move down towards the deeps upon the sloping sea-bottom in the neighbourhood of the coasts, from purely mechanical causes, until the weight and mutual adhesion of the individual particles present so much resistance to the pressure of the masses following them from above that equilibrium is produced.

For the purpose of accurately testing the causes by which sinking materials are moved down in a water-basin from the higher to the lower regions, I made some experiments with two rectangular aquaria. The space for water in the smaller one (fig. 1) was 15 centims. long, 10 centims. broad, and

6 centims. high; that of the larger one (fig. 2) 53 centims. long, 28 centims. broad, and 16 centims. high. The two larger perpendicular walls were glass plates*.

Fig. 1.



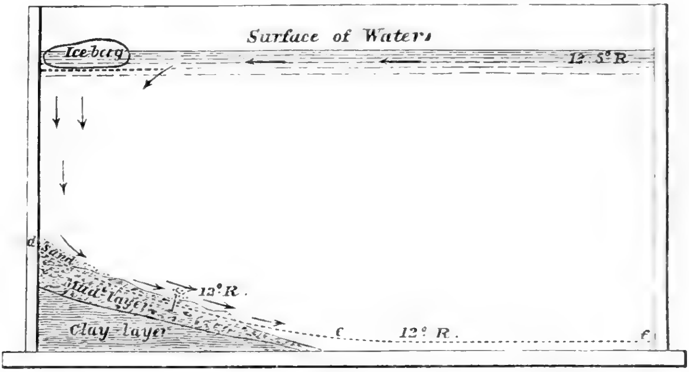
The bottom of the smaller aquarium, after it had been filled with water, was covered with a thin layer of sand, to which I gave an inclination of about 5° (fig. 1). I then, by means of a spoon, allowed fine mud-particles, which had been sifted out of the mud of the mud-region of the harbour of Kiel, to sink slowly down upon one of the narrower sides of the aquarium, until a slope of 35–40° had been formed. The heaped-up mass was inhabited by a number of small animals. *Gammarus locusta*, *Cuma Rathkii*, *Jæra albifrons*, *Scoloplos armiger*, *Nemertes gesserensis*, *Monocelis agilis*, *Pontolimax capitatus*, *Corbula gibba*, *Tellina balthica*, and *Scrobicularia alba* soon made themselves visible in the superficial layer. The next day the mass had settled a little, and its lower boundary had already perceptibly advanced. On the third day its progress was already 3 centims. I now laid a few spoonfuls of sand upon the uppermost part of the slope, and then disturbed the equilibrium of the water for a few minutes by moving a finger up and down in it. By this means the abruptly rising sand acquired a more oblique direction, and covered the mass of mud for a breadth of several centimetres. Two days later, this sand had for the most part sunk down into the mass of mud and pushed it still further forward even at the bottom. Its angle of inclination had decreased from 35–40° (its original amount) to 25°, and the sand spread over the horizontal bottom was covered throughout with fine mud-particles (fig. 1, line *a*, *b*, *c*).

* The two figures represent profiles of these aquaria. The dotted line indicates the future surface of the organic mass. In fig. 2 the arrows indicate the direction of the sinking current.

Before discussing the causes of these changes, I will describe the experiments made with the other and larger aquarium.

Two fifths of the surface of the bottom of this aquarium were covered with a layer of clay, which was laid against one of the narrower walls, and fell with a slope of 12–15° towards the horizontal part of the bottom (fig. 2). The lower boundary

Fig. 2.



of this clay-slope was not rectilinear, but curved inwards in the middle. Round this sinuosity the slope was a little more inclined than near the glass walls of the aquarium. It was then filled with sea-water. After this had become quite clear, the bottom was covered with a very thin coat of clay.

The inclined layer of clay was now carefully covered with unsifted mud from the harbour, inhabited by animals. It formed a slope with an inclination of about 20°. The surface had irregular elevations and depressions, and at its lower margin a reentering curve.

On the following day the surface had become nearly smooth. Living bivalves and worms projected from it and performed their movements. *Scrobicularia alba*, *S. piperata*, and *Tellina balthica* stretched their two mantle-tubes far out of the shell, felt about with the inferior one upon the surface, stirred it up and drew in particles from it; sometimes a stream of fæcal masses passed out of the upper tube and sank down. Here and there a tube of *Pectinaria auricoma* projected from the mud, and from this also fine mud-masses were sometimes expelled. *Leucodore ciliata* waved its filiform tentacles to and fro before its tube. *Edwardsia duodecimcirrata* spread out its circle of tentacles upon the surface of the mud. *Nassa reticu-*

lata, *Hydrobia ulvæ*, *Jæra albifrons*, and *Polynoë cirrosa* crept about upon it upwards and downwards or buried themselves in the soft mass.

Third day. A mixture of sand and finely comminuted shells from the harbour was laid upon the highest part of the slope. This addition formed a wedge of 6 centims. length, with an inclination of 25–26°.

On the *fourth*, *fifth*, and *sixth days* the water was set in motion for a few minutes, at the surface, by means of a glass rod.

On the *seventh day* the greater part of the comminuted shells and sand had sunk in.

On the *ninth day* scarcely any thing but organic mass was to be seen at the surface. The angle of inclination of the slope had sunk from 26° to 20°. The reentering curve at its lower end was almost entirely filled up, and the horizontal part of the bottom covered with mud-particles to a thickness of from 1 to 2 millims.

Tenth day. The temperature of the water was 12·5° R. (=60° F.). Over the highest part of the heap of soil (close to the shore) a wire framework was suspended at a depth of 15 millims. below the surface of the water; and upon this was laid an india-rubber bag filled with ice, for the purpose of cooling the superficial water (fig. 2). Immediately there was produced a movement of the water passing downwards upon the slope. If a *Tellina*, a *Scrobicularia*, or a *Pectinaria* threw out mud, this was carried downwards with some velocity from 10 to 15 millims.; when the Mollusca and worms creeping about stirred up particles of the surface, the current carried these along with it. At the surface a movement of the water towards the cooled spot took place, floating corpuscles went with this, sank down, and glided downwards over the inclined bottom. These movements continued until all the ice was melted, although during this period the difference between the superficial and bottom strata of water amounted only to $\frac{1}{2}$° R. (=1°·125 F.).

On the *thirteenth day* the surface was cooled a second time in the vicinity of the shore.

On the *sixteenth day* the lower boundary of the slope had advanced in one place 10 millims., in another 20 millims.; its inward curve was entirely filled up; its angle of inclination amounted to 17° above and only to 15° below. On the horizontal bottom the fine organic mass lay to a thickness of 3 or 4 millims. This diffusion of the organic mass was followed by worms and Mollusca; and Infusoria swarmed at the bottom.

The aquarium was now left entirely to itself. At the end of four weeks the lower boundary of the slope had nevertheless advanced about 2 centims. further, and the horizontal part of the bottom was covered with mud-particles still more thickly than before.

In both aquaria, therefore, mechanical, thermic, and living forces cooperated to bring about a forward movement of organic materials from the higher towards the lower regions.

Sand-grains and fragments of shells, when laid on the top, pressed the organic mud-particles aside by sinking in between them. As gravity resists their ascent towards the shore, the mass must on the whole go further downwards.

When the bottom is heated in the higher regions, the volume of the constituents of its soil increases. In consequence of this extension, the mass must move more downwards than upwards, because gravity here also opposes movement upwards.

If a cooling of the water takes place above the shallower regions, it becomes condensed, sinks down, and runs upon the sloping ground down into the deeps, where there is warmer and lighter water, which it displaces and replaces. The bottom current carries light organic bodies with it into the deeps.

Fluctuations in the equilibrium of the water, and the restlessness of animals which live on the bottom, both in the higher and lower regions, their creeping about, tube-building, seeking of nourishment, expulsion of indigestible materials, respiration, and growth, keep the constituents of the superficial layer of soil loose and in constant movement, so that they can readily be carried away by the water flowing downwards.

The same moving forces operate also in the sea. Here not only is the extension of the water-basin infinitely greater, but even the sum of the forces is enormously increased.

Dead plants, fragments of shells, and sand are heaped one upon the other to a height of feet or fathoms. The alternation of flood and ebb and the winds keep the upper strata of the water in constant movement, and produce oscillations up and down, even in the lower ones, by increasing or diminishing the column of water resting upon the bottom. The differences of temperature which are dependent on the alternation of day and night, on changes of weather and the course of the seasons, cause expansions and displacements of the constituents of the bottom. Into the greater depths, where these forces can operate but rarely and slightly, or even not at all, the currents of sinking water, which has become heavier than the subjacent strata by cooling or increase of its amount of salt, penetrate.

In my aquarium a downward current, which readily carried organic bodies along with it, was produced when the difference between the superficial and bottom temperatures had scarcely attained half a degree (R.). In the seas of high latitudes, in autumn and winter, differences of temperature between the upper and lower strata of the water will certainly occur, sufficiently great to cause descending currents.

In the year 1869 I was enabled by the captain of the pilot schooner stationed at the mouth of the Ems near the island of Borkum to make some measurements of temperature there, which I may adduce as evidence of the correctness of this assertion. On the 10th September 1869, all the strata of water there (to a depth of 13 fathoms) had acquired a temperature of 13° R. ($=61\frac{1}{4}$° F.). From the 13th September this began to sink, and in the following manner: almost on each consecutive day the superficial stratum was about half a degree (R.) colder than the bottom stratum, until on the 25th December a temperature of only 1° R. ($=34\frac{1}{4}$° F.) was found at a depth of 7 fathoms, and at the surface only $\frac{1}{2}$° ($=33\frac{1}{8}$° F.). When sea-water begins to freeze, its refrigeration has descended to -2° R. ($=27\frac{1}{2}$° F.). This low temperature was observed in all strata of water in the North Sea at the north-eastern point of Sylt, on the 14th of February 1870*.

When the temperature of sea-water diminishes, its density increases. Therefore about the middle of September, a descending current must have been produced in the mouth of the Ems, and continued until all the strata had acquired an equally low temperature. There can be no doubt that in all seas of high latitudes, with a great alteration of temperature in autumn and winter, such descending currents move down from the shore-regions towards the deeps. In the North-Atlantic Ocean they must occur both on the European and North-American coasts far to the south. This appears from the summaries and charts lately published by A. Petermann on the Gulf-stream and the state of thermometrical knowledge of the Atlantic Ocean and land-district in the year

* In connexion with this I may call attention to a distinction between fresh and salt water which is frequently overlooked. Ordinary sea-water (containing from 3·2 to 3·4 per cent. of salts) only attains its greatest density when it is cooled below its freezing point (—2° R.). On becoming colder, therefore, it sinks until it meets with a stratum of water of its own density, or until it reaches the bottom. If it freezes on the way, the fresh water separated as ice rises to the surface, and the sea-water, which has become richer in salts, and therefore heavier, continues to sink.

1870*. From this I only extract, by way of example, the following:—

The temperature of the surface of the sea is:—

	in January.	in July.
On the Norwegian coast between Tromsö and Drontheim	1°·1–1°·5 R.	8°·2–9° R.
Near Bergen	4·3 R.	9·2 R.
On the west coast of Scotland	5·3 R.	10 R.
On the west coast of Iceland	0 R.	8 R.
On the east coast of North America, near Boston	0 R.	12 R.

In the temperature-measurements of the 'Porcupine' Expedition carried out in the summer of 1869 under the superintendence of the English investigators Carpenter, Jeffreys, and Thomson, the surface was found to be much warmer than the deeper strata of the water, as shown by the following numbers, which I select from a table furnished by Thomson (Petermann, *l. c.* p. 235):—

	Temperature of the surface in July.	Temp. of the surface in January, according to Petermann's chart.	Temperature of the depths in July.	Depth in Fathoms.
Atlantic ocean, west of Scotland	11°·1 R.	7° R.	2°·3 R.	1263
	11°·0 R.		2°·1 R.	1264
	10°·6 R.		2°·2 R.	1380
Between the Shetland and Faroe Islands	8°·9 R.	4–6° R.	0°·9 R.	345
Atlantic Ocean, in the west of the Bay of Biscay, 47° 38′ N. lat.	14°·9 R.	9° R.	2° R.	2435

In regions of the sea where the uppermost stratum of water, even on the coldest days, does not acquire so low a temperature as the deepest strata constantly maintain, in consequence of inferior currents from colder seas, descending currents must likewise pass down from the shore-regions towards the deeps, and persist until the progressive cooling of the surface ceases. In this case, indeed, the descending water itself will not attain the bottom lying beneath it; but the organic masses which it carried down from higher regions are there seized upon by still deeper cold currents, with which the last and finest remains of them finally get into the greatest depths, and there remain as the materials of mud (Schlick, ooze).

* Mittheilungen aus Perthes' Geogr. Anst. Bd. xvi. Heft 6 & 7.

Of all the movements which convey organic materials to the sea-bottom, descending currents are evidently among the most efficacious. Their operation falls precisely in the most suitable season for this purpose: it commences after the annual development of the marine vegetation in the temperate and cold zones has attained its maximum, when strong and long-continued storms gather their chief harvest in the fields of *Zostera* and tangle, and the bottom of the sea is disquieted to a greater depth than usual.

I am well aware that between a small bay like the harbour of Kiel and an ocean such as the Atlantic there is a great difference of space. But, as we know, by persistent operations Nature can bring the same things to pass in great spaces which are completed by her in smaller ones in less time. The slowness with which plants decay under water is very favourable to their long transportation before complete decomposition.

Wherever animals were found in great depths, the bottom was muddy. It is worth inquiry whether on elevations (on which little or no mud can remain lying, because the bottom-currents, being contracted there, must sweep the bottom more strongly) the population is not also feebler than in the deep valleys which abound in mud. In the bay of Heligoland those parts of the sea-bottom where the strong current allows neither living plants to grow nor dead ones to rest are very poor in animals.

According to all that we know about the distribution of animals on land and in the shallower parts of the sea, we must assume that the distribution of the deep-sea animals also is chiefly dependent on the presence of vegetable substances. And as yet we have only become acquainted with deep-sea animals which belong to classes living also in higher regions, and which consequently will partake of the same essential conditions of life with these.

To suppose that the simplest organisms originate at the bottom of the sea by primitive generation (*generatio primaria*) has something very seductive about 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 also at the bottom of the sea.

XXIV.—*The supposititious* "Bos (?) pegasus" *of the late* Colonel Charles Hamilton Smith. By Edward Blyth, Hon. Memb. As. Soc. &c.

In a notice of the two species of Aoudad inhabiting North Africa (*Ovis lervia*, Pallas, sp., of the Atlas, and *O. ornata*, Geoffroy, of Upper Egypt) which I contributed to the 'Field' newspaper for May 13th, 1871, I identified the Ethiopian Pegasus of Pliny with one or the other of those well-known animals—which, indeed, had been previously suggested by Col. C. H. Smith, only that he did not sufficiently discriminate a variety of African ruminants, respecting which his extensive erudition enabled him to collate a number of curious but vague notices in sundry languages; while out of the whole of them he constructed a supposed animal, which he denominates "*Bos* (?) *pegasus*," and reproduces a figure (about which more anon), which particular figure I consider to be meant to represent an exceedingly curious and remarkable, but domestic, Angola ram, akin to the well-known long-limbed and very calf-like ram of the Guinea coast. The figure referred to appears in the treatise on the Ruminantia which the Colonel contributed to Griffith's English edition of Cuvier's 'Règne Animal' (vol. iv. p. 386). That very learned officer described his supposed "*Bos* (?) *pegasus*" as follows:—

"The Pagasse.—The names of *Pacase* of Gallini and Carli, *Empaguessa* of Merolla, *Empacasse* of Lopes and Marmol, indicate an animal presumed to be a species of buffalo, but not described with sufficient precision to be admitted into the catalogues of nomenclators. The word is evidently of great antiquity and extent, as may be gathered from Pliny, although at present banished from the regions where the Arabic has usurped the ancient language, and confined to the regions of Angola and Congo, where it is coupled with the generic name *em* or *en*, denoting a bovine animal. Thus *engamba*, a cow; *empalunga*, another large ruminant, which is conjectured to be the *Takhaise* of Daniell" (this being doubtless a misrepresentation, *from memory*, of *Hippotragus equinus*, the equine or roan antelope of South Africa, with a beard on the chin, which is non-existent in any known species of *Hippotragus*); "and *Em-pacasse*. Pliny relates that Ethiopia" (*i. e.* Libya) "produces winged horses armed with horns, named Pegasi" (the Aoudad!). "Fathers Galli and Carli observe that, 'On the road to Loando, they saw two *Pacasses*, which are animals very similar to buffaloes, roaring like lions, the male and female being always together. They are white, with rufous and black spots, with ears half a yard in length, and the horns always straight. When they see human beings they do not flee, but stand and look on.' Lopes describes them as something less than an ox, but similar in head and neck. Dapper reports them to be buffaloes, of a reddish colour, with long horns."

Of all names, the appellation "buffalo" is about the most vaguely applied by unscientific writers. In general, as in North America, it refers to any second animal of the bovine group which is not the ordinary ox of the locality. When English graziers talk of "buffaloes," they are sure to mean the humped taurine cattle; and the latter are referred to by that name in Low's 'Domestic Quadrupeds of the British Islands,' as being kept in certain English parks. The real buffaloes have come to be denominated "water-buffaloes;" but in South Africa there is a genuine buffalo (*Bubalus caffer*), which, as the single bovine species there inhabiting which is additional to the domestic ox, has chanced to be rightly so designated. Capt. Lyon, R.N., in his 'Travels in North Africa,' describes what he styles three species of "buffalo," which prove to be the Barbary Aoudad (*Ovis lervia*), the large North-African Bubalis (*Alcelaphus major*, from its alleged size), and the Barbary Leucoryx (*Oryx leucoryx*). Wherefore it follows that no definite idea can be attached to the name "buffalo" when employed by writers who are not carefully discriminative zoologists.

Next, Lopes describes the animal to which he refers as being "something less than an ox." We have heard of a witness in an English court of justice describing a particular stone, respecting the magnitude of which he was requested to give his testimony, as being "of the size of a piece of chalk!" Hardly less vague is the allusion of a traveller in intertropical Africa to the stature of an ox, inasmuch as there are races of taurine cattle in that part of the world which are of all sizes, from the very largest to the very smallest. The *Pacasses* of Congo, noticed by Fathers Gallini and Carli, "with ears half a yard in length," I should have felt inclined to refer to a species of *Hippotragus* formerly in the Knowsley menagerie (a young animal, of which I have seen an unpublished coloured drawing), only that it is stated that their horns are "always straight." By no means improbably a straight-horned species of *Hipprotragus* (?), except that their "roaring like lions" is somewhat anomalous for a member of the *Oryx* group (to which the *Hippotragi* are unquestionably subordinate, or *vice versâ*). The *Hippotragi*, it may be remarked, represent the horses, as the *Oryges* do the zebras and asses, among the grand antilopine series! The tendency to inordinate development of the ear-conch is remarkable in sundry West-

African ruminants; and they are extraordinarily long in certain African Leporidæ, and large in the diminutive Fennecs. Vide the ears of *Bubalus brachyceros*, represented in the 'Proceedings' of the Zoological Society for 1863, p. 158. Here we have the broad (or forest) form of ear-conch, as likewise in *B. caffer*; whereas in the Asiatic buffaloes the ear-conch is narrow or lanceolate (denoting a more open and covertless abode). Again, we perceive the lanceolate shape of ear-conch in the humped or desert form of taurine cattle, whereas other cattle of naturally forest haunts have the broad form of ear-conch; and the same recurs in the great Derbian eland (*Oreas derbianus*), which is known to be a forest species, as contrasted with the common eland, which is a desert species. The shape of the ear-conch, therefore, is of no small value, as being indicative of the habits, not of ruminants only, but of various other species of the class Mammalia. Dapper's "buffaloes of a reddish colour with long horns" may be no other than the large Senegal race of *Oryx leucoryx* figured by F. Cuvier, and exemplified by specimens now living at Antwerp, should the *habitat* also prove suitable. Here it may be remarked that a third and remarkably small race of *O. leucoryx* is represented by a skull in the British Museum. Col. C. H. Smith continues:—

"These testimonies are very vague, but still indicate one and the same animal"(?) "partially misrepresented. To these accounts might be added the notice of Capt. Lyon respecting the *Wadan*, 'a fierce buffalo'" (!), "'the size of an ass, having large tufts of hair on the shoulders, and very large heavy horns' (the Libyan Aoudad). This Arabic name seems derived from *waad*, braying or bellowing like a young camel, and may coincide with Carli's account of the roar of Pacasse, and the tufted hair on the shoulders be no inapt representation of Pliny's pretended wings of his *Pegasus*" (right enough, only that the lateral tufts of long hair in the Aoudad grow from the fore limbs, above the mid joint); "but no place would have been deservedly given to it in this work, if in the collection of drawings formerly the property of Prince Maurice, of Nassau, now in the Berlin library, there was not among the number of zoological subjects of Brazil several of Angola, such as sheep"(!) "and an African elephant, which latter cannot have been executed from a specimen in America. The sheep also have their Congo and Angola names; and it may fairly be conjectured that the Prince, during his command in Brazil, had an artist on the African coast, from whence, at that time, slaves were beginning to be abundantly exported to the Dutch settlements. Among these is a figure of a ruminant with the name *Pacasse* written underneath it*. Judging from the general appearance of the painting, it represents a young animal, although the horns are already about as long as the head; they are of a darkish colour, with something like ridges passing transversely, commencing on the sides of the frontal ridge, turned down and outwards, with the points slightly upturned; the head is short, thick, abrupt at the nose; the forehead white; the eyes large and full, dark, with a crimson canthus; the neck maned with a dense and rough mane; the tail descending below the hough, entirely covered with dark long hair, appearing woolly; and the legs high and clumsy; but the most remarkable character appears to consist in pendulous ears" (arrant domesticity!) "nearly as long as the head. The mane and tail are dark; the head, neck, body, and limbs dark brown, excepting the pastern joints, which are white" (again domesticity!). "This figure cannot be referred to a known species, and it is sufficiently curious to merit an engraving. If it should appear to be a different animal from *Pacasse*, it may still represent a new species of buffalo"(!) "or, perhaps, of *Catoblepas*, or of *Ovis*."

The last conjecture is indubitably the right one. Unquestionably, as it appears to me, the figure represents a very extraordinary form of domestic sheep, of which, moreover, other races are represented in the same collection of drawings. Might not, by the way, the strange-looking sheep of intertropical western Africa succeed as well as goats in the Indo-Chinese and Malayan countries, where the attempt to maintain the European and Asiatic races of tame sheep is altogether hopeless?

XXV.—*On the Organization of the Worms of the Genus* Perichæta. By Edmond Perrier†.

By the kindness of M. Houllet, chief of the conservatory department of the Museum of Natural History, who has been good enough to collect them in the soil accompanying plants sent to him, I have been enabled to investigate some living worms belonging to the genus *Perichæta*, some of them coming from the West Indies, others from Calcutta.

The group of terricolous Lumbricine Annelids being but little known anatomically, I hope to be able to continue this investigation upon the other worms which may reach me by

* The notes are written by three hands, the Prince's, Marcgrave's, and Piso's. I believe that in this instance the name is written by the first.

† Translated by W. S. Dallas, F.L.S., from the 'Comptes Rendus,' July 24, 1871, tome lxxiii. pp. 277–280.

this course. Those now in question belong to a genus established by Schmarda, of which two species have recently been investigated by M. Léon Vaillant, but upon preserved specimens. Some important details which we have been fortunate enough to bring to light, allow a more exact account to be given of the organization and affinities of these worms, and to extend the results already obtained to Lumbricina belonging to other genera.

We shall especially notice here the worm from Calcutta, reserving the few differences presented by that from the West Indies for the memoir which we shall publish on this subject.

The worm in question is from 140–150 millims. (about $5\frac{1}{2}$–6 inches) in length, and about 3 millims. (or $\frac{1}{8}$ inch) in diameter. Its body contains about 106 segments, not including the head. Each segment bears in its middle a girdle of from forty-five to fifty isolated setæ, placed at equal distances apart and arranged in a circle. On the head we see a slight prominence, slightly notched in front; the *clitellum* appears after the thirteenth segment, and occupies the space of three segments, which is easily ascertained either by means of the nervous ganglia or by means of the girdles of setæ, which often persist after the formation of the clitellum. The segment which follows the clitellum is therefore the seventeenth; and it is in the lower surface of the eighteenth that the two male genital orifices are seen. The fourteenth segment, or the first of the clitellum, bears in the middle of its lower surface, but quite in front, a single orifice, which we regard as the female orifice. At the point of junction of segments 6 & 7, 7 & 8, and 8 & 9, other orifices are seen on each side of the lower surface; these are the capsuligenous glands of D'Udekem, the copulatory pouches of more recent authors.

The digestive apparatus is very complex. It consists of a pharynx with thick and glandular walls, of an œsophagus occupying the sixth, seventh, eighth, and ninth segments, of a muscular gizzard occupying the tenth segment, and, lastly, of an intestine analogous to that of the *Lumbrici*.

The walls of the pharynx are covered with glands of two kinds—the upper ones formed by two rolled-up tubes united by an intermediate substance, the lower ones containing spherical granular cæca. These glands open into the pharynx by three pairs of orifices.

Into the œsophagus there open:—

1. Three groups of glands, supported upon the partitions which separate the fifth segment from the sixth, the sixth from the seventh, and the seventh from the eighth; these glands are formed by isolated floating tubes, bent into loops,

and the two halves of which are rolled spirally round one another.

2. Two pyriform compact glands, situated in the sixth segment, formed of spherical cæca arranged in a bunch, but united by an interstitial substance.

3. Two racemose glands, with spherical, isolated cæca, the excretory canals of which, like those of the preceding glands, open at the point of junction of the œsophagus and the partition 6–7. These last glands occupy the seventh segment.

The gizzard, which is of a pearly-white colour, is remarkable for the thickness of its muscular walls. The intestine presents nothing peculiar.

The nervous system is constructed on the ordinary plan. The brain gives origin laterally to five pairs of nerves: one branch springs from the commissure; two pairs, the anterior of which is the more slender, from each of the ganglia, including that which closes the œsophageal collar. The anterior ganglia, which are short and broad, become elongated in the clitellum, and swell out again in the seventeenth, and especially in the eighteenth segment; the ganglion of this latter segment sends its anterior pair, which are very stout, to the neighbourhood of the male genital orifices.

The system of red vessels, constructed on the ordinary plan, consists of a contractile dorsal vessel and of a ventral vessel. From the ninth to the fourteenth segment, six lateral branches of unequal size unite these two principal trunks: the first are nearly cylindrical and narrow; the last two, on the contrary, which are somewhat nodose (*bosselées*) and pyriform, might be taken for cæca belonging to the ventral vessel; they are in reality united with the dorsal vessel by a small vascular tube. The intermediate branches present a form intermediate between these two extremes. Four of them appeared to us to be very distinctly contractile, as, indeed, was indicated by the interlaced muscular fibres which ran over their walls.

Behind the cincture the dorsal and ventral vessels are united by a series of anastomoses, some adhering to the intestine, others presenting a very curious arrangement. From corresponding points in the dorsal and ventral vessels there originate two slender vessels; the first, after creeping over the intestine, places itself side by side with the second, and both, ramifying parallel, bury themselves in the walls of the body, where their ultimate ramifications unite in the form of loops. These loops occur upon the ovaries, the testes, and the vibratile pavilions; they are also seen in the cephalic region, but there it was impossible to determine very distinctly the points of departure of the vascular branches of which they are the terminations.

The male generative apparatus consists of four trilobate testes, of which the median lobe contains the youngest spermatic cells. These testes are arranged in pairs in the eleventh and twelfth segments. To each of them corresponds a vibratile funnel with very flexuous margins. The canals which form the continuation of these funnels unite two and two on each side into a slender duct, which unites with the excretory canal of a large, very deeply lobed gland situated behind the cincture. These two canals united form a third, very large one, slightly twisted, which opens externally by the so-called *male genital orifices*.

The ovaries have the appearance of a simple racemose gland, and occupy the thirteenth segment; two sessile vibratile funnels, situated on each side of the unpaired orifice of the clitellum, serve them as oviducts.

The copulatory pouches (?), to the number of three pairs, are formed by a large pedunculate pyriform sac, upon the peduncle of which is engrafted, on the same side of the partition, a long tortuous tube, the sinuosities of which are contiguous to each other, and on the other side of the partition a very small and scarcely lobate gland, presenting the same aspect as the tube. The three pairs of copulatory pouches are placed in the seventh, eighth, and ninth segments. We have indicated the position of their orifices.

It is clear that this generative apparatus belongs completely to the type of that of the Lumbricina.

XXVI.—*Description of a new Fossil* Balanus. By Edward Parfitt.

Balanus sauntonensis, n. sp.

Shell like *B. balanoides*, but, on the average, larger, the base in full-grown specimens measuring from six to eight lines in diameter. Parietes perforated with a single row of angular pores, the divisional plates standing at various angles to the walls of the shell.

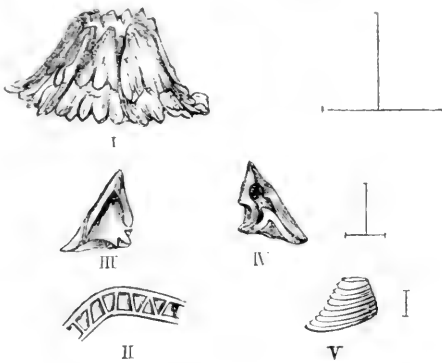
Scutum.—Tergal margin nearly straight; apex pointed; articular ridge very prominent and rounded at the apex; articular furrow strongly impressed; two deep triangular depressions in the place of the cavity usually formed for the lateral depressor muscle.

Tergum.—Apex pointed; scutellar margin slightly curved;

articular ridge large, blunt, and curved towards the scutellar margin, leaving a large articular furrow. Spur none; basal margin nearly straight; in the place of the spur there is a slight curve and a faint triangular depression. Carinal edge very broad and thick, longitudinally striated; the inner edge slightly reflected.

The outside of both scutum and tergum, in the full-grown specimens, is nearly or quite smooth; but in the young or about half-grown specimens it is transversely striated, the striæ not very deep, and consequently the ridges between them not very prominent.

This is a fossil species, and is found in considerable numbers, in some places almost covering the floor of a raised beach between Saunton and Baggy Point, on the shore of North Devon. It was first pointed out by the Rev. D. Williams in a letter in the Geological Society's 'Transactions,' 1837, vol. v. ser. 2, in reply to an article by Prof. Sedgwick and Sir R. Murchison, in the same volume, on the raised beaches; but this gentleman did not distinguish the species, and, curiously enough, the learned Professor and Sir Roderick did not notice it. As they form an important feature in this deposit, and more particularly as they are *in situ*, these *Balani* are of vast importance in discussing these raised beaches. These *Balani* were killed on the spot they now occupy either by being sud-



Balanus sauntonensis.

Fig. I. Shell entire.
Fig. II. Portion of base of shell.
Figs. III & IV. Scutum and tergum, inside view.
Fig. V. Part of young scutum, outside.

denly lifted up above the action of the waves, or by being suddenly covered with sand. The reason that I assert this is, that I find that nearly all these specimens contain the opercular valves, but nearly all of them are more or less distorted by the action of some acid having dissolved the surface, and also that the sand has become imbedded in the valves: where these animals die from natural causes, and remain within the action of the waves, the opercular valves are almost invariably washed out. Although I have used the word "sudden," I would not insist upon this; for the movement might have been gradual, at the same time rapid enough for these animals to have been lifted up beyond the reach of the waves before they died.

MISCELLANEOUS.

Note on Testudo Phayrei.

To Dr. W. Francis, Editor of the Annals and Magazine of Natural History.

Dear Sir,—About twelve days ago, Dr. J. Anderson, the Curator of the Indian Museum, asked me to compare the skull of *Testudo Phayrei*, Blyth, with Dr. J. E. Gray's figure of *Scapia Falconeri*. I did this, and I can assure Dr. Gray that there is no generic or specific difference traceable between his figure of *S. Falconeri* and the skull which Dr. Anderson had extracted from the smaller type specimen of Blyth's *Testudo Phayrei*. I do not think that the identity of the two (*Scapia Falconeri*, Gray, and *Testudo Phayrei*, Blyth) can be questioned for one moment.

It is strange to observe that Dr. Gray should have felt inclined to enter upon such speculations as he expressed in his letter on the subject in the June Number of the 'Annals,' which has just come to hand. Keeping to facts would have been more convincing, and less irritating. However, as Dr. Anderson is now preparing a drawing of the skull of *T. Phayrei*, and has, I believe, the intention of forwarding the same with his notes to the Zoological Society of London, I need not enter upon that subject any further.

Yours faithfully,
Ferd. Stoliczka.

Asiatic Society's Rooms, Calcutta.
July 15, 1871.

On a new gigantic Salamander (Sieboldia Davidiana, *Blanch.*) *from Western China.* By E. Blanchard.

In 1829, F. von Siebold made a discovery which excited a lively interest. The celebrated explorer of Japan found an animal of the salamander-type, the enormous size of which contrasts singularly with that of the other representatives of the group. The Japanese salamander, which attains a length of from a metre to a metre and a half, called for comparison with the famous fossil salamander of the schists of Œningen, which was the subject of a careful study on the part of Cuvier. Of late years the gigantic salamander of Japan, now regarded as the type of a peculiar genus (*Sieboldia maxima*; *Salamandra maxima*, Schleg.), has been several times brought to Europe; and at the present moment we have two living individuals at the Museum of Natural History, which cause, if not the admiration, at least the surprise, of the visitors to the Menagerie. Hitherto no similar species has been met with in any part of the world; and the announcement of the existence of a gigantic salamander in the waters of the western provinces of China could not but attract the attention of naturalists*. Vague intelligence was of little consequence; but among the objects collected by the Abbé Armand David, after his departure from eastern Thibet †, we got the skin of the great Batrachian. The business was to compare the Chinese salamander with that of Japan, and to ascertain whether the two animals were of the same or of different species. The comparison leaves no room for uncertainty: the salamander brought by M. Armand David, although very nearly allied to the salamander discovered by Siebold, is distinguished therefrom by some very apparent characters. On the head and anterior part of the body it has less confluent tubercles, regularly arranged, so as to form very strongly marked lines and patterns. Thus, the eye is as it were framed by a double row of tubercles, which, on the inside, becomes angular like a very open V. In the Japanese species, the tubercles, on the contrary, present a confused arrangement. The Chinese species also appears to us to have the digits of the four limbs rather longer; and we believe that the general colour of the body is blacker; but the imperfect state of preservation of the individual that we possess prevents our dwelling upon many details. To the great salamander of western China we give the name of *Sieboldia Davidiana*, which will once more commemorate the admirable explorer of China, Mongolia, and Thibet.

The gigantic salamander lives on the frontiers of the Celestial Empire, in clear and limpid streams which descend from the mountains of Khou-kou-noor; it acquires, apparently, enormous dimensions; for the Abbé David reports that individuals are taken weighing from 25 to 30 kilogrammes. Of course, such animals are a valuable alimentary resource for the inhabitants of the country.

The discovery of species so remarkable as the great salamanders of Japan and China is of great zoological interest, but it has also another bearing. The fauna of Japan presents great resemblances to the European faunas; and when we consider that the salamander of the schists of Œningen was found with remains of fishes which do not differ from the species at present living in our lakes and rivers, we may suppose that the great Batrachian which formerly lived in the waters of Central Europe is the very same that still lives

* In a work entitled 'Les récentes Explorations de la Chine,' we have noticed the indications transmitted to us by M. l'Abbé David.

† Comptes Rendus, tome lxxii. p. 807.

in Japan: and we should possess materials sufficient to enable us to solve the question.

We know that a multitude of plants and animals occur both in Japan and in the north of China. The relation of the floras and faunas leads to the presumption that lands now separated were united at a more or less ancient period. Standing upon zoological facts, however, it is as yet difficult to adopt any such opinion with regard to the Japanese islands. Many types found in Japan have never been observed in eastern China. The great salamander of Siebold is an example of this; and it must be remarked that the allied species recently discovered only inhabits western China. In Japan alone the species of one of the most singular genera of carnivorous insects (the genus *Damaster*) have been met with; and it is worthy of notice that in each of the large islands of the archipelago a peculiar species of this genus has been taken. The period has not yet arrived for the complete appreciation of the totality of the relations which exist between the Japanese islands and the continent; one piece of knowledge is entirely wanting—that of the natural productions of Corea.—*Comptes Rendus*, July 10, 1871, tome lxxiii. p. 79.

On the Pedicellariæ and Ambulacra of Echinoneus. By Edmond Perrier.

In my memoir on the pedicellariæ and ambulacra of the starfishes and sea-urchins, I was obliged to leave a considerable gap with respect to the irregular Echinida. In the collection of the museum most of the animals belonging to this group had lost the organs in question. An *Echinoneus* of undetermined origin and belonging to M. Deshayes has enabled me to diminish this gap a little.

In this animal, which is perfectly preserved in spirits, I have been able to ascertain the existence of two kinds of pedicellariæ: some of them, which are very small, occur on the buccal membrane, and are analogous in form to the tridactyle pedicellariæ of the true Echinidæ; whilst the others, which are much larger, occur on the surface of the test. The form of the latter is that of the tridactyle pedicellariæ of the *Spatangi*, except that their base is produced into a semicircular arc, analogous in form and position to that of the ophiocephalous pedicellariæ of *Echinus* and allied genera.

These two kinds of pedicellariæ are furnished with a long pedicel, upon which they do not rest directly.

The solid pieces of the ambulacral tubes greatly resemble those of the regular Echinida. We find in them a rosette furnished with its frame, and spicules.

The rosette is, as usual, formed of six pieces; but it is more concave than in the regular Echinida. Moreover, instead of being formed by a reticulated plate of several layers united by transverse calcareous bars, each of the pieces of which the rosette is composed consists simply of a calcareous plate pierced with holes and toothed at the margins, but irregularly. The frame presents nothing peculiar.

The spicules are straight slender bacilli, bearing obtuse spines on two of their sides; these are tolerably long and of the same diameter as the bacillus itself. They are consequently very analogous in their form to those of certain species of *Cidaris*, and especially to the second of the forms represented in fig. 8 of the fifth plate of my memoir on the Echinida. This figure represents various forms of the spicules of a *Brissopsis* from Mexico. In *Echinoneus* there is merely a greater homogeneity of form.

Thus the *Echinonei*, which in form and in the greater part of their characters are intermediate between the regular Echinidæ and the Spatangoidæ, are equally intermediate in the constitution of their ambulacra.

It is to be wished that those naturalists who possess irregular Echinida in a good state of preservation would fill up the gaps which I have been obliged to leave in my general work, at least if they are convinced that the pedicellariæ and ambulacra can furnish good characters, as I believe I have shown to be the case.—*Annales des Sci. Nat.* 5e sér. tome xiv. art. 5.

On the Reproduction of the Lophobranchs, and on the Filiation of certain Genera. By M. Canestrini.

It is known that the males of these fishes, or at least of the greater part of them, present cavities at the lower surface of the tail, in the form of fossettes, or of sacs, in which the ova undergo development, and in which the young remain for a certain time after exclusion. M. Canestrini has not been able, any more than the ichthyologists who preceded him, to actually see the manner in which the ova arrive in these receptacles; nevertheless he gives a sufficiently plausible hypothesis, based on certain anatomical arrangements. He supposes a sort of coition, in which, contrary to what is seen in other cases, the female products pass into the body of the male. The position of the sexual orifice of the female and that of the opening of the ovigerous sac would facilitate this. In fact the female sexual orifice looks downwards, and the orifice of the ovigerous sac is directed upwards, so that, if an individual of each sex be placed the one against the other, the female orifice will face the orifice of the ovigerous sac and be able to discharge its ova into the latter. It is probable that the prehensile tail of these animals also plays a part (at least in the case of the *Hippocampi*) by enabling the two individuals to hold each other closely united during this act, which must last a certain time or else be repeated again and again. The concourse of the sexes is evidently indispensable with the *Nerophes*, which have no pouch to receive the ova, but merely a series of fossettes at the surface of the belly, so shallow that no ovum could remain there if it were not deposited in its place and fixed by an adhesive substance.

M. Canestrini thinks that the male fecundates the ova after they have entered the ovigerous sac, the male sexual opening communicating with that cavity by means of a duct formed at the expense of the swollen walls of the anterior part of the sac. In this duct is found the anal fin, so well concealed that some very accurate observers, such as Van der Hoeven, have denied its existence. The movement of this fin must facilitate the renewal of the water in which float the ova or the hatched young.

The development of the Lophobranchs offers some interesting and rather important facts. Thus M. Canestrini has observed that the *Hippocampi* have, during the initial portion of their life, a snout of normal dimensions; so that the characters of the order only appear in them at a rather advanced period of their development.

Dr. Fries remarked that *Nerophis lumbriciformis* in the young state possesses very distinct pectorals and an embryonic fin comprising the caudal, while in the adult state it is entirely destitute of the former and has only a trace of the second under the form of a dorsal fin. A similar thing occurs with the *Hippocampi*. These fishes are distinguished, when adult, from the *Siphonostomi* and *Syngnathi* by the absence of a caudal fin. But on examining individuals of *Hippocampus brevirostris* of $5\frac{3}{4}$ millims. length, M. Canestrini discovered that they possess a caudal fin perfectly distinct, though little developed. It is formed by a prolongation of the skin which covers the posterior extremity of the animal, and consists of membrane only, without a trace of rays. This observation becomes very important when we remember that in the eocene period there were *Hippocampi* with a caudal fin—a character considered by Agassiz sufficient to separate them generically from those of our present seas, under the name of *Calamostoma*. *C. breviculum*, Ag., bears a very distinct rounded fin.

M. Canestrini relies on these embryological and palæontological facts in order to establish the genealogy of the living genera. He arrives at this conclusion—that *Nerophis* is descended from *Syngnathus*, and *Hippocampus* from *Calamostoma*. He says:—

"The *Syngnathi*, in losing the pectoral fins and the caudal, have given birth to the *Nerophes*, which still preserve during the embryonic period, and as a proof of their origin, those same fins which their ancestors retained during their whole life.

"These conclusions may seem to some persons too premature; and they will ask, as do all the opponents of these ideas, 'Where are the links which ought to unite the two?' or else, 'Which is the derived form? the genus *Syngnathus*, or the genus *Nerophis*?'

"I am, fortunately, able to answer this question, because between the *Syngnathi* (furnished with a well-developed caudal) and the *Nerophes* (quite destitute of a caudal) there exist other *Nerophes*, which possess when adult a rudimentary caudal, and constitute as it were a transition between the extreme forms. In support of this assertion I may mention *Nerophis anguinea*, *N. Heckeli*, and *N. æquorea*, all of which have a rudimentary caudal.

"One may with perfect safety say that *Nerophis* is a genus in process of formation. When the caudal fin, already at the most rudimentary, shall be entirely atrophied in all the species, and shall be no longer present even in the embryos, then we shall be able to affirm that *Nerophis* is a good genus, because it will be quite distinct from *Syngnathus*. At present we cannot quite say that, as is proved by the uncertainty which prevails in the classification of certain species: thus, for example, Kaup places the *Nerophes* with rudimentary tail in the genus *Nerophis*, while Rafinesque and Bonaparte refer them to the genus *Syngnathus*.

"In the same manner the tertiary *Calamostoma*, in losing the caudal fin, gave rise to the existing *Hippocampus*, in which the caudal fin is only present in the embryo.

"It is extremely probable that the caudal fin, before disappearing from the adults, passes through the rudimentary state, as is the case in the species of *Nerophis* cited above. No *Hippocampus* is yet known presenting this degree of conformation; but one may entertain the expectation of discovering, either in the present seas or in the posteocene formations, *Hippocampi* possessing in the adult condition a rudimentary caudal.

"With fishes the caudal is a powerful organ of locomotion. In this respect *Hippocampus* is an exception, in that it effects its movements principally by means of the dorsal. To it a caudal would be almost useless; and if that fin existed in the Calamostomes, perhaps the reason was that it was inherited from other fishes. In the *Hippocampi* it has been subjected to that law which condemns useless organs first to become rudimentary and then atrophied in the adults, and at last to disappear even in the embryo. The existing *Hippocampi* are found precisely in the second of these three phases."

The paper of M. Canestrini concludes with a descriptive and analytical catalogue of the Lophobranchs of the Adriatic, comprising 12 species, distributed into 4 genera:—*Hippocampus*, 2 species; *Siphonostomus*, 2; *Syngnathus*, 6, of which one (*S. tænionotus*) is new; and *Nerophis*, 2. He rectifies numerous errors of synonymy committed by various authors, in particular by Bonaparte, whose 28 species of Lophobranchs ought to be reduced to 19.—*Bibliothèque Universelle, Archives des Sciences Physiques et Naturelles*, July 15, 1871, pp. 355–358.

On a new Organ of Innervation, and on the Origin of the Nerves of Special Sensibility in the Aquatic Pulmonate Gasteropoda. By M. Lacaze-Duthiers.

In a former memoir I made known to the Academy a constant and important relation which exists between the organ of hearing and the posterior nervous centres of the Gasteropoda. Now, by the investigation of nervous centres by means of histological preparations intended to allow the nerves to be traced to their true and real origins, I have been led to the knowledge of new facts of great value for the knowledge of the relations and morphological comparisons.

I believe that no one has yet indicated the existence in the subœsophageal or posterior centres of the Gasteropoda in general, and of the aquatic Pulmonata in particular, of *regions*, *lobes*, or *lobules* having a peculiar structure, constant connexions, and of course distinct and precise physiological attributes.

The anterior centre of the œsophageal collar is destined to innervate the foot—that is to say, the immediate organ of movement, a motor organ which nevertheless is endowed with great sensibility. Now minute anatomy shows clearly in *Paludina* (a species of another group) that a thick cord descends from the posterior or cerebroid centre, attaches itself to the connective uniting the brain and the pedal ganglion, and gives origin to the nerve destined for the superior and eminently sensitive portion of the skin of the foot. Is it possible, after this observation, to refuse to recognize that the anterior ganglia are evidently in relation to motivity, and that the posterior centres are more particularly connected with sensibility? and, lastly, that these latter send forth to the other ganglia the fibres destined to give them sensibility?

From these facts we see how incomplete, from a physiological point of view, was the knowledge that we possessed with regard to the centres of innervation, and how important it was, by minute analysis, to arrive at the distinction of the special secondary parts in these centres.

This remark acquires still more interest when we ascertain, as I have done, that the more the nerves are destined for the perception of delicate and subtle impressions (in a word, the more they are sensitive and specialized), the more also are their origins placed upon the posterior face of the subœsophageal cerebroid centre.

It is not sufficient therefore to indicate in a general way what are the nerves that spring from a ganglion; it is also necessary to seek the points where, relatively and absolutely, the real origins occur. This is so true that cutaneous branches have been described as issuing from the optic nerve, which itself, in some cases, seems to spring from the nerve of the tentacle. This fact, which is difficult to admit *à priori* (since nothing analogous is met with in the higher animals, the nervous system of which is so well known), is not proved by minute histological researches. On the contrary, on separating, by histological processes and reactions, the bundles of fibres simply laid together and approximated under the same general neurilemma, we may ascend, in *Physa*, *Planorbis*, *Lymnæa*, &c., to the real, precise, constant, and always distinct origin of the three nerves of special sensibility, the olfactive, acoustic, and optic nerves, and thus prove that this origin is always met with a little laterally upon the posterior face of the subœsophageal centre, round a small, prominent, hemispherical lobule, which merits the name of the *lobule of special sensibility*.

By indicating with precision the isolation and the distinct starting-points of the nervous cords going to the three principal organs of the senses, I bring a new proof in support of the general idea that, in the lower animals, in the nervous centres hitherto regarded as simple and homogeneous, there exist secondary parts which it is necessary to distinguish, since they have distinctly characterized relations and attributions.

The determination of the homologous parts of the different ganglia has led to the recognition of a new arrangement equally curious and unexpected, which will, I hope, interest physiologists.

It is well known that in the neighbourhood of the external orifice of respiration there is to be found, at the extremity of a large pallial nerve, a ganglion of moderate size, to which one was tempted to give the name of *respiratory ganglion*, in consequence of the functions which its position caused to be ascribed to it. Now, by subjecting this ganglion to microscopic observation, both directly and after chemico-histological preparation (in a word, by analyzing it), we find that it is formed of an accumulation of nervous corpuscles, almost all unipolar, in the midst of which is immersed an actual cæcal process of the skin. This arrangement shows that here the outer limits of the body, by a sort of invagination, become approximated as closely as possible to a nervous centre and to the deep-seated elements characteristic of the centres.

Thus, from the study of the minute structure of the nervous centres of the aquatic pulmonate Gasteropoda we may deduce:—

1. That in these animals, as in higher creatures, there exist regions or lobes the histological constitution and the connexions of which establish for them distinct, special, and localized attributions.

2. That the nerves of special sensibility originate from the posterior part, whilst the nerves of motion have their origin upon the most anterior ganglion.

3. That we must recognize in the supposed respiratory ganglion not a nervous centre or true ganglion, but a new special organ produced by the invagination of the skin in the midst of a mass of ganglionic corpuscles.—*Comptes Rendus*, July 17, 1871, tome lxxiii. p. 161.

Further Observations on the Development of the Crayfish. By S. Chantran.

My recent experiments have confirmed the facts noted by me last year*, especially with regard to the period of the life of the young crayfish beneath the abdomen of the mother. I have observed that not only do they feed upon the pellicle of the eggs and on the carapace shed in their first moult, but the stronger ones eat those individuals whose development is rendered difficult by their agglomeration and which cannot moult. The facilitation of this moult is probably one of the causes of the mother constantly agitating her false legs during the two or three days preceding exclusion; to these the young crayfish are suspended. Those which, in moulting, break their limbs, are also devoured by their companions. Thus the crayfish, when they are ten days old, eat each other; and this is the case also

* See Ann. & Mag. N. H. ser. 4. vol. vi. p. 265.

with those of any age when they moult and are too numerous in a small space.

I have also observed that temperature exerts a marked influence upon the duration of the incubation of the eggs and upon the number of the periodical moults. The number of moults is eight in the first year following exclusion; it is five in the second year, or six in those years when the temperature is high; it is from two to three in the third year, which makes from fifteen to seventeen moults in all to the commencement of the fourth year. The male crayfish becomes adult (that is to say, ready for copulation) on entering upon his third year; and the female is ready for fecundation at the commencement of the fourth year.

All naturalists are aware that the organs of the crayfish are reproduced. According to my experiments the antennæ push out again during the time which separates one moult from the following one. The other limbs (such as the claws, the legs, the false legs, and the lamellæ of the tail) are regenerated more slowly, three moults taking place during their regeneration. When the fourth moult comes on, the regenerated limbs have acquired all their strength. In the first year of their existence, seventy days suffice for the regeneration of these limbs in the young crayfish. This is not the case with the adult crayfish: the female requires three or four years to reproduce its limbs, and the male from a year and a half to two years; for the adult male moults twice a year, and the adult female only once.

In an early note I will make known the results of experiments of this kind relating especially to the regeneration of the eyes.—*Comptes Rendus*, July 17, 1871, tome lxxiii. p. 220.

On Hypocotyledonary Gemmation. By Prof. Asa Gray.

My attention has been called, by Mr. Guerineau, the gardener of the Cambridge Botanic Garden, to a remarkable instance which occurs in all our seedlings of *Delphinium nudicaule*, the unique red- or red-and-yellow-flowered species of California. As this species is now in European cultivation, and probably a variety of it, *D. cardinale*, was raised and figured in England several years ago, the peculiarity in question is likely to have been noted; but I have seen no account of it. In germination the slender radicle elevates a pair of well-formed ovate cotyledons in the usual way. These acquire full development; but no plumule appears between them; consequently the primary axis is here arrested. Soon a napiform thickening is formed underground at the junction of the lower end of the radicle with the true root: from this is produced a slender-petioled 3-lobed leaf, which comes up by the side of the primary plantlet; soon a second leaf appears, and so on, setting up the permanent axis of the plant from a bud which thus originates from the very base of a well-developed radicle, if not from the root itself.—*Silliman's American Journal*, July 1871.

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XXVII.—*Outline of a Scheme of Classification of the Invertebrata, founded upon the Progressive-Development Theory.* By JOHN DENIS MACDONALD, M.D., F.R.S., Staff-Surgeon H.M.S. 'Lord Warden'*.

ON studying the leading members of the Protozoa with the view of discovering, if possible, their nearest descendants, the whole subkingdom of Invertebrate animals arranged itself, apparently quite naturally, into as many groups as there were points of origin. In unfolding the results of this investigation, which must, of course, be more or less speculative, Prof. Huxley's arrangement of the Protozoa may be taken as a basis, thus—

Protozoa.

Astomata. Stomatoda.

1. Rhizopod type. 2. Gregarinidæ. 3. Infusoria. 4. Noctilucidæ.

The four groups numbered in the above table exhibit a marked increase in their vital activity and structural development in the order in which they stand; and although there is no reason to doubt that the last three may have been derived from the first, the upward evolutional tendencies of all would appear to be quite distinct. Indeed each may be regarded as primordial in its own series, or the salient point of descent and divergences, which, however different *inter se*, may be referred to their own definite source.

1. Tracing from the Rhizopod type to the simple polyps, in fact, to the Cœlenterata crowned with the Ctenophora, and from the latter through the Brachiopoda and Polyzoa to the

* Communicated by the Director General of the Medical Department of the Navy.

Tunicata, we finally enter the precincts of the Mollusca proper. This is, no doubt, the "royal road" to the Vertebrata, if, indeed, there be any; for it would be hopeless to seek for the evolution of this higher type through any of the other channels to be briefly noticed in this paper. The Insects, Crustaceans, and Echinoderms present impassable barriers in this respect. They are so curiously constructed, exhausting one's ideas of modification, or so perfect in their way as to preclude any conception of their further development; but the morphological resources of the Molluscan type would appear to be ample enough*.

2. The Gregarinidæ evidently hold a superior position to the other astomatous families of Protozoa; and it would appear as though the cestoid Entozoa were derived from them. In this connexion the sucker occurring in *Actinocephalus* and the circlet of uncini like those of *Tænia* in *Hoplorhynchus* are very significant. Moreover the usually elongated body of these animals is invested with a more distinct tegumentary coat than that of the Rhizopoda. *Tetrarhynchus flaviceps* and such astomatous forms have probably led the way to the more highly organized Acanthocephala and the Nematoidea generally, to which may have succeeded the Trematoda.

3. Many Infusoria have been taken for the larvæ of Turbellaria, and *vice versâ*, giving some support to the view that the latter order of animals may have descended from the former. And further, if we compare the internal anatomy of *Arhynchia* or *Nemertes* with that of *Sipunculus*†, and study also the larval state of these animals, their close affinity will be made apparent; and if this be so, next must follow *Synapta*, *Holothuria*, in fact the Echinodermata as a whole, to

* A more detailed account of the morphological relations of the Molluscoida and Cœlenterata will be found in a paper on this subject by the author, published in the 'Transactions of the Royal Society of Edinburgh,' 1864, vol. xxiii. part 3.

† I can confirm the statement of Krohn as to the existence of two supraœsophageal ganglia in *Sipunculus*, with a bilateral distribution of nerves to the circlet of simple and finely ciliated tentacula. Moreover I have found an unequivocal eye-speck in connexion with each ganglion. The ventral threads are plain and destitute of the series of ganglia occurring in the Hirudinea, to which group many naturalists refer the genus. The intestine passes backwards, winding round a suspensory tendinous cord, upon which it returns to the position of the dorsal anus; and the perivisceral membrane is richly ciliated, forming little mesenteries to inclose the intestinal vessels. In the coral-boring species the armature of the integument consists of pointed tuberculations over the middle and posterior regions of the body, and gradually approximating transverse rings of recurved hooks extending along the fore part to the base of the tentacula.

complete the series. Yet this arrangement would have the apparent effect of crowning the order with the Crinoidea, which, in the more common acceptation of the case, should hold the earliest position. But the theory of the evolution of new forms from preexisting ones would be evidently defective if it did not admit of occasional retrogression in some points of organization as well as progression in others, and even often of considerable latitude of development of no certain significance in either direction.

4. *Noctiluca* has been chosen as the nucleus of the annulose and articulate series, and would seem to be linked with the Rotifera through such genera as *Asplanchna*, Gosse, and *Ascomorpha*, Perty. All things being considered, it is doubtful if a more satisfactory selection could be made from the domain of the Infusoria.

From the Rotifera, through the Annelida, we may trace the development of the crustaceous and chitinous types of Articulata like a dichotomous branch.

The Sagittidæ no doubt hold an important place between the Crustacea and the earlier annulose forms, in connexion with which view their articulated jaws and finely striped muscular fibres must be borne in mind.

The first rudiment of a tracheal system is probably to be sought for in the Terricolous Annelida; but it is doubtful if articulated limbs and a dorsal heart make their appearance earlier than amongst the Julidæ.

Finally, a representative relationship has long been recognized between the crustaceous Macrura, Anomura, and Brachyura and the chitinous Myriopoda, Insecta, and Arachnida; but however plausible the attempt may be to trace them back to a more simple origin, it is certain that we can form no conception of their further development.

I here subjoin a tabular scheme of the leading divisions and groups of the Invertebrata in accordance with the foregoing views.

Protozoa.

Astomata.		Stomatoda.	
Rhizopoda.	*Gregarinidæ.*	*Infusoria.*	*Noctilucidæ.*
Cœlenterata.	Cestoidea.	Aprocta†.	Rotifera.
Molluscoida.	Nematoidea*.	Proctucha†.	Annelida.
Mollusca proper.	Trematoda.	Echinodermata.	Articulata.

* Including Acanthocephala. † Turbellaria.

XXVIII.—*Examination of Deep-sea Soundings; with Remarks on the Habit and Structure of the* Polycystina. By JOHN DENIS MACDONALD, M.D., F.R.S., Staff-Surgeon, H.M.S. 'Lord Warden'*.

VICE-ADMIRAL SIR H. R. YELVERTON, K.C.B., having handed over to me a small bottle of deep-sea soundings, given to him by Staff-Captain Calver, of H.M.S. 'Porcupine,' with a short descriptive paper, I submitted it to microscopic examination, and obtained some interesting results.

It will be convenient to preface my own observations with a copy of the paper above mentioned.

Specimen of Soundings.

"*Position*	....	Lat. 47° 35′ N., Long. 12° 15′ W.
"*Depth*	......	2435 fathoms (3 statute miles).
"*Temperature*	.	Surface, 65°·5 F.; bottom, 36°·5 F.
"*Pressure*	....	457 atmospheres = 6855 lbs.
"*Time occupied.*		Sounding, 3 hours.
,, ,,		Dredge-sinking, 2 hours.
,, ,,		Dredge-working, 2 hours.
,, ,,		Dredge-raising, 4 hours.

"The above pressure will be more readily understood when it is mentioned that a man of ordinary size would, at the foregoing depth, be subjected to a pressure equal to the weight of thirty goods trains loaded with pig-iron, with their engines and tenders included; and yet creatures of great beauty and delicacy live, move, and have their being in this vast depth.

"The specimen consists of fine calcareous mud with myriads of Globigerinæ and other Foraminifera."

It is quite true that "fine calcareous mud, with myriads of Globigerinæ and other Foraminifera" exist in the soundings in question; but on treating them with boiling nitric acid, a large amount of siliceous particles and mineral grit, intermixed with interesting Polycystina and Diatomaceæ, were brought into view after the destruction of the carbonate of lime.

List of Genera observed.

Diatomaceæ.	*Polycystina.*
Coscinodiscus.	Astromma.
Actinoptychus.	Podocyrtis.
Gallionella.	Eucyrtidium.
Surirella.	Stylodictya.
Synedra.	Dictyocha.
Navicula.	Lychnocanium.

* Communicated by the Director General of the Medical Department of the Navy.

Notwithstanding the evidence of excellent observers as to the pseudopodia and the locomotive properties of genuine Foraminifera, I can only say that, having from time to time submitted thousands of the living animals to close inspection, I have seen no evidence of the existence of pseudopodia, and perfect fixity has been the rule, either by a broad base or a pedicle. Indeed the place of attachment of the latter is usually distinctly apparent in the dead shells.

The echinated Globigerine forms are generally found in the free state, being often taken in the towing-net with the Thalassicollidæ or amongst the ingesta of *Salpæ* and other pelagic animals. After the death of the sarcode, these little shells gravitate to the bottom of the ocean, in company with the siliceous frustules of Diatomaceæ and the crystal domes, concentric spheres, and the diverse spicular and fenestrated framework of the Polycystina, which also enjoy a pelagic life. Thus organic and sedimentary particles commingle to compose incipient rocks, whose intimate structure at some remote period may be studied with interest by future geologists.

In *Acanthometra* the animal sarcode is deposited centrally, but at the same time superficially, around the conjoined bases of the radiating spines, through the tubular axis of which pseudopodial extensions of the sarcode may protrude. There are, however, some pedunculated forms (such as are often to be found attached to the keel of *Atlanta*, the shells of Pteropoda, and other pelagic bodies) with exceedingly delicate and imperforate spines radiating through a reddish-brown sarcode mass surmounting the pedicle (*Acanthometra*, young?).

Professor Müller describes the sarcode of the *Eucyrtidium* of Messina as an olive-brown four-lobed body occupying the dome or summit of the shell, through the fenestrations of which emerge fine pseudopodia like those of *Actinophrys*.

Many of the free Polycystina(?) taken in the towing-net exhibit a remarkable alliance with the Thalassicollidæ. Thus a sarcode body, in every particular resembling a single punctum of the *Thalassicolla punctata* of Huxley, or in some instances two or three such bodies, were included within a more or less open siliceous framework.

The genus *Dictyocha* is an example of this group, which I have little doubt should be referred to the Thalassicollidæ. It is certain, however, that they are at present confounded with the Polycystina in the well-known fossil gatherings from Oran, Barbadoes, and other places.

Of course, where concentric shells are formed at intervals, the mode of growth of the sarcode must be in all essential particulars similar to that of the Foraminifera; but where this is not the case, it is simply continuous or only augmentative. Though our knowledge of the Polycystina is yet very limited, the two modes of growth here indicated suggest their distribution into two corresponding sections, thus :—

Polycystina.

Rhizopoda furnished with a siliceous spicular or fenestrated framework.

Growth of sarcode	Simple or continuous ..	*Acanthometra.* *Eucyrtidium.*
	By concentric accessions	*Stylodictya.* *Astromma.*

Now that the surface pelagic life of the Polycystina is a matter of fact, we can readily account for the occurrence of so many interesting forms in guano.

Fig. 1.

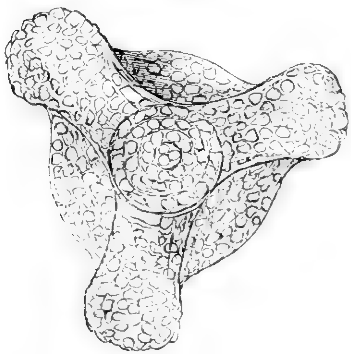


Fig. 2.

Astromma Yelvertoni.

Front view. Side view.

Figs. 1 & 2 are respectively a front and a side view of a species of *Astromma* with three radiating lobes, *A. Aristotelis* having four. As the species appears to be new, I have named it *Astromma Yelvertoni.*

H.M.S. 'Lord Warden.'
Corfu, June 24, 1871.

XXIX.—*Note on some Chelonian Remains from the London Clay.* By Harry G. Seeley, F.G.S., St. John's College, Cambridge.

Glossochelys (nov. gen.).

Chelone harvicensis (Woodward).
—— *planimentum* (Owen).

In his description in the Palæontographical volume for 1849, Professor Owen states that the carapace is 15 inches long and 13 inches wide. The type specimen having perished, there is now no means of verifying these measurements, except from the natural internal cast of the specimen figured. This shows the impression left by the posterior part of the carapace, something of the form of the inner surface of the bones of the anterior part of the plastron and parts of marginal plates, coracoid, scapula, and humerus.

Prof. Owen remarks that in general form this carapace differs from that of the existing Chelones in being less contracted and pointed posteriorly than in *Chelone mydas* and *Chelone caouanna*, and more contracted posteriorly than in *Chelone imbricata*. Attention is also drawn to the great thickness to which the true ribs are developed on the undersides of the costal plates.

From the posterior termination of what Prof. Owen determines to be the eleventh and last neural plate to the anterior border of the fifth costal plate is rather more than nine inches. From the longitudinal median line of the neural spines of the dorsal vertebræ to the marginal plate beyond the termination of the fourth rib is 7 inches; the same measurement is found at the fifth rib. The ribs appear to be cylindrical, and terminate in obtuse longitudinally grooved rods, of which the naked extremity is not less than an inch long; they are about $\frac{3}{8}$ of an inch in diameter, never more.

The distance from the lateral termination of the fourth rib to the lateral termination of the eighth rib (which is directed rapidly backward) is 10 inches. The interspace between the terminal ends of the eighth pair of ribs is $5\frac{1}{2}$ inches.

The interspace between the terminal ends of the eighth and seventh ribs is 3 inches, between the seventh and sixth ribs is 2 inches, between the sixth and fifth $1\frac{3}{4}$ inch, and between the fifth and fourth about 2 inches. The transverse interspace between the marginal plates and the costal plates seems usually to be about 2 inches, or, according to the carapace figured by Prof. Owen, $1\frac{1}{2}$ inch.

The termination of the pygal end of the shield is very curious, the characters drawn in Prof. Owen's figure (pl. x.) being repeated in the main in this specimen. The eighth pair of costal plates bear a small tenth pair of ribs*, supposing the first costal to have had the usual short pair in front of the proper rib of the plate. Behind these ribs and the neural plate marked by Prof. Owen as the ninth (which appears to me to be as *wide* as the preceding one), lies a diamond-shaped terminal part of the carapace. A transverse suture appears to divide it into two nearly equal parts—one anterior, the other posterior. The anterior part shows throughout its length two subparallel longitudinal sutures, which separate a middle part, the neural plate, from what would be a ninth pair of costal plates, though they do not support the ninth pair of ribs.

The posterior half of the diamond shows a transverse suture which separates a narrow anterior piece from the larger posterior trapezoidal plate. If the preceding plates were rightly numbered, these plates would be the eleventh and twelfth neural.

The characters described are, in their essential points, repeated in another carapace, figured by Prof. Owen in pl. x. A†, where the ninth pair of ribs are represented as being prolonged to the marginal plates. That lithograph shows the neural plates to extend far in front of their corresponding costal plates, herein being unlike *Chelone*. It also shows that the neural plates which Prof. Owen has numbered, in plate x., 5, 6, 7, 8, 9, 10, respectively, should be numbered 4, 5, 6, 7, 8, while the plates beyond should be numbered 10 and 11; thus in number the neural plates conform to the Chelonian type, though their arrangement is unlike that in any of the recent genera.

In the typical specimen figured, and in this specimen also, the marginal plates are remarkable for their narrowness; for though of some width from below upward, they seem to be only from an eighth to a quarter of an inch thick; and the specimen now described shows no trace of the ribs being inserted into holes. The pygal plate, presuming such a plate to have existed, must have been of the same thin character as the others. There is no trace of sutures between the marginal plates.

* "Perhaps no monstrosity would sooner arrest the attention, or excite more wonder in the comparative anatomist, than the appearance in a recent or fossil chelonian of a greater number of pairs of ribs in the carapace than 8" (Owen, Palæont. 1851). Yet that condition had already been figured by Prof. Owen (Palæont. 1849, t. x. & x. A) without arousing the anticipated emotion.

† Since perished.

At the anterior part of the stone are seen portions of the hyosternal and hyposternal bones, the entosternal and episternal. The hyosternal and hyposternal meet in a transverse suture, and resemble in form those bones in the recent marine Chelonia, differing chiefly in the much greater extent to which the lateral rays approximate; so that the deep and long emargination usual between these bones is almost lost, while the distance from the front lateral margin of the hyosternal to the back lateral margin of the hyposternal is of emydian shortness. From front to back, in the median line of the skeleton, the hyosternal measures $4\frac{3}{4}$ inches; from front to back where narrowest, at the side, the same bone measures $1\frac{3}{4}$ inch. The transverse width of the two hyposternal bones is about 12 inches; the narrowest measurement of the right hyposternal from front to back is $1\frac{3}{4}$ inch. They terminate in the middle line of the skeleton, and laterally in short digitations. Unlike the marine Chelonia, this animal had the internal surface of these bones convex; their external surface appears to be concave.

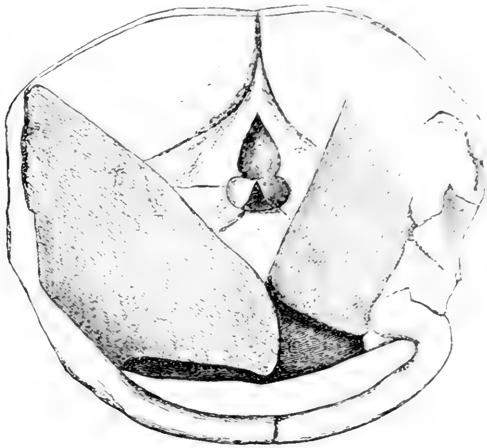
Between the inner anterior ends of the hyosternal bones, and touched by them, extends a thin narrow bone for $2\frac{3}{4}$ inches; it appears to be less than an inch wide; its anterior termination is not seen; but it widens anteriorly after the usual T-shaped pattern of the interclavicle.

External to the anterior end of the right hyosternal is the right episternal; it is very thin, becomes narrower posteriorly, does not exceed half an inch in width, and is exposed for $1\frac{3}{4}$ inch.

Over the sternal bones of the right side are the coracoid, scapula, and a part of the humerus. The coracoid is imperfectly preserved; it appears to have been about 4 inches long, and 2 inches wide at the distal termination, very thin, and convex on the *superior* side; its proportions are more in accord with the Emydian type than with that of the marine Chelonians. The scapula measures nearly $1\frac{1}{2}$ inch from the articular surface to the part where the scapula proper branches at about a right angle from the part called the precoracoid. This latter portion is small, subcylindrical, a little compressed, and about 2 inches long. The scapula is fractured, so that its length is not known.

So far as the remains preserved indicate affinities, the genus may as well have been Chelonian as Emydian, but cannot with certainty be affiliated to either type.

Prof. Owen observes that "this carapace is understood to have formed part of the same individual turtle as the skull (t. ix.)" on which I now offer a few notes.



Back view of the skull of *Chelone harvicensis* (Woodward), half nat. size, showing the large hyoid bones in shade; between them is seen the tripartite occipital condyle, with the conical foramen magnum above it, and laterally the outlines of the other occipital bones.

Chelone planimentum (Owen), Proc. Geol. Soc. Palæont. Soc. 1849, pl. ix.

This skull has been very incorrectly figured and imperfectly described.

It is wide behind the orbits, but in front of them tapers more abruptly from side to side and from above downward than shown in the figure, somewhat resembling *Chelone caouanna*.

The nostril is subquadrate, broader than high, about $\frac{13}{16}$ of an inch wide, and small for the size of the skull when compared with recent marine Chelonians. The premaxillary is a little worn; but the extreme length of the skull from the premaxillary to the occipital condyle is 5 inches; the antero-posterior length to the termination of the supraoccipital crest is $6\frac{1}{2}$ inches. The maxillary bones look outward, forward, and upward, in this latter character differing from those of the recent marine Chelonia.

The orbits are subcircular, rather less than $1\frac{3}{4}$ inch in diameter; they look outward and forward and a little upward; and the prefrontal bones which separate them superiorly are little more than an inch wide. At the posterior margin of the orbits the skull is $3\frac{1}{2}$ inches wide; from the front of the orbit to the nares is $\frac{9}{16}$ of an inch. The parietal and frontal bones are deeply marked with scutes, which are represented in Prof. Owen's figure. The head widens to not less than $5\frac{1}{2}$ inches; but the quadrato-jugal (squamosal, Owen) and squamosal (mastoid, Owen) are imperfectly preserved. The squamosal bone extends further outward, and looks upward more than in marine Chelonians. It appears to terminate behind in a thin film, as in *C. caouanna*. In transverse section the parietal region is similar to that of marine Chelonians, only broader.

The quadrate bone is more conically excavated than in the recent types, but otherwise similar.

So far as they are exposed, the basioccipital, exoccipital, supraoccipital, and paroccipital, Owen, offer no variations from the ordinary type. From the base of the tripartite occipital condyle to the top of the spine of the supraoccipital is $2\frac{1}{4}$ inches.

The lower jaw is remarkably flattened on the under side. In front of the articulation it measures $4\frac{1}{2}$ inches from side to side. The symphysis is not less than $2\frac{1}{2}$ inches long. An obscure suture divides the dentary bone into two parts: Wagler figures a like condition in some recent species of *Trionyx*; and it is shown in Mr. Dinkel's plates to Prof. Owen's monograph, representing *Chelone crassicostata* (t. xi. fig. 3) and *Chelone convexa* (t. vii. fig. 3), but does not occur in the recent marine Chelonia. The lower jaw is not deep from above downward. From the margin of the surangular bone (which in recent species is usually compressed at the upper part) a thin process of bone, an inch long and half an inch wide, is directed upward, outward, and backward towards the malar bone. The ramus measures rather less than 5 inches from front to back. Behind the skull are seen the well ossified hyoid bones; they form on each side of the occipital region a broad, thin, oblique sheet of flat bone, extending from the upper margin of the squamosal bone and approximating to the palate, where (as preserved) they meet or overlap mesially. On the palatal surface they are fractured, and appear there to be about $\frac{3}{8}$ of an inch thick. So much as is preserved on each side is 4 inches long and fully $1\frac{1}{2}$ inch wide. The outer margin of each is convex. With the exception of the basihyal, I suppose all the hyoid elements to be here represented in one bone.

The only species from the London Clay which this resembles is *Chelone plana* (Kœnig) [*Chelone crassicostata*, Owen], which, however, is represented as having but ten neural plates instead of eleven. It has but eight pairs of ribs attached to the carapace, instead of nine. The costal plates are shorter from front to back; the free ends of the ribs are wider; the marginal plates appear to be wider. The whole carapace is relatively much wider.

The skull ascribed to that species, as studied from the figure, pl. xi. of Prof. Owen's memoir, shows no character to differentiate it from *C. harvicensis*, other than might be attributed to difference in age and preservation.

Besides the characters enumerated, both these species are distinguished from the recent marine Chelonia by the forward position of the first neural plate, from which it results that only one pair of ribs is attached to the first costal plate, as among certain Emydians.

Of the generic distinction of *Chelone harvicensis* from the recent marine types I have no doubt, and, from the characters of the carapace and skull detailed, institute the genus *Glossochelys* for its reception.

The following notes are from additional specimens in the Woodwardian Museum:—

Glossochelys harvicensis (Woodward).

A carapace, which may perhaps be from the young of this species, displays the impressions left by the nuchal, first marginal, neural, and eight pairs of costal plates, which are imperfectly preserved at the marginal terminations. The extreme width of the carapace over the third costal plate would be 11 inches; the measurement over the second to the seventh costal plates is about $7\frac{1}{2}$ inches; in *C. harvicensis*, t. x. A (Owen), these measurements respectively are 15 inches in width by 12 inches in length; so that the specimen now noticed is only about two-thirds as large.

All the plates were exceedingly thin; and the costal plates were concave from front to back, and markedly convex from the neural to the marginal ends. The true ribs appear to have been unusually elevated on the inside of the carapace, often compressed from side to side at their proximal ends, while at the marginal ends they widen and appear to terminate in flattened ribs $\frac{3}{8}$ of an inch wide. In these characters they differ from the type of *C. harvicensis*.

The nuchal plate is concave in front; behind it unites with the first pair of costal plates by oblique sutures; so that while it is $1\frac{3}{10}$ inch long mesially in front of the neural plates, it is only $\frac{3}{4}$ of an inch long at the sides, where it meets the marginal plates. Its extreme width is about $3\frac{3}{4}$ inches; its least width in front is about 3 inches.

At the upper part of its lateral margin adjoins the flattened marginal plate, $\frac{5}{8}$ of an inch wide. Between the nuchal and first costal rib there appear to have been three marginal plates, none of which touch the first costal plate.

The first costal plate appears to be an irregular pentagon, about $1\frac{1}{8}$ inch long at the suture with the first neural plate, nearly $1\frac{3}{4}$ inch long behind the nuchal plate; behind the marginal plates it again becomes narrow. Herein it is unlike the recent marine Chelonia.

The second costal plate, which is less than $1\frac{1}{2}$ inch long at the neural suture, widens at the marginal end to $1\frac{3}{4}$ inch. The third and fourth costal plates measure at the neural suture each $1\frac{5}{10}$ inch, but spread a little towards the marginal ends. The fifth and sixth pairs are not so well preserved, but similarly widen towards the margin, as does the seventh pair. The eighth pair of costal plates is much longer from back to front than the seventh, and, as in the type of *C. harvicensis*, supports the eighth and ninth pairs of costal ribs. Beyond this point the carapace is not preserved.

I anticipate that it will prove to be specifically distinct from the species described, and that the hyosternal bone next noticed may be referred to it.

A nodule exhibiting the greater part of a right hyosternal bone similar in size to that in the typical specimen of *C. harvicensis*. Its shortest measurement, from the deeply cupped front to the hyposternal suture, is about $1\frac{1}{2}$ inch. At the free marginal side the sharp rays are well seen; they differ from the type in being elevated above the bone on which they rest, much as the rib is elevated in its passage along a costal plate.

Scarcely any group of described vertebrates more urgently demands a renewed critical study than the Tertiary Chelonia. The case has yet to be made out which will justify the reference of any one of Prof. Owen's species to the genus *Chelone*, while the majority are obviously Emydians, with very little to even insinuate their affinity with the chelonian suborder, some, like the so-called *Chelone longiceps* (Owen), being valuable new types for comparative study.

Glossochelys, if the hyoid bones can be credited with such an inference, may have had a voice like a trumpet, and have served as an alarmist to the gentler inhabitants of the Spice Islands of lat. 51° or 52°, whenever he gave tongue.

XXX.—*Notes on some African Birds.* By R. B. SHARPE, F.L.S. &c., Librarian to the Zoological Society of London.

THE receipt of several interesting birds from the Fantee country, in Western Africa, sent to me by my friend Governor Ussher, enables me to write a few words on two of the species mentioned in the present paper—while the identity of the *Crithagra* has been a rock to split upon for many ornithologists, and the additional information respecting these puzzling birds will, I believe, be read with some interest.

Fam. **Muscicapidæ.**

Genus BUTALIS.

1. *Butalis epulata.*

Butalis epulata, Cass. Proc. Phil. Acad. 1850, p. 326; Sharpe, Ibis, 1870, p. 480; *id.* Cat. Afr. B. p. 42.
Muscicapa epulata, Hartl. Orn. W. Afr. pp. 96, 276 (1856): Cass. Proc. Phil. Acad. 1859, p. 51; Hartl. J. f. O. 1861, p. 169; Gray, Hand-l. of B. pt. i. p. 322.

Hab. Gaboon; Moonda, Muni, and Camma rivers (*Du Chaillu*); Fantee (*Swanzy, Aubrin*).

This is the smallest Flycatcher of the genus *Butalis*; and it is for the purpose of describing the young bird that I have here introduced it, as this stage of plumage has not yet been noticed. In the last collection brought home by Governor Ussher was a specimen which had been obtained on the boundary between Denkera and Ashantee, near the rivers Orffee, on the 20th of April 1871, by Mr. Aubrin, who says that the natives call it "Abrodomeh." The following is a description of the bird in question:—

Above dusky grey, covered with little pointed spots of buff, deeper on the rump and upper tail-coverts, all these spots being margined with black; cheeks similarly marked; wing-coverts coloured and spotted like the back, but the spots much deeper, almost golden in colour; quills blackish, the secondaries plainly edged with buff; tail blackish, with little buff tips to the feathers; under surface of the body whitish, the flanks and under tail-coverts tinged with buff, the throat and breast presenting a mottled appearance, owing to the feathers being narrowly edged with grey; under wing-coverts white varied with grey near the edge of the wing; bill black, yellow at the base and gape; feet dark brown. Total length 4·2 inches, culmen 0·45, wing 2·25, tail 1·65, tarsus 0·5.

Fam. **Fringillidæ.**

Genus Crithagra.

2. *Crithagra leucoptera*, n. sp.

C. supra olivaceo-brunnea, uropygio concolori vix pallidiore, plumis obsolete brunneo saturatiore longitudinaliter striatis: tectricibus alarum dorso concoloribus, medianis et majoribus albo terminatis, fasciam duplicem alarem formantibus: remigibus brunneis, extus olivaceo limbatis, secundariis intimis albido marginatis: cauda brunnea anguste olivaceo marginata: facie laterali tota olivaceo-brunnea, pileo concolori: mento albido, profuse brunneo notato: gula ima conspicue alba: corpore subtus sordide brunneo, abdomine pallidiore, olivaceo-viridi vix lavato; subcaudalibus albidis; subalaribus sordide brunneis: rostro carneo: pedibus rufescenti-brunneis.

Above dull earthy, the rump slightly paler and more grey, and a gloss of olive-yellow pervading the whole of the upper surface, the centres of the feathers rather darker, producing an obsolete striped appearance, which is more distinct on the crown; wing-coverts coloured like the back, the greater and median coverts tipped with whitish, forming a double alar bar; quills and tail brown, edged with olive, the secondaries being edged and tipped with whitish; sides of the face and neck brown like the back; throat white, the chin thickly covered with little brown spots; rest of the under surface of the body brown, the abdomen and under tail-coverts much paler and inclining to whitish, the flanks brown, with a slight tinge of olive-yellow spread over the breast and belly; under wing-coverts brown like the sides of the body; bill flesh-colour, legs reddish brown. Total length 5·7 inches, culmen 0·55, wing 2·95, tail 2·45, tarsus 0·7.

Hab. South Africa (*Layard*).

Among all the descriptions of the grey finches from South Africa I have failed to find one which agrees with the bird above characterized. The white bars on the wing are a distinguishing feature; the spots on the chin are also very distinct.

I now add a few remarks on some of these birds, as Dr. Finsch and I do not agree as to the correctness of the names assigned by me in my Catalogue, so that a few words will be necessary to uphold the conclusions at which I have there arrived. On sending him one of the types of my *Poliospiza crocopygia* to examine, Dr. Finsch expressed his opinion that it is the true *Crithagra albogularis* of Smith. I am willing to admit the bird as a thin-billed *Crithagra*, and I classify the grey South-African species under dispute as follows:—

a. uropygio dorso concolori .... 1. *C. leucoptera.*
b. uropygio flavo.
  a′. major: uropygio viridi-flavo .... 2. *C. albogularis.*
  b′. minor: uropygio læte sulphureo...... 3. *C. crocopygia.*

3. *Crithagra albogularis.*

Crithagra albogularis, Smith, S. Afr. Q. J. ii. p. 48 (1833, descr. orig.); Sharpe, Cat. Afr. B. p. 67.
—— *Selbyii*, Smith, App. to Rep. of Exp. p. 50 (1836, descr. orig.); Swains. An. in Menag. p. 319 (1837); Layard, B. of S. Afr. p. 219.
—— *sulphurata* (juv.), Jard. & Selby, Ill. Orn. pl. 109. fig. 2.
—— *cinerea*, Swains. Classif. of B. ii. p. 294 (1837).

Above greyish brown, with dark centres to the feathers, giving a striped appearance; rump and upper tail-coverts greenish yellow; lores and a distinct eyebrow, as well as a spot at the base of the lower mandible, throat, and centre of the belly white; cheeks and sides of the neck, upper part of the breast, and flanks greyish brown; under tail-coverts buffy white; under wing-coverts greyish brown, with a slight yellow tinge; wing-coverts and quills dark brown, with edgings of paler brown; tail-feathers dark brown, edged with dull olive; upper mandible horn-brown, lower mandible flesh-colour; legs dark reddish brown. Total length 6·7 inches, culmen 0·5, wing 3·3, tail 2·6, tarsus 0·8.

I have taken the above description from a specimen given me by Mr. Layard, and procured by that gentleman himself on the Berg River, the exact locality where Sir Andrew Smith obtained his typical examples. We may therefore depend upon having got the true *C. albogularis* of Smith. My species, *C. crocopygia*, is very similar, but smaller, more mealy in plumage, and has a bright sulphur-coloured rump. As there has always been a great confusion respecting this species, owing to the difficulty of consulting Smith's original characters, I subjoin his first description:—

"Above greenish grey, with some dark variegation; rump and tail-coverts greenish yellow; chin, throat, and eyebrows white; breast and flanks dusky grey; centre of belly, vent, and under tail-coverts white; wing and tail-feathers brownish, slightly edged with dull white. Length five inches and a half." (S. Afr. Q. J. ii. p. 48.)

Again, in the Appendix to the Report of his Expedition (p. 50), Sir Andrew Smith gives the following description of *C. Selbyii*, without the slightest reference to the previous name:—

"Upper parts brown-grey, dashed longitudinally with a dark brown; rump greenish yellow; eyebrows, chin, throat, middle of belly, vent, and under tail-coverts white; breast and sides of belly brown-grey; quills and tail brown. Length 6 inches."

That Sir Andrew Smith is alluding to the same bird in both the above instances is clear from the fact that to both descriptions he gives a note to the effect that, "although a distinct species, it has been figured by Sir William Jardine and Mr. Selby as the young of *Crithagra sulphurata.*"

Genus Spermospiza.

4. *Spermospiza hæmatina.*

Loxia hæmatina, Vieill. Ois. Chant. pl. 67 (♂ ad.)
—— *guttata,* Vieill. Ois. Chant. pl. 68 (♀ sen.).
Crimson-breasted Grosbeak, Lath. Gen. Syn. v. p. 222, pl. 88* (1822).
Coccothraustes guttata et hæmatina, Bonn. et Vieill. Enc. Méth. iii. p. 1007 (1823).
Fringilla pustulata, Voigt, ed. Cuv. Thierr. i. p. 222 (1830).
Spermophaga cyanorhynchus, Swains. B. of W. Afr. i. p. 164 (1837); Jard. Contr. Orn. 1849, p. 9.
—— *hæmatina,* Jard. & Selby, Ill. Orn. n. s. i. pl. 11 (1837).
Spermospiza hæmatina, Gray, Gen. of B. ii. p. 356 (1844); Hartl. Abhandl. Naturw. Hamb. ii. p. 31 (1852), et J. f. O. 1854, p. 115, et 1855, p. 361; Cass. Proc. Phil. Acad. 1858, p. 137; Heine, J. f. O. 1861, p. 142; Hartl. J. f. O. 1861, p. 257; Gray, Hand-l. of B. ii. p. 49 (1870); Sharpe, Cat. Afr. B. p. 68 (1871).
—— *guttata,* Hartl. J. f. O. 1854, p. 115, et 1855, p. 361; Cass. Proc. Phil. Acad. 1858, p. 137; Heine, J. f. O. 1861, p. 142; Hartl. J. f. O. 1861, p. 257; Sharpe, Ibis, 1869, p. 384; Gray, Hand-l. of B. ii. p. 49 (1870).

Both *S. hæmatina* and *S. guttata* were figured by Vieillot originally as different species, as indeed they would appear to any one at first sight to be—the former bird having a black rump, while the latter has a beautiful crimson rump and a spotted breast. It was, however, afterwards discovered that the latter bird was a female, and that the male was jet-black on the breast and upper surface of the body. To *S. hæmatina,* however, no female has ever been discovered, and Dr. Hartlaub, in his standard work on the Birds of Western Africa, says, "Fœm. ignota." But, on looking through the large series of these birds in my collection, I was able to solve the mystery; for I am now in a position to declare that *S. hæmatina* is nothing but the perfectly adult male of *S. guttata.* The males, before they get fully adult, have black rumps; and the crimson colour is only gradually assumed; for I have now before me examples in which there is no trace of crimson on the rump, some where a slight lustre is apparent, and some where it is altogether fiery crimson. In the females it is apparently the same; for I have some with blackish rumps, while others show a tinge of crimson, which colour, in the adult birds, extends all over the rump.

XXXI.—*On the Nomenclature of the Foraminifera.* By W. K. Parker, F.R.S., T. Rupert Jones, F.G.S., and H. B. Brady, F.L.S., F.G.S.

[Continued from p. 179.]

97. *Soldania limia*, D'Orb. Pl. VIII. fig. 1.

"Hammoniæ circulares planissimæ," &c.; Soldani, Testac. vol. i. pt. 1. p. 62, pl. 53. fig. C. D'Orb. *op. cit.* p. 281. no. 4.

"*Hab.* The Mediterranean."

Without professing quite to understand the details of Soldani's figure, we have little hesitation in regarding this as a variety of *Cornuspira foliacea.* Figs. *A*, *B*, *C*, *D*, *G*, & *H*, pl. 47, are also either *Cornuspiræ* or *Spirillinæ.* They are of minute size (except fig. *H*), and hence were greatly misunderstood with the imperfect microscopes then in use. Larger specimens of Foraminifera were drawn by Soldani's artists much more true to nature, and often remarkably so.

98. *Soldania orbicularis*, D'Orb. Pl. VIII. fig. 2.

"Hammonia;" Soldani, Testac. vol. i. pt. 1. p. 60, pl. 47. fig. H. D'Orb. *op. cit.* p. 281. no. 5.

"*Hab.* The Mediterranean."

Whatever decision may be arrived at with respect to the last-named species must obtain also with this, which has the same characters, save that slight constrictions at the periphery appear to indicate in this form the partial subdivision of one or more turns of the spire into chambers. In both cases the earlier turns of the spire are not septated. With some hesitation, we are disposed to consider this also a subvarietal modification of *Cornuspira.* Possibly the septations have been deepened by the artist.

99. *Soldania annulata*, D'Orb. Pl. VIII. fig. 3.

"Hammonia trivoluta;" Soldani, Testac. vol. i. pt. 1. p. 59, pl. 47. fig. C. D'Orb. *op. cit.* p. 282. no. 6.

"*Hab.* The Mediterranean."

Very doubtful; either another aspect of *Cornuspira* or, perhaps, a granular *Spirillina*, in which the exostoses have been mistaken for small chambers, under a badly defining microscope. (See no. 97.)

100. *Vertebralina striata*, D'Orb. Pl. VIII. fig. 27.

"Lituus" &c.; Soldani, Testac. vol. i. pt. 1. p. 76, pl. 67. figs. *vv–zz*. D'Orb. *op. cit.* p. 283. no. 1.

"*Hab.* The Mediterranean, the Red Sea, and the South Seas at Rawack."

See notes on Models no. 22 and no. 81. (Fig. *zz* is copied.)

101. *Polystomella crispa*, Linné, sp. Pl. XII. fig. 154.

"Nautili *striati communes* (*crispi* Linnæi);" Soldani, Testac. vol. i. pt. 1. p. 54, pl. 34. figs. *cc*, *ee*, G, H. D'Orb. *op. cit.* p. 283. no. 1.

"*Hab.* The Atlantic shores of France, the Mediterranean, and the Adriatic."

See our note on Model no. 45. Fig. *ee* is *Polystomella striatopunctata*; the same figure is again referred to by D'Orbigny, at p. 289, as *Robulina sulcata*!

Fig. *cc* is an explanate *Polystomella*, like *P. macella* (Ann. N. H. ser. 3. vol. v. p. 104); *dd* is *Cristellaria cultrata*; *ee* & *ff* are forms of *P. striatopunctata* (Ann. N. H. *l.c.* p. 103); G & H are umbonate *P. crispæ*; K & L are *Rotaliæ*. Pl. 33. fig. F is also a good umbonate *P. crispa*. See Phil. Trans. vol. clv. pp. 399 &c.

102. *Polystomella strigillata*, F. & M. sp. Pl. XII. fig. 155.

"Nautili striati" &c.; Soldani, Testac. vol. i. pt. 1. p. 54, pl. 34. fig. I. D'Orb. *op. cit.* p. 284. no. 4.

"*Hab.* The Tau lagoon, and the coast of Africa, according to Fichtel and Moll." (Mediterranean, *Soldani*.)

This is umbilicate, and therefore cannot be F. & M.'s *P. strigillata*: on the contrary, it is a somewhat impoverished form, between *P. crispa* and *P. macella*, as, indeed, it stands in Soldani's arrangement on the plate.

103. *Peneroplis planatus*, F. & M. sp. Pl. VIII. fig. 28.

"Testæ hammoniformes seu *lituitatæ* semilunares;" Soldani, Testac. vol. i. pt. 1. p. 73, pl. 64. figs. M, Q. D'Orb. *op. cit.* p. 285. no. 1.

"*Hab.* The Mediterranean, New Holland, and Rawack."

See Ann. N. Hist. ser. 3. vol. v. p. 180, and vol. xv. p. 231, for notes on this common species. Soldani's plates 64, 65, 66, and figs. *rr*, *ss*, *tt* of pl. 67, are occupied with varieties and modified individuals of *Peneroplis* and its elongate Spiroline forms (*Coscinospira*), both perfect and worn. The first trivial name given to *Peneroplis* was "*pertusus*" by Forskål. See Ann. Nat. Hist. ser. 3. vol. xv. p. 231.

104. *Robulina cultrata*, Montfort, sp. Pl. X. fig. 84.

"Nautili (*Lenticulæ marginatæ*);" Soldani, Testac. vol. i. pt. 1. p. 54, pl. 33. figs. B &c. D'Orb. *op. cit.* p. 287. no. 1.

"*Hab.* Living in the Adriatic; fossil in the neighbourhood of Vienna." (Mediterranean, and fossil near Sienna, *Soldani.*)

See note on Model no. 82. In pl. 33, figs. *A* & *B* are both *Cristellaria cultrata*; fig. *C* (obscured with matrix or foreign matter), *E*, *aa*, *bb*, *mm*, and *nn* are *C. calcar*; fig. *D* is a young *C. cassis.*

105. *Robulina orbicularis*, D'Orb. Pl. X. fig. 81.

"Nuclei *conico-rotundati*;" Soldani, Testac. vol. ii. App. p. 138, pl. 1. figs. 12, *p*, *P*. D'Orb. *op. cit.* p. 288. no. 2.

"*Hab.* Fossil in the neighbourhood of Sienna." (Coroncina, *Soldani.*)

This is a carinate *Cristellaria vortex*, F. & M. sp., not differing materially from the next following.

106. *Robulina vortex*, Fichtel & Moll, sp. Pl. X. fig. 82.

"Nautili *globuli*;" Soldani, Testac. vol. i. pt. 1. p. 66, pl. 59. fig. *tt*. D'Orb. *op. cit.* p. 288. no. 4.

"*Hab.* Fossil at Coroncina."

A good subordinate form. Fig. *vv* is also a carinate *C. vortex* (Ann. N. H. ser. 3. vol. v. p. 113). Soldani rightly refers also to his pl. 1. fig. 12, *p*, *P*, in the "Appendix," as being the same; this was fossil at Coroncina, the other also being fossil in the Sienna district.

107. *Robulina Soldanii*, D'Orb. Pl. X. fig. 85.

"Nautili *globuli*;" Soldani, Testac. vol. i. pt. 1. p. 66, pl. 59. fig. *rr*. D'Orb. *op. cit.* p. 288. no. 5.

"*Hab.* Fossil, Coroncina." (Near Sienna, *Soldani.*)

This connects *Cristellaria vortex* with *C. cultrata.*

108. *Robulina marginata*, D'Orb. Pl. X. fig. 89.

"Nautili (*Lenticulæ marginatæ*);" Soldani, Testac. vol. i. pt. 1. p. 54, pl. 33. fig. D.

"Nautili læves (*Lenticulæ*);" ibid. fig. *mm*. D'Orb. *op. cit.* p. 288. no. 6.

"*Hab.* The Adriatic, near Rimini." (The Mediterranean, *Soldani.*)

Young examples of *Cristellaria cassis*, F. & M. sp., of simple character.

(D'Orbigny gives the first of his references to Soldani as fig. L, which is a manifest error, as there is no "L" on the plate. After careful consideration, we have come to the conclusion that D was intended.)

109. *Robulina radiata*, D'Orb. Pl. X. fig. 93.

"Nautili (*Lenticulæ radiatæ*);" Soldani, Testac. vol. i. pt. 1. p. 54, pl. 33. fig. *bb*. D'Orb. *op. cit.* p. 288. no. 7.

"*Hab.* The Mediterranean."

A small specimen of *Cristellaria calcar*, Linn. sp.

110. *Robulina pulchella*, D'Orb. Pl. X. fig. 94.

"Nautili (*Lenticulæ radiatæ*); Soldani, Testac. vol. i. pt. 1. p. 54, pl. 33. fig. *aa*. D'Orb. *op. cit.* p. 288. no. 8.

"*Hab.* The Mediterranean."

Another *Cristellaria calcar*: the septation not very clearly indicated.

111. *Robulina lævigata*, D'Orb. Pl. X. fig. 95.

"Nautilus;" Soldani, Testac. vol. i. pt. 1. p. 59, pl. 47. fig. E. D'Orb. *op. cit.* p. 288. no. 9.

"*Hab.* The Mediterranean."

Referable to the type *Cristellaria calcar*. The growth of the rowelled keel has been arrested, or possibly portions of it have been broken away.

112. *Robulina sulcata*, D'Orb. Pl. XII. fig. 156.

"Nautili striati;" Soldani, Testac. vol. i. pt. 1. p. 59, pl. 33. fig. *ee*. D'Orb. *op. cit.* p. 289. no. 10.

"*Hab.* The Mediterranean."

This is *Polystomella striatopunctata*, and does not belong to the Cristellarian type at all.

113. *Robulina rosacea*, D'Orb. Pl. X. fig. 90.

"Nautili læves (*Lenticulæ*);" Soldani, Testac. vol. i. pt. 1. p. 44, pl. 33. fig. *nn*. D'Orb. *op. cit.* p. 289. no. 11.

"*Hab.* The Mediterranean."

One of the spinous varieties of *Cristellaria*, which, though the keel is but little developed, might fairly be placed with *C. calcar*. It has apparently an umbonate centre (not an uncommon character in the type), with subsidiary granules giving a rose-like pattern.

114. *Robulina calcar*, Linné, sp. Pl. X. fig. 96.

"Nautilus *papillosus*;" Soldani, Testac. vol. i. pt. 1. p. 65, pl. 59. figs. *qq*, *rr*. D'Orb. *op. cit.* p. 289. no. 12.

"*Hab.* The Adriatic, near Rimini." (Fossil near Sienna, *Soldani.*)

This is a keeled but tuberculate variety *, and can scarcely be accepted as the representative of the type. It resembles more or less several of Fichtel and Moll's varieties, approaching their var. ε most nearly. Their *Nautilus papillosus* is granular on the septa, and lacks the spinous armature of the keel, and thus differs from Soldani's figures under the same name. We shall do best to accept the trivial name appended by Montfort to his copy of Fichtel and Moll's drawing (pl. 12. figs. *a–c*), *Cristellaria rostrata*, Montf. sp.

115. *Robulina aculeata*, D'Orb. Pl. X. fig. 91.

"Nautili carinati (*Lenticulæ*);" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 58. figs. *hh*, *mm*. D'Orb. *op. cit.* p. 289. no. 14.

"*Hab.* The Adriatic, near Rimini." (Fossil near Sienna, *Soldani.*)

Two forms of the typical *Cristellaria calcar*.

116. *Robulina Planciana*, D'Orb. Pl. XII. fig. 157.

"Lenticulæ;" Soldani, Testac. vol. ii. (not i. pt. 2) p. 110, pl. 26. fig. *O*. D'Orb. *op. cit.* p. 290. no. 20.

Hab. "Fossil in the neighbourhood of Sienna." (Clusentini, *Soldani.*)

This is a lenticular, umbilicate *Nonionina*, scarcely so thick relatively as most specimens of *N. umbilicatula*, but hardly worth separating from that species.

117. *Robulina rugosa*, D'Orb. Pl. IX. fig. 31.

"Lenticulæ;" Soldani, Testac. vol. ii. (not i. pt. 2) p. 110, pl. 26. fig. *N*. D'Orb. *op. cit.* p. 290. no. 21.

"*Hab.* Fossil in the neighbourhood of Sienna."

A nautiloid *Lituola*, sublenticular, and depressed at the umbilicus; septation entirely obscured by the rough texture of the exterior †. This may be accepted as a varietal form, closely allied to *L. canariensis*.

* Also Soldani, Sag. Oritt. p. 98, pl. 1. figs. 6, *J*.

† If the obscuration of the shell be due to rock-matrix, it may be doubtfully referred to *Cristellaria*.

118. *Robulina nitida*, D'Orb. Pl. XII. fig. 152.

Soldani, Testac. vol. ii. App. p. 141, pl. 7. figs. *zz*, *ZZ*. D'Orb. *op. cit.* p. 290. no. 22.

"*Hab.* Fossil at Coroncina." (Near Sienna and San Quirico, *Soldani*.)

This is from fossil shell-dust, and is probably an *Amphistegina*. In the Siennese Tertiary clays and sands (described in Quart. Journ. Geol. Soc. vol. xvi. p. 297 *et seq.*) *Amphistegina* occurs at Pienza, Montopoli, Castel-Arquato, and San Frediano.

119. *Robulina plicata*, D'Orb. Pl. X. fig. 80.

"Hammoniæ subrotundæ;" Soldani, Testac. vol. i. pt. 1. p. 61, pl. 50. fig. *cc*. D'Orb. *op. cit.* p. 290. no. 23.

"*Hab.* Fossil at Coroncina." (Mediterranean, *Soldani*.)

A small umbonate *Cristellaria*, not separable from *C. rotulata*. The posterior angle of each chamber is somewhat produced.

120. *Robulina rotundata*, D'Orb. Pl. X. fig. 92.

"Nautilus *Lenticula*;" Soldani, Testac. vol. i. pt. 1. p. 66, pl. 60. fig. *yy*. D'Orb. *op. cit.* p. 290. no. 24.

"*Hab.* The Adriatic." (Fossil near Sienna, *Soldani*.)

A damaged specimen of a limbate *Cristellaria calcar*.

121. *Cristellaria consecta*, D'Orb. Pl. XI. fig. 100.

"Litui *crispati* et *orbiculi*;" Soldani, Testac. vol. i. pt. 1. p. 63, pl. 55. figs. A, C, E, G.

"Nautili *Lituitati*;" Id. ibid. p. 64, pl. 57. fig. X. D'Orb. *op. cit.* p. 290. no. 1.

"*Hab.* Fossil at Coroncina." (Near Sienna and San Quirico, *Soldani*.)

This is the *Nautilus cassis*, var. δ, of Fichtel and Moll ("*le Pharame perlé*" of De Montfort), which differs from their other varietal forms in the absence of beaded ornament on the early chambers and over the sutural lines. A trivial name is perhaps more convenient than the Greek letter; and on this ground De Montfort's term (latinized) *margaritacea* may be accepted. (Pl. 55. fig. A, is copied.)

122. *Cristellaria navicularis*, Montfort, sp. Pl. XI. fig. 101.

"Litui *crispati* et *orbiculi*;" Soldani, Testac. vol. i. pt. 1. p. 63, pl. 55. figs. B, D. D'Orb. *op. cit.* p. 290. no. 2.

"*Hab.* Fossil at Coroncina." (Near Sienna and San Quirico, *Soldani*.)

A subvarietal modification of *C. cassis*, F. & M., in which the chambers take on the Flabelline character to a very considerable extent. De Montfort copied Soldani's figure under the name *Scortimus navicularis*. Fig. *C* also, and others figured by Soldani, show the Flabelline tendency. See also fig. 86, which, however, is both limbate and tuberculate.

123. *Cristellaria cassis*, F. & M. sp. Pl. X. fig. 86.

"Litui *crispati* et *orbiculi*;" Soldani, Testac. vol. i. pt. 1. p. 63, pl. 56. figs. I, K, &c. &c. D'Orb. *op. cit.* p. 290. no. 3.

"*Hab.* Living in the Adriatic, near Rimini; fossil at Sienna." (Fossil at San Quirico and near Sienna, *Soldani.*)

A full-grown limbate variety, with tubercles on the early chambers.

Figs. *L, M, N, O, P, Q,* & *R* also represent *C. cassis*.

See notes on Models nos. 44 and 83; and Ann. N. H. ser. 3. vol. v. p. 115.

124. *Cristellaria Soldanii*, D'Orb. Pl. X. fig. 87.

"Litui *crispati* et *orbiculi*;" Soldani, Testac. vol. i. pt. 1. p. 63, pl. 56. fig. H. D'Orb. *op. cit.* p. 290. no. 4.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

Without tubercles, but with a limbate border to the outer edge of each segment. Similar in general contour to *C. consecta*, no. 121 (*margaritacea*).

125. *Cristellaria nitida*, D'Orb. Pl. X. fig. 88.

"Nautili *Lituitati*;" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 56. figs. O, P. D'Orb. *op. cit.* p. 291. no. 4.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

Soldani's figures referred to by D'Orbigny are unsatisfactory as affording a basis for a distinct name. They are somewhat irregular suborbicular *Cristellaria cassis*, with a more or less limbate septa and some scattered umbilical granules.

126. *Cristellaria marginata*, D'Orb. Pl. XI. fig. 99.

S. "Nautilus *hystrix marginatus*;" T. "Nautilus *Echinus*;" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 57. figs. S, T. D'Orb. *op. cit.* p. 291. no. 7.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

Two subvarieties of *C. calcar*. Fig. S (like the next, fig. S *s*) shows no segmentation, but has traces of umbilical radiate limbation, and numerous widely scattered granules over the round part of the shell. Thus it somewhat approaches the better formed figs. *qq*, *rr*, pl. 59 (no. 114). Fig. T is an orbicular rowelled *C. calcar*, with beaded septa, like Fichtel and Moll's var. γ, pl. 11. figs. *g*, *h*, in their 'Test. Micr.,' and comparable with their var. ϵ, which is named "perlé" (*margaritacea*) by De Montfort.

Fig. S, which we have copied, seems to come under *C. rostrata*, Montf. sp. (no. 114).

127. *Cristellaria elongata*, D'Orb. Pl. X. fig. 76.

"Nautili *Lituitati*: *aa*, *bb*, *Ligulæ*; *cc*, *Cuspis*;" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 58. figs. *aa*, *bb*, *cc*. D'Orb. *op. cit.* p. 292. no. 11.

"*Hab.* Fossil at Coroncina." (Near Sienna and San Quirico, *Soldani.*)

This is a keeled subvariety of *Cristellaria crepidula*, F. & M. sp. (Fig. *aa* is copied.)

In the preceding pl. 57, figs. *V*, *X*, *Y*, & *Z* clearly exhibit passages from *C. cassis* to *C. crepidula*, as arranged by Soldani.

128. *Cristellaria bilobata*, D'Orb. Pl. X. fig. 78.

"Nautilus *Lituitatus*, *Ligula*:" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 57. fig. Z. D'Orb. *op. cit.* p. 292. no. 12.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

Inseparable from *C. crepidula*, except that it is carinate (see also nos. 48 & 127).

129. *Cristellaria aculeata*, D'Orb. Pl. XI. fig. 97.

"*Lituus innominatus*;" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 57. fig. T *t*. D'Orb. *op. cit.* p. 292. no. 14.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

This is a very doubtful shell. If we accept it as a Foraminifer, it is more out of deference to the generally clear perception shown by Soldani than from any conviction the figure carries with it. The drawing shows no septation and no Cristellarian aperture, only a spirally coiled shell, thickly studded with tubercles, which at the margin run into spines. If it be a Foraminifer, it may be regarded as a granular or tuberculate variety of *C. calcar*, and as such nearly related to *C. rostrata*, Montfort, sp.

130. *Cristellaria tuberculata*, D'Orb. Pl. XI. fig. 102.

"Nautilus lituitatus;" Soldani, Testac. vol. ii. p. 13, pl. 1. fig. *A*. D'Orb. *op. cit.* p. 292. no. 21.

"*Hab.* The Adriatic." (Rare, fossil, at San Quirico, and not found by Soldani elsewhere.)

An intermediate variety. General contour like *C. rotulata* or *C. acutauricularis*, but having broadly and irregularly limbate septa, and strongly tuberculate flattish centre, like some varieties of *C. cassis*. The margin is bluntly dentated by the projecting septal ribs; there is no carina. It will be well to recognize this as a subordinate suborbicular form of *C. cassis*.

131. *Cristellaria elegans*, D'Orb. Pl. XI. fig. 103.

"*Lituus elegans*;" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 56. fig. Q. D'Orb. *op. cit.* p. 293. no. 24.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

The specimen figured by Soldani is not a very good one; it apparently represents a shell with somewhat thinner edge than the last named, and with the posterior angles of the chambers exserted, but not otherwise differing materially from it. The name *C. tuberculata* may well cover wider distinctions than exist between these two forms.

132. *Cristellaria papillosa*, D'Orb. Pl. XI. fig. 98.

"Nautilus *papillosus*;" Soldani, Testac. vol. i. pt. 1. p. 66, pl. 59. fig. *ss.* D'Orb. *op. cit.* p. 293. no. 25.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

A minute and probably a young shell. It belongs to the spinous and tuberculate series, of which *Cristellaria rostrata*, Montfort, sp., may be taken as the best developed type.

133. *Cristellaria* (*Saracenaria*) *Italica*, Defrance. Pl. X. fig. 79.

"*Nautili* (*Seminula*) *tricostulati*;" Soldani, Testac. vol. i. pt. 1. p. 62, pl. 53. figs. A, B. D'Orb. *op. cit.* p. 293. no. 26.

"*Hab.* Living in the Adriatic, near Rimini; fossil in the neighbourhood of Sienna." (Mediterranean and fossil at San Quirico and Sienna, *Soldani.*)

See notes on D'Orbigny's Models nos. 19 and 85. (Fig. A is copied.)

134. *Nonionina melo*, D'Orb. Pl. XII. fig. 158.

"Nautilus *Melo*;" Soldani, Testac. vol. ii. p. 33, pl. 8. figs. *zz, A, B, C.* D'Orb. *op. cit.* p. 293. no. 4.

"*Hab.* Fossil at Coroncina." (Near Sienna, *Soldani.*)

This is *Nonionina pompilioides*, F. & M. sp. (Fig. *C* is copied.)

135. *Nonionina umbilicata*, D'Orb. Pl. XII. fig. 135.

"Nautilitæ;" Soldani, Testac. vol. i. pt. 1. p. 66, pl. 60. fig. B. D'Orb. *op. cit.* p. 293. no. 5.

"*Hab.* Living in the Adriatic, near Rimini, and in the

Mediterranean; fossil at Bordeaux and at Sienna." (Fossil near Sienna, *Soldani.*)

Soldani's figure does not represent the same form as D'Orbigny's Model no. 86, though references to both are given by the latter. The model is the subglobular form known as *N. pompilioides*, F. & M., whilst Soldani's figure, associated with other nearly symmetrical *Planorbulinæ* (figs. A–E, near *Pl. ammonoides*), arranged by him at the end of the Cristellarian series, is a large, subconvex, and neatly made Truncatuline *Planorbulina*, nearly allied to *Pl. Lamarckiana*, D'Orb. sp., 'For. Canar.' 1839, pl. 2. figs. 13–15, and like some individuals of *Pl. rotula*, D'Orb. sp., For. Foss. Vien. pl. 10. figs. 10–12. Only one face is figured. (The next figure in this group of forms, about which Soldani was doubtful, is fig. *F*, in pl. 61, representing *Trochammina inflata*, J. & P.)

136. *Biloculina bulloides*, D'Orb. Pl. VIII. fig. 4.

"Frumentaria* *Ovula*;" Soldani, Testac. vol. i. pt. 3. p. 228, pl. 153. figs. *R, S.* D'Orb. *op. cit.* p. 297. no. 1.

"*Hab.* Living in the Adriatic, near Rimini; fossil in the neighbourhood of Paris and of Bordeaux." (Mediterranean, and fossil near Sienna, *Soldani.*)

This is *Biloculina ringens*, Lamk. See note on Model no. 90, and Ann. Nat. Hist. ser. 3. vol. v. p. 469. (Fig. *S* is copied.)

137. *Biloculina elongata*, D'Orb. Pl. VIII. fig. 6.

"Frumentaria *Ovula*;" Soldani, Testac. vol. i. pt. 3. p. 228, pl. 153. figs. *M, Q.* D'Orb. *op. cit.* p. 298. no. 4.

"*Hab.* Fossil at Pauliac (Gironde)." (Mediterranean, and fossil(?) near Sienna, *Soldani.*)

The feeble attenuated variety, common in shallow water. See Phil. Trans. vol. clv. p. 409, pl. 17. figs. 88, 90, 91.

138. *Biloculina depressa*, D'Orb. Pl. VIII. fig. 5.

"Frumentaria *Lenticulæ*;" Soldani, Testac. vol. i. pt. 3. p. 231, pl. 156. figs. *yy, zz.* D'Orb. *op. cit.* p. 298. no. 7.

"*Hab.* Living in the Adriatic, near Rimini; fossil at Castel-Arquato." (Mediterranean, *Soldani.*)

See note on Model no. 91, and Phil. Trans. vol. clv. p. 409.

* "Seminula maris," "Sitomojas," &c. (p. 223).

139. *Spiroloculina depressa*, D'Orb. Pl. VIII. fig. 23.

"Frumentaria *Sigma* et *Rhombos*;" Soldani, Testac. vol. i. pt. 3. p. 229, pl. 155. fig. *kk*. D'Orb. *op. cit.* p. 298. no. 1.

"*Hab.* Recent in the Mediterranean; fossil at Castel-Arquato." (Mediterranean, and probably fossil at Clusentino &c., *Soldani*.)

See note on Model no. 92. It is the *Spiroloculina planulata* of Lamarck, Ann. N. H. ser. 3. vol. v. p. 236.

140. *Spiroloculina nitida*, D'Orb. Pl. VIII. fig. 24.

"Frumentaria *Sigma* et *Rhombos*;" Soldani, Testac. vol. i. pt. 3. p. 230, pl. 155. figs. *ll*, *mm*. D'Orb. *op. cit.* p. 298. no. 4.

"*Hab.* The Atlantic shores of France." (Mediterranean, and probably fossil at Clusentino &c., *Soldani*.)

An attenuated variety of *S. planulata*.

Soldani here refers to his other figures of *Spiroloculinæ* (limbate varieties), 'Appendix,' pl. 9. figs. 52, *t*, *T*, *V*, and vol. i. pt. 1. pl. 61. figs. I, K, L, M.

141. *Spiroloculina limbata*, D'Orb. Pl. VIII. fig. 22.

"Frumentaria *Sigma* et *Rhombos*;" Soldani, Testac. vol. ii. p. 54, pl. 19. fig. *m*. D'Orb. *op. cit.* p. 299. no. 12.

"*Hab.* Fossil at Castel-Arquato." (Borro Cieco, *Soldani*.)

A bold variety, with inflated chambers.

142. *Spiroloculina rotundata*, D'Orb. Pl. VIII. fig. 25.

"Frumentaria *Sigma* et *Rhombos*;" Soldani, Testac. vol. i. pt. 3. p. 229, pl. 154. fig. *hh*, and pl. 155. fig. *ii*. D'Orb. *op. cit.* p. 299. no. 14.

"*Hab.* The Mediterranean."

A large round-edged variety of *S. planulata*, nearly circular in contour.

143. *Spiroloculina plicata*, D'Orb. Pl. VIII. fig. 26.

"Frumentaria *Sigma* et *Rhombos*;" Soldani, Testac. vol. i. pt. 3. p. 229, pl. 155. fig. *nn*. D'Orb. *op. cit.* p. 299. no. 15.

"*Hab.* The Mediterranean."

General outline similar to that of *S. nitida*; but the ultimate chamber is comparatively very large and crenate on its surface, the depressions running inwards from the outer margin.

144. *Triloculina gibba*, D'Orb. Pl. VIII. fig. 7.

"Frumentaria tricostata;" Soldani, Testac. vol. i. pt. 3. p. 232, pl. 157. figs. *I*, *K*. D'Orb. *op. cit.* p. 299. no. 3.

"*Hab.* Living in the Adriatic, near Rimini, and in the

South Seas at Rawack; fossil at Castel-Arquato." (Mediterranean, *Soldani.*)

A compactly made *Triloculina*, of the angular type, but lacking the equilateral regularity of *T. tricarinata* and *T. trigonula.*

145. *Triloculina reticulata*, D'Orb. Pl. VIII. fig. 18.

"Frumentaria *reticulata*;" Soldani, Testac. vol. i. pt. 3. p. 233, pl. 159. figs. *bb*, *cc*. D'Orb. *op. cit.* p. 299. no. 9.

"*Hab.* Recent in the Mediterranean, at the Island of St. Helena, and Shark Bay, Australia."

If there be any value of subgeneric sort in the number of visible chambers, the specimens indicated by these figures belong to *Quinqueloculina* rather than *Triloculina.*

146. *Triloculina inflata*, D'Orb. Pl. VIII. fig. 16.

"Frumentarium *nautiliforme*;" Soldani, Testac. vol. i. pt. 3. p. 233, pl. 159. fig. *aa*. D'Orb. *op. cit.* p. 300. no. 10.

"*Hab.* Recent in the Mediterranean; fossil in the neighbourhood of Dax, of Bordeaux, and of Soissons, and at Castel-Arquato." (Isola del Giglio, Mediterranean; and Rimini, Adriatic, *Soldani.*)

Apparently an irregular loose-growing *Quinqueloculina*; but it might with almost equal justice be placed under D'Orbigny's genus *Hauerina.* Well-developed specimens of this latter genus are very rare in a recent condition; whilst ill-grown *Quinqueloculinæ*, like the figures, are common in littoral sands and muddy shallows.

147. *Triloculina tricostata*, D'Orb. Pl. VIII. fig. 20.

"Frumentaria *fœniculum*;" Soldani, Testac. vol. i. pt. 3. p. 229, pl. 154. fig. *Y*. D'Orb. *op. cit.* p. 300. no. 21.

"*Hab.* Fossil in the neighbourhood of Paris." (Mediterranean and Adriatic, *Soldani.*)

Apparently a young or few-ribbed specimen of *Quinqueloculina pulchella.* D'Orbigny, in his Vienna-Basin Monograph, figures a beautiful example of the same form under the name of *Q. Josephina.* When the number of costæ modifies to any extent the general morphological characters of the test, it may become a character of some subordinate value; but, taken by itself, it entirely breaks down as a specific or even varietal distinction.

148. *Triloculina Brongniartii*, D'Orb. Pl. VIII. fig. 9.

"Frumentaria *fœniculum*;" Soldani, Testac. vol. i. pt. 3. p. 229, pl. 154. figs. *bb*, *cc*. D'Orb. *op. cit.* p. 300. no. 23.

"*Hab.* The Antilles, and fossil at Castel-Arquato." (Mediterranean and Adriatic, *Soldani.*)

Though Soldani's figures are not without indications of the Quinqueloculine arrangement of chambers, they may be accepted as comprehending the finely striate Triloculine *Miliolæ*; and we may allow Walker & Jacob's trivial name (*Q. bicornis*) to stand for the *Quinqueloculinæ* having similar ornamentation.

149. *Quinqueloculina aspera*, D'Orb. Pl. VIII. fig. 11.

"Frumentaria *Seminula*;" Soldani, Testac. vol. i. pt. 3. p. 228, pl. 152. fig. *B*. D'Orb. *op. cit.* p. 301. no. 11.

"*Hab.* The Mediterranean."

We can find nothing in Soldani's figure to justify the name "*aspera*." So far as appears, it represents only a flattish outspread example of the type *Q. seminulum*.

150. *Quinqueloculina vulgaris*, D'Orb. Pl. VIII. fig. 15.

"Frumentaria *Seminula*;" Soldani, Testac. vol. i. pt. 3. p. 228, pl. 152. fig. *E*. D'Orb. *op. cit.* p. 302. no. 33.

"*Hab.* The Mediterranean; the Adriatic, near Rimini; and the Antilles."

See note on no. 152, *Quinqueloculina secans*, to which species we refer this form.

151. *Quinqueloculina pulchella*, D'Orb. Pl. VIII. fig. 19.

"Frumentaria *Seminula*," &c.; Soldani, Testac. vol. ii. p. 53, pl. 18. fig. *f*. D'Orb. *op. cit.* p. 303. no. 42.

"*Hab.* The Atlantic shores of France, and the Mediterranean." (Fossil at Borro Cieco, *Soldani.*)

The two figures *e* on the same plate manifestly belong to the same species. This name takes precedence for the varieties of *Quinqueloculina* having strong, bold, longitudinal costæ, and may include all such forms as *Q. Schreibersii*, D'Orb. For. Foss. Vien. p. 296, pl. 19. figs. 22–24.

152. *Quinqueloculina secans*, D'Orb. Pl. VIII. fig. 14.

"Frumentaria *Seminula*;" Soldani, Testac. vol. i. pt. 3. p. 228, pl. 152. fig. *C*. D'Orb. *op. cit.* p. 303. no. 43.

"*Hab.* The Adriatic and the Mediterranean." (Mediterranean, *Soldani.*)

We shall do best to take D'Orbigny's Model no. 96, rather than the Soldanian figures referred to, as the type of *Q. secans*; and with this in view we have no hesitation in placing No. 150 (*Q. vulgaris*), as well as the drawings indicated in the reference given above, under the same species. Indeed the drawing named *Q. vulgaris* by D'Orbigny more nearly resembles the "Model" than those do to which he gives the name *Q. secans*.

153. *Quinqueloculina seminulum*, Linné, sp. Pl. VIII. fig. 10.

"Frumentaria *Seminula*;" Soldani, Testac. vol. i. pt. 3. p. 228, pl. 152. fig. *A*. D'Orb. *op. cit.* p. 303. no. 44.

"*Hab.* The shores of France and England, the Adriatic and the Mediterranean; fossil at Castel-Arquato." (Mediterranean, *Soldani*.)

Amongst all Soldani's figures we do not find one that is quite a good representative of the central type of the Milioline group. Possibly that selected by D'Orbigny is as near as any, but it approaches *Q. bicornis* in the partial striation of the later chambers.

154. *Quinqueloculina longirostris*, D'Orb. Pl. VIII. fig. 8.

"Frumentaria *Seminula*;" Soldani, Testac. vol. i. pt. 3. p. 228, pl. 152. figs. *F, H*. D'Orb. *op. cit.* p. 303. no. 46.

"*Hab.* Fossil at Castel-Arquato." (Mediterranean, *Soldani*.)

A feeble intermediate form, best disposed of by being placed under *Triloculina oblonga*, Montagu, sp.

155. *Quinqueloculina Soldanii*, D'Orb. Pl. VIII. fig. 17.

"Frumentaria *Seminula*;" Soldani, Testac. vol. i. pt. 3. p. 228, pl. 152. fig. *D*. D'Orb. *op. cit.* p. 303. no. 48.

"*Hab.* The Mediterranean."

An attenuated variety of *Q. seminulum*, with partial striation at the base of the chambers.

156. *Adelosina lævigata*, D'Orb. Pl. VIII. fig. 12.

"Frumentaria *phialiformia lævia*;" Soldani, Testac. vol. i. pt. 3. p. 232, pl. 158. figs. *S, T, U*. D'Orb. *op. cit.* p. 304. no. 1.

"*Hab.* Fossil at Castel-Arquato." (Mediterranean, *Soldani*.)

The genus *Adelosina*, instituted by D'Orbigny and adopted by some subsequent writers, has by common consent been abandoned, since it has been shown that it only represents a stage in the life-history of *Quinqueloculina*. The figures referred to are probably the young of *Q. secans* (*S*) and *Q. seminulum* (*T, U*).

157. *Adelosina semistriata*, D'Orb. Pl. VIII. fig. 13.

"Frumentaria *phialiformia striatula*;" Soldani, Testac. vol. i. pt. 3. p. 232, pl. 158. fig. *R*. D'Orb. *op. cit.* p. 304. no. 3.

"*Hab.* The Adriatic, near Rimini." (Mediterranean, *Soldani.*)

Fig. *Q* on the same plate would have better accorded with the names *semistriata* and *striatula*. It is true that *R* may be the young of a striate or even costate form.

158. *Adelosina Soldanii*, D'Orb. Pl. VIII. fig. 21.

"Frumentaria *phialiformia striatula*;" Soldani, Testac. vol. i. pt. 3. p. 232, pl. 157. fig. *M*. D'Orb. *op. cit.* p. 304. no. 4.

"*Hab.* The Adriatic, near Rimini." (Mediterranean, *Soldani.*)

This (like pl. 158. fig. *P*) is the young of *Quinqueloculina pulchella*.

APPENDIX.

To render it complete, our review of Soldani's 'Testaceographia' and of the 'Tableau Méthodique' still requires a few remarks concerning subsequent references made by D'Orbigny either to figures in Soldani's works not alluded to in the 'Tableau,' or to species alluded to in the 'Tableau' without description or reference to any illustration.

The memoirs which thus aid us in determining the meaning of the author with respect to a few out of the very large number of species enumerated in the 'Tableau,' which would otherwise lapse for want of definition, are those on the recent Foraminifera of Cuba, of the Canaries, and of South America, and on the fossil Foraminifera of the Vienna Basin.

We do not propose at present to speak generally of the Foraminifera described in these works, but to confine ourselves to the few species which stand in some relation either to the 'Testaceographia' or to the 'Tableau Méthodique.'

There is just a little difficulty in settling the order of precedence of the three first-named monographs. The best known edition of the Cuba memoir is the folio, written in Spanish and published in Paris in 1840; but we find that an earlier octavo edition in French, without plates, was issued in

1839. This has the following note, which does not appear in the folio work :—

"Indépendamment des espèces de Cuba décrites dans cet ouvrage, nous publions en ce moment trois autres faunes locales : 1, celle des Canaries, dans l'ouvrage de MM. Webb et Berthelot, Histoire naturelle des îles Canaries ; 2, celle de l'Amérique méridionale, dans notre Voyage dans l'Amérique méridionale (une partie spéciale) ; 3, faune de la craie blanche du bassin de Paris, dans les Mémoires de la Société géologique de France." (Footnote, p. xlvii.)

This note, and the fact that references are made in the two shorter papers to the 'Cuba,' determine the order which should be adopted in any question of precedence.

§ 1. D'ORBIGNY'S FORAMINIFERA OF THE ISLAND OF CUBA.

D'Orbigny, in his Cuba Monograph—'Historia fisica, politica y natural de la Isla de Cuba : por D. Ramon de la Sagra ; Foraminiferas por Alcides D'Orbigny,' folio (pp. 180, 12 plates), Paris, 1840 [the French edition (8vo) was published in 1839]—describes and figures a few species enumerated in the 'Tableau Méthodique,' of which no previous description or reference to figures had been published, namely :—

1. *Cristellaria gibba*, D'Orb.

Cristellaria gibba, D'Orb. Ann. Sci. Nat. vol. vii. p. 292. no. 17 ; Foram. Cuba, p. 63, pl. 7. figs. 20, 21.

"*Hab.* The Antilles, and the Mediterranean near Corsica."

This subvariety stands between *C. rotulata* and *C. italica.*

2. *Dendritina antillarum*, D'Orb.

Dendritina antillarum, D'Orb. Ann. Sci. Nat. vol. vii. p. 285. no. 3 ; Foram. Cuba, p. 77. no. 21, pl. 7. figs. 3–6.

"*Hab.* The sands of the island of Cuba, rare."

A flattish specimen of *D. arbuscula* ; Ann. Nat. Hist. ser. 3, vol. v. pp. 179, 180.

3. *Rosalina squamosa**, D'Orb.

Rotalia squamosa, D'Orb. Ann. Sci. Nat. vol. vii. p. 272. no. 8.
Rosalina squamosa, D'Orb. Foram. Cuba, p. 100. no. 43, pl. 3. figs. 12–14.

"*Hab.* Found plentifully, by D. Ramon de la Sagra, adhering to seaweeds on the shores of Cuba. Occurs also about Jamaica and other of the West-India Islands."

* Misspelt "*squammosa*" by D'Orbigny throughout.

Figs. 18–20, in pl. 3 (*Rosalina Poeyi*, D'Orb.), represent the typical *Cymbalopora Poeyi* (Carpenter's 'Introd. Foram.' 1862, p. 215). *R. squamosa*, D'Orb., is the high-coned, livid-coloured, purple-topped *Cymbalopora* of the West Indies, common in shallow-water shell-beds, especially with *Strombus gigas*. Figs. 2–5 of the same plate (*Ros. bulloides*, D'Orb.) is a closed-in polystomellous form of the same, and is common in the tropics, both east and west. In *C. bulloides* the last septal wall closes in the whole umbilical face, and is multi-perforate, with large passages similar to those on its isomorph *Orbulina* (formed of *Globigerina* in an analogous manner) and in the wild Spirilline forms of *Pulvinulina* (Phil. Trans. vol. clv. p. 390).

4. *Rosalina opercularis*, D'Orb.

Rosalina opercularis, D'Orb. Ann. Sci. Nat. vol. vii. p. 271. no. 7; Foram. Cuba, p. 101. no. 45, pl. 3. figs. 24, 25, and pl. 4. fig. 1.

"*Hab.* The sands of Cuba and Martinique."

This is a subvariety of *Discorbina parisiensis*, with linear ornamentation on the concave face (Phil. Trans. vol. clv. p. 385).

5. *Rosalina semistriata*, D'Orb.

Rosalina semistriata, D'Orb. Ann. Sci. Nat. vol. vii. p. 271. no. 3; Foram. Cuba, p. 102. no. 47, pl. 3. figs. 15–17.

"*Hab.* The sands of the islands of Cuba, Jamaica, and Martinique."

An outspread and prickly *Discorbina*, related (as shown by gradations of form) to the high conical varieties of *D. pileolus*, D'Orb. sp., which connects *D. rosacea* with *D. parisiensis* mentioned above.

6. *Rosalina valvulata*, D'Orb.

Rosalina valvulata, D'Orb. Ann. Sci. Nat. vol. vii. p. 271. no. 4; Foram. Cuba, p. 103. no. 48, pl. 3. figs. 21–23.

"*Hab.* The sands of Cuba, Jamaica, Martinique, and other islands of the West Indies."

An inconspicuous subvariety of *Discorbina rosacea*; small and not fully developed. See the foregoing.

7. *Textularia cuneiformis*, D'Orb.

Textularia cuneiformis, D'Orb. Ann. Sci. Nat. vol. vii. p. 263. no. 18; Foram. Cuba, p. 138. no. 77, pl. 1. figs. 37–39.

"*Hab.* Fossil at Castel-Arquato; living in the sands of Cuba."

A narrow, many-chambered *Textularia*, belonging to the *T. sagittula* group.

8. *Triloculina suborbicularis*, D'Orb.

Triloculina suborbicularis, D'Orb. Ann. Sci. Nat. vol. vii. p. 300. no. 12; Foram. Cuba, p. 156. no. 94, pl. 10. figs. 9–11.

"*Hab.* Fossil at Castel-Arquato; recent in sands from the Antilles."

D'Orbigny figures in the Cuba Monograph three Triloculine *Miliolæ*, all with surface-ornamentation of delicate, parallel, longitudinal striæ, viz. *Triloculina Brongniartiana*, *Tr. Fichteliana*, and *Tr. suborbicularis*. These differ only in that ever variable character, the contour of the test, as determined by the greater or less ventricosity of the individual chambers. We propose to include all these under the term *T. Brongniartii*, the term applied by D'Orbigny to Soldani's figures.

We may here note that figs. 12–14, pl. 10 (*Triloculina labiosa*, D'Orb.), represent a Milioline form very closely approaching Reuss's genus *Chilostomella* in form.

Some Soldanian figures and some of the illustrations of the 'Tableau Méthodique' are referred to in the Cuba Monograph with respect to the following species; a detailed account has been previously given of each of these:—*Lingulina carinata*, pl. 1. figs. 13, 14; *Cristellaria crepidula*, pl. 8. figs. 17, 18; *Orbiculina numismalis*, pl. 8. figs. 4–16; *Rotalina* [*Planorbulina*] *rosea*, pl. 3. figs. 9–11; *Rosalina Parkinsoniana* [*Rotalia Beccarii*], pl. 4. figs. 25–27; *Calcarina calcar*, pl. 5. figs. 22–24; *Planorbulina vulgaris* (*mediterranensis* in 'Tabl. Méth.'), pl. 6. figs. 11–15; *Triloculina oblonga*, pl. 10. figs. 3–5; and *Triloculina Brongniartiana* (called *Tr. Brongniartii* in the 'Tabl. Méth.'), pl. 10. figs. 6–8.

§ 2. D'ORBIGNY'S FORAMINIFERA OF THE CANARIES.

Species enumerated in the 'Tableau Méthodique,' and subsequently described and figured (for the first time) by D'Orbigny in his memoir on the Foraminifera of the Canaries, 'Histoire Naturelle des îles Canaries, par MM. P. Barker-Webb et Sabin Berthelot. Paris, 1835–49. Vol. II. Partie Foraminifères,' pp. 121–146, 3 planches, 4to, Paris, 1839. In this memoir the author refers his readers to the Cuba Monograph for the generic characters of the Foraminifera; therefore the latter book takes precedence of date.

1. *Rotalina contecta*, D'Orb.

Gyroïdina contecta, D'Orb., Ann. Sci. Nat. vol. vii. p. 278. no. 7.
Rotalina contecta, D'Orb., Foram. Canaries, p. 131. no. 17, pl. 2. figs. 16–18.

"*Hab.* In the Adriatic near Rimini, common; at the island of Teneriffe, less abundant."

This is an umbonate *Planorbulina*, and may be said to be a thick, arrested form, belonging to the *Pl. ammonoïdes* group, and related to *Pl. Haidingeri* and *Pl. rosea*, agreeing with the last in its umbonate condition. (Phil. Trans. vol. clv. p. 379.)

2. *Rosalina valvulata*, D'Orb.

Rosalina valvulata, D'Orb. Ann. Sci. Nat. vol. vii. p. 271. no. 4; Foram. Canaries, p. 136. no. 28, pl. 2. figs. 19–21.

"*Hab.* Cape Carbet, Martinique; the island of Teneriffe; the Antilles."

This is an outspread and nearly squamate form of *Discorbina rosacea*; Phil. Trans. vol. clv. p. 385.

3. *Quinqueloculina lævigata*, D'Orb.

Quinqueloculina lævigata, D'Orb. Ann. Sci. Nat. vol. vii. p. 301. no. 6; Foram. Canaries, p. 143. no. 43, pl. 3. figs. 31–33.

"*Hab.* Fossil in the neighbourhood of Paris; living, but very rare, on the shores of Teneriffe."

There is no characteristic feature by which the form figured by D'Orbigny can be separated from the type *Q. seminulum*.

Soldani's figures are referred to in the Canaries Monograph with respect to the following species, all of which are redrawn for the work. As these have already been treated of in detail, a mere enumeration of their names will suffice.

Lingulina carinata, p. 124, pl. 1. figs. 5, 6; *Globigerina bulloides*, p. 132, pl. 2. figs. 1–3; *Planorbulina vulgaris*, p. 134, pl. 2. fig. 30; *Truncatulina lobata*, p. 134, pl. 2. figs. 22–24; *Truncatulina variabilis*, p. 135, pl. 2. fig. 29; and *Textularia sagittula*, p. 138, pl. 1. figs. 19–21.

The *Planorbulina vulgaris* is the *Pl. mediterranensis* of the 'Tableau Méthodique.'

§ 3. D'ORBIGNY'S FORAMINIFERA OF SOUTH AMERICA.

Species mentioned in the 'Tableau Méthodique,' and subsequently described and figured by D'Orbigny in the Voyage dans l'Amérique Méridionale (le Brésil, la République Orientale de l'Uruguay, la République Argentine, la Patagonie, la République du Chili, la République de Bolivia, la République du Pérou), exécuté pendant les années 1826–33. Par Alcide D'Orbigny. Vol. V. 5e partie, Foraminifères. 4to, Paris, 1839. In this monograph references are made to that of the Canaries; and this fact decides the order of date.

1. *Polystomella Lessonii*, D'Orb.

Polystomella Lessonii, D'Orb. Ann. Sci. Nat. vol. vii. p. 284. no. 6; Voy. Amér. Mérid. p. 29. no. 17, pl. 3. figs. 1, 2.

"*Hab.* The shores of Patagonia, to the south of the mouth of the Rio Negro, and in sands from the Falkland Islands."

This appears to be a subvariety of *Polystomella macella*, F. & M.

Soldani's figures of *Globigerina bulloides* are referred to amongst other representations of the same species in this work (p. 9, *note*, & p. 37); no fresh drawing of it is given.

§ 4. D'ORBIGNY'S FOSSIL FORAMINIFERA OF THE VIENNA BASIN.

Eight other species enumerated in the 'Tableau Méthodique' were without reference to figures or definition of characters until the publication of D'Orbigny's Vienna-Basin Monograph in 1846 (Foraminifères fossiles du Bassin tertiaire de Vienne, par Alcide d'Orbigny. 4to, Paris, 1846). They are as follow:—

1. *Textularia carinata*, D'Orb.

Textularia carinata, Ann. Sci. Nat. vol. vii. p. 263. no. 23; For. Foss. Vien. p. 247, pl. 14. figs. 32–34.

"*Hab.* Living at Rimini, in the Adriatic; fossil at Coroncina, near Sienna, and at Nussdorf, in Austria."

A good subvarietal form of *Textularia*, with limbate sutures and a wide, thin, dentate, marginal carina.

2. *Clavulina communis*, D'Orb.

Clavulina communis, Ann. Sci. Nat. vol. vii. p. 268. no. 4; For. Foss. Vien. p. 196, pl. 12. figs. 1, 2.

"*Hab.* Living in the Mediterranean (off Corsica) and in the Adriatic (at Rimini); fossil at Castel-Arquato (Italy), the neighbourhood of Dax, and at Nussdorf, in Austria."

The common Tertiary form of *Clavulina*, abundant in the London Clay. See the 'Geologist,' vol. vii. p. 86.

3. *Bulimina elongata*, D'Orb.

Bulimina elongata, Ann. Sci. Nat. vol. vii. p. 269. no. 9; For. Foss. Vien. p. 187, pl. 11. figs. 19, 20.

"*Hab.* Recent at Rimini; fossil at Nussdorf, Vienna Basin."

This is one of the endless modifications of *Bulimina*.

4. *Robulina ariminensis*, D'Orb.

Robulina ariminensis, Ann. Sci. Nat. vol. vii. p. 289. no. 15; For. Foss. Vien. p. 95, pl. 4. figs. 8, 9.

"*Hab.* Living in the Adriatic at Rimini; fossil at Baden near Vienna, and at Bohitsch in Styria."

A carinate *Cristellaria*, with depressed sutures and well-defined, concentric, superficial costæ.

5. *Nonionina bulloides*, D'Orb.

Nonionina bulloides, Ann. Sci. Nat. vol. vii. p. 293. no. 2; For. Foss. Vien. p. 107, pl. 5. figs. 9, 10.

"*Hab.* Fossil at Nussdorf, in Austria, and at Coroncina, near Sienna."

Neither this nor the "species" immediately preceding it in the 'Tableau' (*N. sphæroides*) belongs to the Nonionine group. They both belong to *Pullenia sphæroides*, D'Orb. sp. See Carpenter's 'Introd. Foram.' p. 184; Phil. Trans. vol. clv. p. 368; and Ann. Nat. Hist. ser. 3. vol. xvi. p. 26.

6. *Nonionina granosa*, D'Orb.

Nonionina granosa, Ann. Sci. Nat. vol. vii. p. 294. no. 8; For. Foss. Vien. p. 110, pl. 5. figs. 19, 20.

"*Hab.* Fossil at Nussdorf (not common), and at Coroncina."

One of the Nonionine subvarieties of *Polystomella*: see Ann. N. H. ser. 3. vol. v. pp. 101, 102.

7. *Nonionina communis*, D'Orb.

Nonionina communis, Ann. Sci. Nat. vol. vii. p. 294. no. 20; For. Foss. Vien. p. 106, pl. 5. figs. 7, 8.

"*Hab.* Living in the Mediterranean and the Adriatic, in the West Indies, and off Madagascar. Fossil at Bordeaux, at Nussdorf in Austria, and at Coroncina and Castel-Arquato in Italy."

This differs from *Nonionina scapha* only in being less convex and turgid. There must be stout and emaciated specimens of Foraminifera as of other animals; but this, of course, does not necessitate specific subdivision. Ann. N. H. ser. 3. vol. v. p. 102.

8. *Quinqueloculina triangularis*, D'Orb.

Quinqueloculina triangularis, Ann. Sci. Nat. vol. vii. p. 302. no. 34; For. Foss. Vien. p. 288, pl. 18. figs. 7–9.

"*Hab.* Living in the Adriatic and off the Island of St. Helena; fossil at Nussdorf, at Coroncina, at Castel-Arquato, and in the neighbourhood of Dax."

A subangular modification of *Quinqueloculina seminulum*, hardly worth a distinguishing name.

In addition to the above, the Vienna-Basin Monograph contains references to a large number of other species mentioned in the 'Tableau,' to which we have already adverted as having been illustrated by the original figures in the 'Ann. Sci. Nat.' vol. vii., models, illustrations by earlier authors, and the like. These are all refigured in the Vienna Monograph. An enumeration of names will suffice in the present place:—

Glandulina lævigata, p. 29, pl. 1. figs. 4, 5.
Nodosaria hispida (*N. hirsuta* of the 'Tableau'), p. 35, pl. 1. figs. 24, 25.
—— *bacillum*, Defr., p. 40, pl. 1. figs. 40–47.
Marginulina hirsuta, p. 69, pl. 3. figs. 17, 18.
Cristellaria cassis, F. & M., p. 91, pl. 4. figs. 4–7.
Textularia lævigata, p. 243, pl. 14. figs. 14–16.
Guttulina communis, p. 224, pl. 13. figs. 6–8.
—— *problema*, p. 224, pl. 12. figs. 26–28.
Globulina gibba, p. 227, pl. 13. figs. 13, 14.
Uvigerina pygmæa, p. 190, pl. 11. figs. 25, 26.
Rotalina Brongniartii (*Rotalia* in the 'Tableau'), p. 158, pl. 8. figs. 22–24.
—— *Soldanii* (*Gyroïdina* in the 'Tableau'), p. 155, pl. 8. figs. 10–12.

Globigerina bulloides, p. 163, pl. 9. figs. 4–6.
Truncatulina lobatula, W. & J. (*tuberculata*, 'Tabl. Méth.'), p. 168, pl. 9. figs. 18–23.
Planorbulina mediterranensis (*vulgaris* in the Cuba Monograph), p. 166, pl. 9. figs. 15–17.
Robulina calcar (*R. aculeata* of the 'Tableau'), p. 99, pl. 4. figs. 18–20.
—— *echinata* (*R. calcar* of the 'Tableau'), p.100, pl. 4. figs. 21, 22.
—— *cultrata*, Montfort, p. 96, pl. 4. figs. 10–13.
—— *imperatoria* (*R. vortex* in the 'Tableau;' stated to differ from Fichtel and Moll's species), p. 104, pl. 5. figs. 5, 6.
Polystomella crispa, Linné, sp., p. 125, pl. 6. figs. 9–14.
Nummulina radiata, Montfort, sp., p. 115, pl. 5. figs. 23, 24.
Alveolina melo, F. & M., sp., p. 147, pl. 7. figs. 15, 16.
Triloculina gibba, p. 274, pl. 16. figs. 22–24.
Quinqueloculina longirostra, p. 291, pl. 18. figs. 25–27.
Adelosina lævigata, p. 302, pl. 20. figs. 22–24.

The figures in Soldani's 'Testaceographia' are referred to in the Vienna Monograph with respect to the following species. As they are refigured by D'Orbigny from specimens collected in the Austrian Tertiaries, we have thought it needless to include them amongst the outline sketches appended to the present paper.

1. *Orbulina universa*, D'Orb.*

"*Sphærulæ vitreæ*;" Soldani, Testac. vol. i. pt. 2. p. 116, pl. 119. figs. *I, K, L, M.*
"Sphærulæ *hispidæ*," Id. ibid. vol. ii. p. 53, pl. 17. fig. *X*, and pl. 18. fig. *a*.
Orbulina universa, D'Orb. For. Foss. Vien. p. 22, pl. 1. fig. 1.

"*Hab.* Very common at Rimini and on the shores of the Adriatic. We have also found it in sands from the coast of Algiers and from Teneriffe. It inhabits, but more rarely, the sand of Cuba, Jamaica, St. Thomas's, Guadaloupe, and Martinique; and we have it again from the Indian seas." (Foram. de Cuba.)

"Fossil in the Tertiary sands of Baden (Austria) and Coroncina, near Sienna, in Tuscany. Recent in the Adriatic, Mediterranean, and Atlantic." (For. Foss. Vien.)

(Mediterranean, *Soldani.*)

This is a well-known species. The *hispid* figures are to be accepted as *Orbulina* with caution; for, though the closely allied *Globigerina* becomes highly hispid under some circumstances, we have not yet seen *Orbulinæ* with nearly such aciculate or hispid surface.

* Foram. Cuba, 1839, p. 3. no. 1, pl. 1. fig. 1; Foram. Canaries, p. 122, pl. 1. fig. 1.

2. *Nodosaria affinis*, D'Orb.

"Orthoceratia conico-cylindroidea;" Soldani, Saggio, p. 107, pl. 5. figs. 37, *m*, *M*.
"Orthoceras *Fæniculum*;" Soldani, Testac. vol. i. pt. 2. p. 91, pl. 94. fig. Z.
"Hortqceratia," Id. ibid. vol. ii. App. p. 141, pl. 5. figs. 37, *m*, *M*.
Nodosaria affinis, D'Orb. For. Foss. Vien. p. 39, pl. 1. figs. 36–39.

"*Hab.* Baden near Vienna; not common." (Recent, Mediterranean; fossil, Coroncina; *Soldani*.)

This is the straight few-ribbed *Nodosaria raphanus*, not uncommon in both the recent and the fossil state.

3. *Dentalina inornata*, D'Orb.

"Orthoceratia *lævia*" &c.; Soldani, Testac. vol. i. pt. 2. p. 92, pl. 97. fig. *b b* [?]. (D'Orbigny gives this reference as pl. 97. fig. O, which is manifestly an error, as no figure O appears on pl. 97. Probably the figure we have noted is what was intended.)
Dentalina inornata, D'Orb. For. Foss. Vien. p. 44, pl. 1. figs. 50, 51.

"*Hab.* Fossil, Baden near Vienna; not common." (Mediterranean, *Soldani*.)

There is no special character to distinguish this from *Dentalina communis*, D'Orb.

4. *Dentalina floscula*, D'Orb.

"Orthoceratia *Flosculi*;" Soldani, Testac. vol. ii. p. 34, pl. 9. fig. *L*.
Dentalina floscula, D'Orb. For. Foss. Vien. p. 50, pl. 2. figs. 16, 17.

"*Hab.* Living in the Adriatic, at Rimini; fossil in the Baden beds, Vienna Basin." (Near Sienna, *Soldani*.)

This is the setose variety of *Dentalina* corresponding to *Nodosaria hispida* in the straight series.

5. *Cristellaria lanceolata*, D'Orb.

"Nautili *lituitati*;" Soldani, Testac. vol. i. pt. 1. p. 64, pl. 57. fig. Z, and pl. 58. fig. *a a*.
Cristellaria lanceolata, D'Orb. For. Foss. Vien. p. 89, pl. 3. figs. 41, 42.

"*Hab.* Fossil at Baden in Austria, and in the neighbourhood of Sienna." (Mediterranean, *Soldani*.)

This elegant, acute-ovate, and keeled *Cristellaria*, already referred to (p. 166), is the elongate flattened subvariety of *Cr. cultrata*, having the same relation to the latter as *Cr. crepidula* has to *Cr. rotulata*.

6. *Nonionina Soldanii*, D'Orb.

"Nautilus *Melo*;" Soldani, Testac. vol. i. pt. 1. p. 59, pl. 46. fig. *q q*.
Nonionina Soldanii, D'Orb. For. Foss. Vien. p. 109, pl. 5. figs. 15, 16.

"*Hab.* Fossil at Nussdorf, common; and at Coroncina, near Sienna." (Mediterranean, *Soldani*.)

There seems no good reason for separating this from *Nonionina umbilicata*; the only suggested difference is a somewhat excessive number of conspicuous pseudopodial perforations. Soldani's figures are more doubtful than D'Orbigny's, and, indeed, in all probability represent a nautiloid *Lituola*.

7. *Rotalina Boueana*, D'Orb.

"Hammonia;" Soldani, Testac. vol. i. pt. 1. p. 56, pl. 36. fig. X.
Rotalina Boueana, D'Orb. For. Foss. Vien. p. 152, pl. 7. figs. 25–27.

"*Hab.* Living in the Adriatic; fossil in the Nussdorf and Baden beds, Vienna Basin." (Mediterranean, *Soldani.*)

This is a variety of *Pulvinulina repanda* (Phil. Trans. vol. clv. p. 353) near *P. pulchella*.

8. *Asterigerina planorbis*, D'Orb.

"Ammoniæ *Planorbes*;" Soldani, Testac. vol. ii. App. p. 140, pl. 3. figs. 24, *m*, *M*, *N*. (Saggio, p. 104, pl. 3. figs. 24, *m*, *M*, *N*.)
Asterigerina planorbis, D'Orb. For. Foss. Vien. p. 205, pl. 11. figs. 1–3.

"*Hab.* Fossil at Nussdorf, Austria, and at Coroncina, near Sienna."

The same as *Discorbina rosacea*, D'Orb. sp., Modèle No. 39.

9. *Anomalina austriaca*, D'Orb.

"Hammonita;" Soldani, Testac. vol. i. pt. 1. p. 66, pl. 60. fig. C*.
Anomalina austriaca, D'Orb. For. Foss. Vien. p. 172, pl. 10. figs. 4–9.

"*Hab.* Fossil at Nussdorf, rare." (Mediterranean, *Soldani.*)

A *Planorbulina*, near *Pl. ammonoides*, D'Orb. sp.

10. *Textularia abbreviata*, D'Orb.

"Nautili amphorarii;" Soldani, Saggio, p. 108, pl. 7. figs. 46, *c*, *C*.
"Nautilus amphorarius," Testac. vol. ii. App. p. 141, pl. 7. figs. 46, *c*, *C*.
Textularia abbreviata, For. Foss. Vien. p. 249, pl. 15. figs. 7–12.

"*Hab.* Fossil, Baden and Nussdorf, in Austria; Coroncina in Italy."

Whatever D'Orbigny intended to represent by his figures of the *Textulariæ* before him, Soldani's figure is very much like that of a *Polymorphina*.

Lastly, we have to remark that, after all the references made to Soldanian and other Foraminifera in the foregoing analyses of the 'Tableau Méthodique' and other monographs by D'Orbigny, there are still in the 'Tableau' 253 species which (unless they be figured and described from his collec-

* D'Orbigny's reference to Soldani as "pl. 90, var. 196" is wrong; it should be "pl. 60, vas 196."

tion) must lapse entirely, because there is no indication of the author's meaning and intention, either by description or by reference to figures.

INDEX TO THE PLATES.

ARRANGED IN THE ORDER OF THE CORRECTED NOMENCLATURE OF THE SPECIES*.

FORAMINIFERA IMPERFORATA.

Miliolida.

No.	Corrected Name.	Plate.	Fig.	D'Orbigny's Name.
97	Cornuspira foliacea(?), *Philippi*, sp.	8	1	Soldania limia.
98	—— —— (?), *D'Orb.* sp.	8	2	Soldania orbicularis.
99	——? (*Spirillina?*)	8	3	Soldania annulata.
136	Biloculina ringens, *Lamarck*, sp.	8	4	Biloculina bulloides.
138	—— depressa, *D'Orb.*	8	5	Biloculina depressa.
137	—— elongata, *D'Orb.*	8	6	Biloculina elongata.
144	Triloculina gibba, *D'Orb.*	8	7	Triloculina gibba.
154	—— oblonga, *Montagu*	8	8	Quinqueloculina longirostris.
148	——Brongniartii, *D'Orb.*	8	9	Triloculina Brongniartii.
153	Quinqueloculina seminulum, *Linn.* sp.?	8	10	Quinqueloculina seminulum, *Linn.* [sp.
149	—— ——	8	11	Quinqueloculina aspera.
156	—— —— (young)?	8	12	Adelosina lævigata.
157	—— —— (young)?	8	13	Adelosina semistriata.
152	—— secans, *D'Orb.*	8	14	Quinqueloculina secans.
150	—— ——	8	15	Quinqueloculina vulgaris.
146	—— inflata, *D'Orb.*	8	16	Triloculina inflata.
155	—— Soldanii, *D'Orb.*	8	17	Quinqueloculina Soldanii.
145	—— reticulata, *D'Orb.*	8	18	Triloculina reticulata.
151	—— pulchella, *D'Orb.*	8	19	Quinqueloculina pulchella.
147	—— —— (young)	8	20	Triloculina tricostata.
158	—— —— (very young)	8	21	Adelosina Soldanii.
141	Spiroloculina limbata, *D'Orb.*	8	22	Spiroloculina limbata.
139	—— planulata, *Lamk.* sp.	8	23	Spiroloculina depressa.
140	—— nitida, *D'Orb.*	8	24	Spiroloculina nitida.
142	—— rotundata, *D'Orb.*	8	25	Spiroloculina rotundata.
143	—— plicata, *D'Orb.*	8	26	Spiroloculina plicata.
100	Vertebralina striata, *D'Orb.*	8	27	Vertebralina striata.
103	Peneroplis pertusus, *Forskål*, sp.	8	28	Peneroplis planatus, *F. & M.* sp.

Lituolida.

24	Lituola scorpiurus, *Montf.* sp.	9	29	Nodosaria (Dentalina) scorpiurus, *Montf.* sp.
6	—— dubia, *D'Orb.* sp.	9	30	Nodosaria dubia.
117	—— rugosa, *D'Orb.* sp.	9	31	Robulina rugosa.
4	Clavulina clavulus (?), *Lamk.* sp.	9	32	Nodosaria orthocera.

* It must be observed that this *Index* is not an epitome of the species mentioned in the foregoing memoirs. Only the Soldanian figures which have been selected and *copied* are here alluded to.

FORAMINIFERA PERFORATA.

Lagenida.

No.	Corrected Name.	Plate.	Fig.	D'Orbigny's Name.
15	Lagena melo, *D'Orb.* (bilocular)	9	33	Nodosaria cancellata.
1	Glandulina lævigata, *D'Orb.*	9	34	Nodosaria (Glandulina) lævigata.
8	Nodosaria glabra, *D'Orb.*	9	35	Nodosaria glabra.
2	—— ovicula, *D'Orb.*	9	36	Nodosaria ovicula.
9	—— pyrula, *D'Orb.*	9	37	Nodosaria pyrula.
5	—— semistriata, *D'Orb.*	9	38	Nodosaria semistriata.
11	—— raphanus, *Linn.* sp.	9	39	Nodosaria scalaris.
12	—— —— (monstrous)	9	40	Nodosaria sulcata.
13	—— raphanistrum, *Linn.* sp.	9	41	Nodosaria rapa.
14	—— scalaris, *Batsch*, sp.	9	42	Nodosaria longicauda.
16	—— Soldanii, *D'Orb.*	9	43	Nodosaria Soldanii.
19	—— nitida, *D'Orb.*	9	44	Nodosaria nitida.
3	—— hispida, *D'Orb.*	9	45	Nodosaria hirsuta.
20	Dentalina communis, *D'Orb.*	9	46	Nodosaria (Dentalina) communis.
21	—— —— *subvar.* obliqua, *D'Orb.*	9	47	N. (Dentalina) obliqua.
10	—— filiformis, *D'Orb.*	9	48	Nodosaria filiformis.
22	—— arcuata, *D'Orb.*	9	49	N. (Dentalina) arcuata.
23	—— carinata, *D'Orb.*	9	50	N. (Dentalina) carinata.
7	—— interrupta, *D'Orb.*	9	51	Nodosaria interrupta.
25	—— aciculata, *D'Orb.*	9	52	N. (Dentalina) aciculata.
18	—— flexuosa, *D'Orb.*	9	53	Nodosaria flexuosa.
27	—— substriata, *D'Orb.*	9	54	N. (Dentalina) substriata.
17	—— nodosa, *D'Orb.*	9	55	Nodosaria nodosa.
28	—— cornicula, *D'Orb.*	9	56	N. (Dentalina) cornicula.
26	—— obliqua, *Linn.* sp.	9	57	N. (Dentalina) Cuvieri.
36	Vaginulina striata, *D'Orb.*	9	58	Vaginulina striata.
37	—— marginata, *D'Orb.*	9	59	Vaginulina marginata.
38	—— caudata, *D'Orb.*	9	60	Vaginulina caudata.
33	Lingulina carinata, *D'Orb.*	9	61	Lingulina carinata.
41	—— —— (dimorphous var.)	9	62	Marginulina carinata.
34	—— alata, *D'Orb.*	9	63	Lingulina alata.
31	Frondicularia pupa, *D'Orb.*	10	64	Frondicularia pupa.
32	—— digitata, *D'Orb.*	10	65	Frondicularia digitata.
29	—— alata, *D'Orb.*	10	66	Frondicularia alata.
30	—— striata, *D'Orb.*	10	67	Frondicularia striata.
43	Marginulina lævigata, *D'Orb.*	10	68	Marginulina lævigata.
46	——, sp. (cast)	10	69	Marginulina consecta.
44	—— lituus, *D'Orb.*	10	70	Marginulina lituus.
45	—— lobata, *D'Orb.*	10	71	Marginulina lobata.
39	—— raphanus, *D'Orb.*	10	72	Marginulina raphanus.
42	—— ——	10	73	Marginulina sublituus.
47	Planularia auris, *Defrance*	10	74	Planularia auris, *Defr.*
49	—— rostrata, *D'Orb.*	10	75	Planularia rostrata.
127	Cristellaria elongata, *D'Orb.*	10	76	Cristellaria elongata.
48	—— ——	10	77	Planularia crepidula, *F. & M.* sp.
128	—— ——	10	78	Cristellaria bilobata.
133	—— italica, *Defr.* sp.	10	79	Cristellaria (Saracenaria) Italica, [*Defr.*
119	—— rotulata, *Lamk.*	10	80	Robulina plicata.
105	—— vortex, *F. & M.* sp.	10	81	Robulina orbicularis.

No.	Corrected Name.	Plate.	Fig.	D'Orbigny's Name.
106	Cristellaria vortex, *F. & M.* sp.	10	82	Robulina vortex, *F. & M.* sp.
94	—— carinata, *D'Orb.* sp.	10	83	Soldania carinata.
104	—— cultrata, *Montf.* sp.	10	84	Robulina cultrata, *Montf.* sp.
107	—— Soldanii, *D'Orb.* sp.	10	85	Robulina Soldanii.
123	—— cassis, *F. & M.* sp.	10	86	Cristellaria cassis, *F. & M.* sp.
124	—— ——	10	87	Cristellaria Soldanii.
125	—— —— (feeble)	10	88	Cristellaria nitida.
108	—— —— (young)	10	89	Robulina marginata.
113	—— rosacea, *D'Orb.* sp.	10	90	Robulina rosacea.
115	—— calcar, *Linn.* sp.	10	91	Robulina aculeata.
120	—— ——	10	92	Robulina rotundata.
109	—— ——	10	93	Robulina radiata.
110	—— ——	10	94	Robulina pulchella.
111	—— ——	10	95	Robulina lævigata.
114	—— rostrata, *Montf.* sp.	10	96	Robulina calcar, *Linn.* sp.
129	—— —— (?)	11	97	Cristellaria aculeata.
132	—— ——	11	98	Cristellaria papillosa.
126	—— ——	11	99	Cristellaria marginata.
121	—— margaritacea, *Montf.* sp.	11	100	Cristellaria consecta.
122	—— navicularis, *Montf.* sp.	11	101	Cristellaria navicularis, *Montf.* sp.
130	—— tuberculata, *D'Orb.*	11	102	Cristellaria tuberculata.
131	—— ——	11	103	Cristellaria elegans.
64	Polymorphina lactea, *W. & J.* sp.	11	104	Polymorphina (Globulina) ovata.
62	—— compressa, *D'Orb.*	11	105	Polymorphina tuberosa.
63	—— Soldanii, *D'Orb.*	11	106	Polymorphina Soldanii.
65	—— gutta, *D'Orb.*	11	107	Polymorphina (Pyrulina) gutta.
61	Dimorphina tuberosa, *D'Orb.*	11	108	Dimorphina tuberosa.
66	Uvigerina pygmæa, *D'Orb.*	11	109	Uvigerina pygmæa.
67	—— ——	11	110	Uvigerina nodosa.
68	—— ——	11	111	Uvigerina nodosa, *var. β.*

GLOBIGERINIDA.

81	Globigerina bulloides, *D'Orb.*	11	112	Globigerina bulloides.
83	—— helicina, *D'Orb.*	11	113	Globigerina helicina.
55	Textularia sagittula, *Defr.*	11	114	Textularia sagittula, *Defr.*
51	—— gibbosa, *D'Orb.*	11	115	Textularia obtusa.
52	—— ——	11	116	Textularia lævigata.
53	—— ——	11	117	Textularia punctulata.
54	—— ——	11	118	Textularia gibbosa.
58	—— ——	11	119	Textularia tuberosa.
57	—— ?	11	120	Textularia caudata.
35	Grammostomum pennatula, *Batsch*, sp.	11	121	Lingulina Soldanii.
59	—— pupa, *D'Orb.*	11	122	Vulvulina pupa.
60	—— elegans, *D'Orb.*	11	123	Vulvulina elegans.
50	Bigenerina lævigata	11	124	Bigenerina lævigata.
40	—— ? (*Lituola?*)	11	125	Marginulina hirsuta.
56	Bulimina aculeata, *D'Orb.*	11	126	Textularia echinata.
69	—— ——	11	127	Bulimina trilobata.
70	—— ——	11	128	Bulimina aculeata.
82	Cassidulina oblonga, *D'Orb.* sp.	11	129	Globigerina elongata.
78	Planorbulina Ungeriana, *D'Orb.* sp.	12	130	Rotalia (Turbinulina) Siennensis.

No.	Corrected Name.	Plate.	Fig.	D'Orbigny's Name.
89	Planorbulina rotula, *D'Orb.* sp.	12	131	Planulina Ariminensis.
91	—— Soldanii, *D'Orb.* sp.	12	132	Planulina Soldanii.
92	—— mediterranensis, *D'Orb.*	12	133	Planorbulina Mediterranensis.
96	—— ?(fragment)	12	134	Soldania nitida.
135	—— umbilicata	12	135	Nonionina umbilicata.
86	Truncatulina lobatula, *W. & J.* sp.	12	136	Truncatulina tuberculata.
90	—— —— (? young)	12	137	Planulina incerta.
88	—— tuberosa, *F. & M.* sp.	12	138	Truncatulina variabilis.
87	—— refulgens, *Montf.* sp.	12	139	Truncatulina refulgens, *Montf.* sp.
72	Pulvinulina repanda, *F. & M.* sp.	12	140	Rosalina Mediterranensis.
71	—— mediterranensis, *D'Orb.* sp.	12	141	Rosalina Mediterranensis.
79	—— elegans, *D'Orb.* sp.	12	142	Rotalia (Turbinulina) elegans.
75	—— auricula, *F. & M.* sp.	12	143	Rotalia Brongniartii.
73	—— Soldanii, *D'Orb.* sp.	12	144	Rosalina Soldanii.
76	—— communis, *D'Orb.* sp.	12	145	Rotalia communis.
93	—— vermiculata, *D'Orb.* sp.	12	146	Planorbulina vermiculata.
77	Rotalia Beccarii, *Linn.* sp.	12	147	Rotalia (Turbinulina) Italica.
74	—— —— (?)	12	148	Rosalina Soldanii.
80	—— ammoniformis, *D'Orb.*	12	149	Rotalia (Turbinulina) ammoniformis.
84	—— orbicularis, *D'Orb.* sp.	12	150	Gyroïdina lævigata.
85	—— Soldanii, *D'Orb.* sp.	12	151	Gyroïdina Soldanii.
	Nummulinida.			
118	Amphistegina?	12	152	Robulina nitida.
95	Nummulina exponens, *Sow.* sp.	12	153	Soldania spirorbis.
101	Polystomella macella, *F. & M.* sp.	12	154	Polystomella crispa, *Linn.* sp.
102	—— crispa, *Linn.* sp.	12	155	Polystomella strigillata, *F.&M.* sp.
112	—— striatopunctata, *F. & M.* sp.	12	156	Robulina sulcata.
116	Nonionina umbilicatula, *Montagu*, sp.	12	157	Robulina Planciana.
134	—— pompilioides, *F. & M.* sp.	12	158	Nonionina melo.

XXXII.—*Descriptions of two new Species of Humming-birds belonging to the Genera* Eupherusa *and* Cyanomyia. By D. G. Elliot, F.L.S., F.Z.S., &c.

Eupherusa poliocerca.

Top of head and upper parts rich bronzy green; entire under parts brilliant grass-green. Wings purple, tertials bright chestnut. Upper tail-coverts similar to the back but more reddish; under tail-coverts long, pure white; two central tail-feathers metallic olive-green, purplish at the tips; remaining feathers white, purplish grey on the edges of the outer webs and at the tips. Bill black; feet flesh-colour. Total length $3\frac{3}{4}$ inches; wing $2\frac{1}{2}$ inches, tail $1\frac{5}{8}$ inch, bill $\frac{3}{4}$ inch.

Hab. Putla, Mexico.

This species is most nearly allied to *Eupherusa egregia*, but can at once be distinguished from it, as well as all the other members of the genus, by its tail. In *egregia* the four central tail-feathers are black, and the remainder are black at the tips; in the present species only the two median feathers are bronzy, all the remainder being as described above. This bird, together with the following, was obtained in a small collection of birds procured at Putla in the western part of Mexico. This is the third species now known of the genus *Eupherusa*, which for a long time was only represented by *E. eximia*. The species are as follows:—

1. *Eupherusa eximia.* Guatemala.
2. *E. egregia.* Veragua.
3. *E. poliocerca.* Putla, Western Mexico.

Two species, named respectively *E. cupreiceps* and *E. nigriventris*, have been allotted to this genus; but I think that they will hereafter be assigned to another genus (*Thaumatias*), to which they seem more naturally to belong.

Cyanomyia viridifrons.

Forehead and lines over the eyes dark green, metallic in some lights and rather brilliant towards the nape; centre of crown dark grey; upper part of back and shoulders brilliant light green; lower part of back bronzy brown. Wings purple. Upper tail-coverts and tail rich coppery bronze. Flanks grass-green. Entire under parts pure white. Bill reddish, black at tip. Total length $3\frac{3}{4}$ inches; wing $2\frac{1}{8}$ inches, tail $1\frac{3}{8}$ inch, bill $\frac{5}{8}$ inch.

Hab. Putla, Mexico.

The present bird differs from all the members of this genus by its peculiarly coloured head and tail, which do not in any way resemble any other species of *Cyanomyia* at present known. It is perhaps nearest in its relationship to the *C. violiceps*, being about the same size as that species; but there is no trace whatever of the beautiful violet crown of that bird, and the tail is also quite different. It is also from Putla, where the species appears to be not uncommon. The present makes the seventh species of this genus now known; they are:—

1. *Cyanomyia quadricolor.* Northern Mexico.
2. *C. violiceps.* Western Mexico, vicinity of Oaxaca.
3. *C. cyanocephalus.* Southern Mexico.
4. *C. Franciæ.* New Granada.
5. *C. guatemalensis.* Guatemala.
6. *C. cyanicollis.* Peru.
7. *C. viridifrons.* Putla, Western Mexico.

XXXIII.—*Descriptions of new Genera and Species of Longicorns, including three new Subfamilies.* By Francis P. Pascoe, F.L.S. &c.

[Plate XIII.]

List of Genera and Species.

PRIONIDÆ.

Teledapinæ (subfam. nov.).

Teledapus (*n. g.*) dorcadioides.

Remphaninæ.

Brephilydia (*n. g.*) jejuna.

CERAMBYCIDÆ.

Hesperophaninæ.

Phacodes tenuitarsis.
—— longicollis.

Neosteninæ.

Maltheba (*n. g.*) flexilis.

Stenoderinæ.

Syllitus terminatus.
—— tabidus.
Aphiorhynchus divisus.
Simocrysa (*n. g.*) discolor.

Macroninæ.

Macrones subclavatus.

Mythodinæ.

Phyodexia (*n. g.*) concinna.

Necydalinæ.

Earinis picta.

Ochyrinæ (subfam. nov.)

Ochyra (*n. g.*) coarctata.

Disteniinæ.

Distenia fastuosa.
Melegena cyanea.

LAMIIDÆ.

Tmesisterninæ.

Temnosternus vitulus.

Ancylonotinæ.

Ancylonotus nasicornis.

Disterninæ*.

Disterna Mastersii.

Hebesecinæ.

Scotinauges (*n. g.*) diphysis.

Ægoprepinæ (subfam. nov.).

Ægoprepes (*n. g.*) antennator.

Hippopsinæ.

Pothyne silacea.
Euthuorus protensus.

Phytœciinæ.

Blepisanis porosa.
—— fervida.
—— incensa.
—— larvata.
—— suturalis.
—— exilis.
—— collaris.

Teledapus.

(Teledapinæ, *subfam. nova.*)

Caput latum, pone oculos productum et in collo constrictum; *tubera* antennifera nodiformia, basi fere contigua; *facies* brevis; *genæ*

* The second part of the ninth volume of Lacordaire's 'Genera,' in which these and the rest of the Longicorns will appear, has not yet been published; but its lamented author, just two months before his death, sent me eight closely written octavo pages, comprising a sketch or synopsis of his arrangement, from which I have here quoted. Only those who have studied the Longicorns can know the difficulties of his task. Of the results at which he had arrived he says:—"Ils vous étonneront plus d'une fois, j'en suis sûr; aussi je ne vous les donne que pour ce qu'ils valent, mon dernier mot sur les Longicornes étant que leur arrangement systématique est au-dessus des forces humaines." Still it will probably be long before a more successful attempt is made.

ampliatæ; *labrum* parvum, *clypeo* sessile. *Oculi* integri, verticales, grosse granulati. *Antennæ* setaceæ, corpore breviores, subtiliter pubescentes; *scapus* brevis, articulis tertio quintoque æqualibus, quarto et reliquis gradatim brevioribus. *Palpi* labiales longiores. *Prothorax* cylindricus quam caput angustior, utrinque in medio tumidulus. *Scutellum* semiorbiculare. *Elytra* angustata, longiuscula, humeris rotundatis. *Femora* compressa, modice incrassata; *tibiæ* rectæ, compressæ, apice breviter bicalcaratæ; *tarsi* (intermedii) subtus tomentosi, articulo basali elongato, æquilato, secundo dimidio breviore, tertio parvo angusto, profunde bilobo; *coxæ* anticæ conicæ; *acetabula* antica aperta, intermedia extus angulata. *Metasternum* breve. *Episterna* metathoracis angusta, postice acuta.

The only specimen I have seen of this remarkable genus was taken by Capt. Lang, R.E., but is, unfortunately, without tarsi, except one of the intermediate, and even this is without the claw-joint. Of the three aberrant forms of Cerambycidæ it is most allied to Dynamostinæ; but its conical anterior coxæ with their acetabula open behind will effectually prevent its union with that group: it must therefore be considered to represent a distinct subfamily. I am ignorant of the sex of my specimen; there are no wings, and the elytra are connate. It has very much the appearance of a *Dorcadion*, or at least one of that group.

Teledapus dorcadioides. Pl. XIII. fig. 1.

T. oblongus, angustus, toto brunneus, sat nitidus, tenuiter sparse pubescens; capite prothoraceque subtiliter punctulatis; elytris subnitidis, confertim rude punctatis; femoribus crebre punctulatis; corpore infra creberrime punctulato. Long. 9 lin.

Hab. Himalaya (Mussooree).

Brephilydia.

(Remphaninæ.)

Ab *Eurynassa* differt *tibiis* lævibus, quatuor anticis extus spinosis; *abdomine* haud granulato, segmentis parte anteriore subtilissime punctulatis, posteriore lævissimis, foveis lateralibus fere obsoletis.

The type of this genus is *Mallodon jejunum*; and it is now separated generically in accordance with Lacordaire's opinion that it is a distinct form allied to *Eurynassa* (Gen. viii. 111, note). The characters attached to the tibiæ seem to me of comparatively little importance, seeing that they are scarcely to be distinguished from those of *Eurynassa Odewahnii*; but the sculpture of the abdomen is one of the primary characters employed in the differentiation of the genera recently separated from *Mallodon*.

Brephilydia jejuna. Pl. XIII. fig. 6.

Mallodon jejunum, Pascoe, Journ. of Entom. ii. 243.

Phacodes tenuitarsis.

P. fuscus, subnitidus, pube grisea interrupte vestitus, setulisque adspersus; antennis articulis tertio quartoque fere æqualibus; prothorace vix longiore quam latiore, parum rotundato, in medio leviter carinulato, antice tuberculis duobus indistinctis, postice versus latera costulis duabus obliquis munito; scutello subtriangulari; elytris haud elongatis, depressis, apicibus emarginatis, granulis indistinctis remotis notatis, singulis plagis duabus minus pubescentibus signatis; femoribus fortiter incrassatis, compressis, tarsis linearibus. Long. (♂) 5 lin., (♀) 7 lin.

Hab. Western Australia (Nicol Bay).

The smallest of my specimens is a male; the female has considerably broader tarsi, although still linear, the three basal joints being of equal breadth.

Phacodes longicollis.

P. subtestaceus, pube grisea vestitus; antennis articulis tertio quartoque fere æqualibus; prothorace capite paulo angustiore, oblongo, utrinque parum rotundato, in medio breviter carinulato, antice tuberculis duobus nitidis; scutello suborbiculari; elytris haud elongatis, depressis, apice rotundatis, granulis nitidis distinctis adspersis; femoribus sat fortiter clavatis, maculis denudatis notatis; tarsis posticis articulo basali anguste triangulari. Long. 4 lin.

Hab. Queensland (Wide Bay).

This species has a narrow prothorax, and the femora are more clavate and less compressed than in its congeners, in this respect approaching *Thephantes*, and distinct from *Phacodes* by its abruptly clavate femora and mutic antennæ, thicker in the middle in the male.

Maltheba.

(Neosteninæ.)

Caput breve; tubera antennifera distantia. *Antennæ* 11-articulatæ, (♂) corpore vix longiores, articulis, secundo excepto, subæqualibus, extus apice unilateraliter dilatatis, (♀) corpore breviores. *Oculi* permagni. *Palpi* articulo ultimo cylindrico. *Mandibulæ* breves. *Labium* minutum. *Prothorax* transversus, utrinque in medio tuberculato-spinosus. *Elytra* elongata, parallela, submembranacea. *Femora* leviter incrassata; *tibiæ* graciles; *tarsi* lineares, articulo tertio lobis angustis. *Coxæ* anticæ fere contiguæ, modice exsertæ. *Prosternum* depressum. *Abdomen* molle, lævissimum, segmento ultimo detecto.

This genus has a soft abdomen and thin membranous elytra, like *Vesperus*. In outline it somewhat resembles *Neostenus*, but differs in its spined prothorax &c. *Mystrosa* has a quite different texture*.

Multheba flexilis.

M. fulvo-rufa, subtus elytrisque testaceis, subnitidis, pube subtili grisea vestita; capite prothoraceque subtiliter punctulatis; scutello transverso; elytris subtilissime punctulatis, humeris callosis, apicibus rotundatis, singulis costulis quatuor instructis. Long. 14 lin.

Hab. West Australia.

Syllitus terminatus.

S. fulvo-aurantiacus, apice elytrorum nigro; antennis infuscatis nitidis; prothorace ante medium valde constricto; elytris minus elongatis, singulis costulis duabus discoidalibus in medio manifeste magis separatis; apicibus femorum infuscatis; abdomine infra, basi excepta, nigrescente. Long. 3 lin.

Hab. Nicol Bay (West Australia).

Syllitus tabidus.

S. pallide aurantiacus, elytris stramineis; antennis rufo-luteis; prothorace vix constricto; elytris angustis, costulis duabus discoidalibus in medio minus separatis; abdomine basi pallide infumato. Long. $3\frac{1}{2}$ lin.

Hab. Nicol Bay.

These two species are too distinct to be confounded with any of the four previously described from Australia.

Aphiorhynchus divisus.

A. angustior; capite prothoraceque totis rufis, obsolete punctulatis; antennis nigris, articulis 3., 4., 5. basi subluteis, art. tertio quam quarto plus duplo breviore; elytris dimidio basali aurantiacis, apicali cyaneis, leviter costulatis, inter costulas conferte punctulatis, apicibus oblique truncatis; metasterno abdomineque subnigris; pedibus infuscatis, femoribus tibiisque anticis aurantiacis exceptis. Long. 4 lin.

Hab. Queensland (Rockhampton).

* In reference to *Aposites*, another genus of this subfamily, M. Lacordaire is certainly in error in assigning it a prothorax "strongly rounded" at the posterior angles; on the contrary, they are so produced, owing to a slight reflection at the base, as to form, when viewed from above, a distinctly acute outline. This is well shown by Mr. Robinson in the figure (Journ. of Entom. ii. pl. 16. fig. 6).

Differs from *A. lusorius* in the narrower outline, short third antennal joint, elytra with the apical half blue and their apices obliquely truncate. *Aphiorhynchus* was proposed by Lacordaire for the former species, which I had referred to *Psilomorpha*, but which is certainly distinct, on account of its entire finely granulated eyes. *D. apicalis* is another species. Both are from Queensland, not from Western Australia, as Lacordaire has stated.

SIMOCRYSA.

(Stenoderinæ.)

Characteres ut in *Aphiorhyncho*, sed antennis corpore brevioribus, articulis tertio et sequentibus subæqualibus, duobus ultimis quam præcedentibus crassioribus; scapo vix elongato, basin prothoracis haud attingente, apice clavato; *femoribus* breviusculis.

The characters of the antennæ and the comparatively short femora, the posterior not extending beyond the middle of the second abdominal segment, give this genus a different appearance from *Aphiorhynchus*. From *Demomisis* it is differentiated by the length of its muzzle and the non-approximation of the antennæ to the eyes. A front view of the head is given on Pl. XIII. fig. 7.

Simocrysa discolor.

S. linearis, capite toto æreo, subtiliter punctulato; antennis luteis, apicibus articulorum, duobus ultimis totis, nigrescentibus; prothorace subnigro, apice luteo marginato, indistincte punctulato; scutello suborbiculari, nigro; elytris angustis, parallelis, obscure luteis, singulis in medio subnigro vittatis, tenuiter costulatis, inter costulas biseriatim conferte punctatis; corpore infra luteo, metasterno abdomineque basi apiceque subnigris; pedibus luteis, femoribus apice tarsisque intermediis et posticis nigrescentibus. Long. $3\frac{3}{4}$ lin.

Hab. King George's Sound.

Macrones subclavatus.

M. capite prothoraceque purpureis, illo crebre punctulato, hoc confertissime granulato; antennis nigro-chalybeatis, articulis 5., 6., 7. et 8., apice excepto, infuscatis, 9., 10., 11. albidis; scutello triangulari, nigro; elytris basi flavescentibus, cæteris subnigris; abdomine subcupreo; pedibus purpureis, violaceo nitentibus. Long. 8 lin.

Hab. Sydney.

Like *M. acicularis*, this species has the four tubercles on the prothorax much reduced, the two anterior being nearly obsolete. The antennæ have the terminal joints manifestly thicker than the preceding ones.

Phyodexia.

(Mythodinæ.)

Caput pone oculos elongatum, æquilatum; *facies* quadratum. *Oculi* rotundati, prominuli. *Antennæ* corpore breviores; *scapus* elongatus, articulis 2., 3., apice solo, 4., 5., 6. omnino fasciculatis, reliquis breviusculis, apice unilateraliter dilatatis. *Prothorax* oblongus, basi angustior, in medio utrinque turgidus. *Scutellum* elongato-triangulare. *Elytra* modice elongata, parallela, apice rotundata. *Femora* clavata, basi pedunculata; *tibiæ* rectæ.

In this formula I have not given the characters so far as they are identical with those laid down by Lacordaire for his "*Mythodides*," in which this genus is to be placed, but to the other two genera of which it is strikingly dissimilar in habit, as well as in many points of structure just enumerated. My specimen appears to be a female. It was taken by Capt. Lang, R.E.

Phyodexia concinna. Pl. XIII. fig. 2.

P. oblonga, nigra, nitida, pilis erectis dispersis obsita; capite rude punctulato; antennis nigrescentibus, scapo luteo, articulis 4., 5., 6. pilis nigris dense vestitus; prothorace confertim fortiter punctato; scutello obscure nigro; elytris violaceis, purpureo micantibus, subvage punctatis; corpore infra punctulato; femoribus luteis, nitidis; tibiis posticis nigris, longe et densius pilosis, reliquis tarsisque, posticis obscure luteis exceptis, infuscatis. Long. 8 lin.

Hab. Himalaya (Mussooree).

Earinis picta.

E. nigra, flavo variegata, nitida; capite sat angusto, infra oculos fascia flava ornato; antennis nigris; prothorace elongato, remote punctulato, flavo, plaga magna centrali decorato; scutello nigro; elytris elongatis, parallelis, confertim punctulatis, basi circa scutellum fasciisque duabus, una antemediana obliqua ad suturam interrupta, una postmediana, flavis; corpore infra flavo, maculatim nigro variegato; abdominis segmento ultimo dimidioque præcedentis elytris haud obtectis; pedibus nigris. Long. $3\frac{1}{4}$–$4\frac{1}{2}$ lin.

Hab. New South Wales (Eastern Creek).

The female is a large and proportionally broader insect; but in both the prothorax is very much narrower than in the other two species: of the two, however, it approaches nearest to *E. Kreusleræ*.

Ochyra.

(Ochyrinæ, *subfam. nova.*)

Caput sessile, fere ad oculos insertum, inter antennas excavatum; *facies* subquadrata; *clypeus* distinctus; *labrum* breve. *Antennæ* muticæ, setaceæ, corpore longiores, articulo basali haud elongato, articulis 3., 4. quam 5. breviores. *Oculi* profunde emarginati. *Prothorax* globoso-ovalis, basi valde strangulatus, utrinque spina brevi armatus. *Scutellum* parvum, triangulare. *Elytra* oblonga, dorso in medio incurvato-depressa, apice rotundata, singula tuberculo basali instructa. *Femora* fusiformia; *tibiæ* graciles, posticæ longiores, arcuatæ; *tarsi* postici articulo basali cæteris conjunctim longiore. *Coxæ* anticæ conicæ; *acetabula* antica aperta. *Prosternum* inter coxas angustissimum.

The contour of this genus is similar to that of *Euderces* among the Tillomorphinæ*; but the conical anterior coxæ, almost contiguous at the base, prevent its being joined to that subfamily; its place in Lacordaire's table, in reference to this character and to its deeply emarginate eyes, would be next to Aphneopinæ, from which it essentially differs in the form of the head, not contracted into a neck, and the basal joint of the antennæ of normal length. With the five subfamilies of the same series possessing the last two characters it is needless to compare it, as its affinities are obviously not in their direction. On the whole, I think this genus must be placed in a new subfamily, which, from the form of the prothorax and elytra approximating it to *Zoëdia*, and in the absence of other indications, may be placed immediately after Aphneopinæ. I am indebted for my specimens to Mr. Masters.

Ochyra coarctata. Pl. XIII. fig. 3.

O. fusca, pilis erectis parce adspersa; antennis pedibusque luteis; capite prothoraceque subtilissime crebre punctulatis; elytris basi prothorace duplo latioribus, utrinque incurvatis, postice valde convexis, singulis ante medium plaga elevata lutea triangulari, basi ad marginem exteriorem, apice juxta suturam, ornatis; corpore infra fusco, abdomine nitido. Long. 4 lin.

Hab. Tasmania (Mount Wellington).

Distenia fastuosa.

D. nitidissime nigro-viridis, sparse erecto-pilosa; elytris cyaneo-chalybeatis, antennis, scapo excepto, palpis, pedibusque castaneo-rufis; capite fere impunctato; clypeo profunde emarginato; antennis corpore fere duplo longioribus; scapo nigro, transversim rugoso; prothorace elongato, in medio subtrituberculato; scutello subtransverso, nigro; elytris anguste cuneatis, apicibus oblique emarginatis, angulo exteriore longe spinoso, pube subtilissima vage vestitis, fortiter seriatim punctatis, punctis pone medium evanescentibus; corpore infra polito, nitidissimo. Long. 11 lin.

Hab. Nicaragua (Chontales).

A fine and very distinct species, which, from its longer and

* This is omitted by Lacordaire in his table. It is his 32nd "*groupe*."

narrower prothorax, sparse pubescence, and femora without spines at the apex, most nearly approaches the typical forms of the genus, such as *D. columbina*, Serv.; in colour it is somewhat like *D. rufipes*, Bates. The long hairs beneath the antennæ in this and allied genera are, I believe, only found in the early life of the insect, and are not dependent on sex, as Lacordaire supposes.

Melegena cyanea.

M. nitida, violacea, elytris cyaneis, sparse erecto-pilosa; capite vage punctato, labro palpisque flavis; antennis tenuibus, setaceis, corpore fere duplo longioribus, articulis duobus basalibus flavis, cæteris apicem versus infuscatis, basi sordide fulvis; prothorace paulo longiore quam latiore, disco subquadrituberculato (2 . 2), vage punctato; scutello nigro; elytris modice elongatis, pube subtilissima sparse vestitis, apicibus subemarginatis, haud spinosis, sat fortiter punctatis, punctis apicem versus evanescentibus; corpore infra nitide violaceo, pube subtilissima sericante induto; pedibus fulvis, femoribus intermediis et posticis parte clavata violacea. Long. 6 lin.

Hab. Cochin China.

A proportionally shorter form than the Borneo *M. pubipennis*, with more slender antennæ, the apices of the elytra not mucronate, &c. *Melegena*, *inter alia*, is distinguished from *Noëmia* by its coarsely facetted, reniform eyes. (See Trans. Ent. Soc. ser. 3. iii. p. 659.)

Temnosternus vitulus.

T. piceus, pube grisea tectus; capite dense pubescente, linea media excepta; prothorace valde disperse punctato, vittis tribus minus pubescentibus ornato; elytris oblongo-ovatis, remote punctatis, apicibus oblique truncatis, angulo exteriore breviter mucronato, postice fascia lata pubescente, marginibus denudatis, ornatis, singulis costis duabus longitudinalibus munitis, costa exteriore abbreviata et minus determinata; corpore infra castaneo, nitidissimo, lateribus pubescentibus. Long. 5 lin.

Hab. Queensland (Wide Bay).

Something like *T. planiusculus*, Wh.; but that species, *inter alia*, has the elytra gradually drawn out into a point.

Ancylonotus nasicornis.

A. fuscus, pube plerumque fuscescente tectus; capite inter antennas fortiter excavato, supra clypeum cornu triangulari porrecto armato; scapo modice elongato, articulo tertio flexuoso, duobus sequentibus conjunctim longiore; prothorace transverso, antice posticeque bisulcato, utrinque fortiter dentato, antice in medio tuberculis duobus nitidis subapproximatis instructo; scutello suborbiculari; elytris remote punctulatis, in medio depressis, fascia indeterminata albida notatis, singulis tuberculis quatuor, tribus basalibus, uno antemedio, pone medium parte elevata literam λ (lambda) simulante signatis; corpore infra pedibusque griseo-pubescentibus, his saturatiore annulatis; tibiis anticis intus haud dentatis; tarsis anticis, art. ultimo excepto, subnigris. Long. 6 lin.

Hab. Sierra Leone (Sherbro' Island).

The absence of the tooth on the inner edge of the anterior tibiæ, and the presence of a horn in front, as in *Prosopocera*, seem to indicate that this species should scarcely be referred to *Ancylonotus*. For the present, however, I am content to consider it a somewhat aberrant species of the genus. My specimen is a male; but, from a note, I see that the female has much shorter antennæ, although the third joint bears the same relative proportion to the two following.

Disterna Mastersii.

D. saturate cinnamomea, vix nitida, lineis maculisque fulvis e pube adpressa effectis; capite utrinque lineis duabus verticalibus, una ante, altera pone oculum sitis; antennis tenuibus, infra vage ciliatis; prothorace valde transverso, disco haud tuberculato, lineis transversis ornato; scutello semicirculari, densius pubescente; elytris cuneiformibus, singulis bicostulatis, basi bituberculatis, apicibus bispinosis, spina exteriore longiore, in medio punctis nudis plurimis notatis, maculis plus minusve contiguis ornatis; corpore infra nitido, lateribus fulvo maculatis. Long. $4\frac{1}{2}$–$5\frac{1}{2}$ lin.

Hab. Queensland (Wide Bay).

This species, with *D. pumila* and *D. cuneata*, seem to be intermediate between *Zygocera* and *Disterna*, having the narrower prosternum of the former, but with its anterior portion abruptly vertical and a little excavated as in the latter; yet Lacordaire places them in different groups. *Zygocera* was originally characterized by Erichson (Wiegm. Arch. 1842, p. 224); but as it was in German, and after the Latin description of *Z. canosa*, it has been generally overlooked. Dr. Howitt informs me that the latter is identical with the species I subsequently described under the name of *Z. lugubris*. The type of *Disterna*, J. Thoms., is *Z. bifasciata*, Pasc., erroneously printed "*infuscata*" in the 'Systema Cerambycidarum' (p. 88). I owe my specimens of the well-marked species described above to Mr. Masters, to whom I dedicate it.

Scotinauges.

(Hebesecinæ.)

Tubera antennifera mediocria, fronte inter ea triangulariter excavata; *facies* transversa. *Antennæ* (♂) corpore vix longiores, haud ciliatæ; *scapus* brevis, subpyriformis, articulus secundus longiusculus, cæteris gradatim brevioribus. *Oculi* parvi, subtenuiter granulati. *Prothorax* transversus, inæqualis, utrinque dente obtuso armatus. *Elytra* ampliata, apice divergentia, humeris callosa. *Femora* linearia; *tibiæ* intermediæ extus, versus apicem, ciliatæ; *tarsi* breviusculi, articulo ultimo elongato. *Mesosternum* antice verticale.

The genus *Hebesecis*, so well represented in Australia, gives its name to the subfamily which includes, among others, *Phyxium*, *Tetradia*, *Probatodes*, &c.; but to none of them does the one before us seem very nearly allied. The short scape scarcely reaching to the prothorax, the linear femora, and the vertical edge of the anterior portion of the mesosternum, form together a very trenchant diagnosis of the genus. The female is larger and broader, with somewhat shorter antennæ. I am indebted for my specimens to Arthur Adams, Esq., Staff-Surgeon, R.N. The name was suggested (*in lit.*) by M. James Thomson.

Scotinauges diphysis. Pl. XIII. fig. 4.

S. niger, supra pube silaceo-grisea reticulatim vestitus; capite prothoraceque parce punctatis, hoc postice anticeque transversim sulcato, in medio rude tuberculato-punctato; scutello semiorbiculari; elytris supra inæquatis, sat confertim punctatis, singulis basi nigro-fasciculatis; corpore infra pedibusque rufo-silaceo maculatis. Long. 9–11 lin.

Hab. Tsusima (Japan).

Ægoprepes.

(Ægoprepinæ, *subfam. nova.*)

Facies subquadrata; *clypeus* latus, truncatus; *labrum* sat angustum; *tubera* antennifera contigua erecta. *Oculi* medioceres, subplanati, supra profunde emarginati, tenuiter granulati. *Palpi* minusculi, subæquales. *Antennæ* breves, articulis quatuor basalibus, secundo excepto, elongatis, bifariam dense pilosis, sequentibus brevibus, cylindricis. *Prothorax* oblongus, cylindricus. *Elytra* prothorace paulo latiora, elongata, subparallela, supra depressa, apicibus oblique truncata. *Pedes* perbreves; *femora* incrassata; *tibiæ* intermediæ extus sinuatæ; *tarsi* latiusculi, articulo ultimo elongato. *Prosternum* arcuatum, postice abbreviatum; *mesosternum* antice breve, inter coxas arcuatum.

The peculiar character of the antennæ isolates this genus from all others of the groups to which it is otherwise allied; but it appears to lie between the Hippopsinæ and Ectatosiinæ, and rather to approach the former, on account of the very short legs, more quadrate face, and the form of the pro- and mesosterna, which in the latter are very different. From the Spalacopsinæ (except *Dorcasta*) it is separated, *inter alia*, by the undivided eyes and normal form of the head.

Ægoprepes antennator. Pl. XIII. fig. 5.

Æ. angustus, fuscus, maculis parvis pallide flavescenti-pubescentibus adspersus; capite granulato-punctato; antennis griseo-pubescentibus, articulis quatuor basalibus bifariam subnigro-pilosis; prothorace paulo longiore quam latiore, utrinque parallelo, transversim corrugato-punctato, in medio pallide vittato; scutello suborbiculari; elytris sat fortiter punctatis, punctis apicem versus evanescentibus, sutura maculisque numerosis distinctis pallidis ornatis; pedibus albido pubescentibus; abdominis lateribus albido maculatis. Long. 12 lin.

Hab. Malacca.

Pothyne silacea.

P. rufo-brunnea, elytris silaceis, supra pube grisea sparse tecta, vittisque pube condensata formatis; antennis articulo tertio quam primo manifeste longiore; prothorace perparum longiore quam latiore, basi fortiter transversim sulcato; elytris leviter disperse punctulatis, apicibus rotundatis; corpore infra pedibusque regulariter griseo-pubescentibus. Long. $7\frac{1}{2}$ lin.

Hab. Nagasaki.

In its broader elytra it resembles *P. capito*, but differs in colour, the greater length of the third antennal joint, the prothorax not corrugated, and the rounded apices of the elytra. The genus now includes species extending from Malacca and New Guinea to Japan.

Euthuorus protensus.

E. angustissimus, fusiformis, testaceo-piceus, pube sordide grisea vestitus; capite quam prothorace haud latiore; antennis sparse setulosis; prothorace antice parum angustiore; scutello elongato; elytris pone medium gradatim angustioribus. Long. $4\frac{1}{2}$ lin.

Hab. Mexico.

Differs from *E. filum*, Guér., in its fusiform outline, the elytra behind the middle gradually tapering to a point, the oblong scutellum, and the face in a perfectly horizontal line with the under surface. The head and first three joints of the antennæ are outlined on Pl. XIII. fig. 8.

Blepisanis.

(Phytœciinæ.)

Caput antice convexum, inter oculos sulcatum; *labrum* breve, transversum. *Oculi* profunde emarginati. *Antennæ* corpore longiores, apicem versus sensim incrassatæ; *scapo* breviusculo, articulis tertio et sequentibus cylindricis, subæqualibus, ultimo apice obtuso. *Prothorax* cylindricus (in *B. collari* in medio tumidus). *Scutellum* semicircularis. *Elytra* supra planata, prothorace basi multo latiora, apicibus rotundatis. *Pedes* mediocres vel breviusculi; *unguiculi* valide dentati. *Pro-* et *mesosterna* simplicia. *Abdomen* cylindricum, segmentis fere æqualibus. *Processus* intercoxalis vix distinctus.

I have already briefly pointed out the characters of this genus as distinguished from *Glenea* (Trans. Ent. Soc. ser. 3. iii. p. 365, note). M. Lacordaire places it in the Phytœciinæ, separating it from *Glenea*, which forms the last "*groupe*"* of his "Lamiides vraies," the "Phytœciides" being the first "*groupe*" of the "Phytœciides vraies." The latter are distinguished by their toothed, or cleft, claws; but as several of the Gleneas have the same kind of claws, and all the species are very intimately connected, I do not think this arrangement a happy one. The type of the genus is *Saperda Bohemani*, Pasc., with which *S. erythaca* is congeneric. The following are all very distinct species, and, like the two preceding, are natives of South Africa.

Blepisanis porosa.

B. nigra, pube ochracea dense vestita, nigro-punctata; capite tenuiter punctulato; antennis nigris, subtilissime pubescentibus; prothorace transverso, disco maculis denudatis nigris notato; elytris concinne sat confertim seriatim punctatis; corpore infra dense ochraceo-pubescente; segmentis tribus intermediis abdominis utrinque macula denudata signatis. Long. 8 lin.

Hab. Natal.

Blepisanis fervida.

B. subtiliter pubescens, capite prothoraceque rubris, confertim punctatis; antennis nigris, subtilissime pubescentibus; scutello magis

* Lacordaire regards the Longicorns as forming one family, but thinks that their primary groups ought to be elevated to the rank of subfamilies. This rank of subfamily is here used for the first time. In the secondary division the "Prionides vrais" and "Cerambycides vrais" have no "*tribus*," but are simply divided into "*groupes*." The "Lamiides," having no aberrant forms so called, are divided into four "*tribus*." This explanation is necessary, as I consider these "*groupes*," taking them one with another, fully equivalent to the "*tribus*" of the previous volumes, and, like the latter, I treat them as subfamilies.

transverso, apice bilobo; elytris subsericatis, sat confertim punctatis, rubris, præsertim basi, regione suturali lateribusque nigris; corpore infra nigro, marginibus segmentorum abdominis pedibusque rufescentibus. Long. $7\frac{1}{2}$ lin.

Hab. Natal.

Blepisanis incensa.

B. tenuiter ochraceo-pubescens, pilis erectis longis instructa; capite prothoraceque nigris, modice punctulatis; antennis scapo articuloque secundo apice nigris, sequentibus rufescentibus; scutello rude piloso; elytris silaceis, fortiter nigro-punctatis; corpore infra nigro, segmentis tribus ultimis rufescentibus, singulis in medio nigro-signatis; pedibus rufescentibus. Long. 4 lin.

Hab. Natal.

Blepisanis larvata.

B. supra rufo-fulva, pilis erectis nigris instructa, omnino pube sericea aurea sat vage vestita, infra magis dense pubescens; capite inter oculos nigro; antennis obscure fulvis; prothorace longitudine latitudini æquali, disco quadricalloso (2.2); elytris subseriatim fortiter punctatis, sutura dense aureo-pubescentibus; corpore infra nigro, abdominis segmentis duobus ultimis pedibusque rufis. Long. 5 lin.

Hab. Natal.

Blepisanis suturalis.

B. omnino nigra, supra tenuiter, subtus pedibusque sat dense cinereo-pubescentibus, linea longitudinali e pilis albidis effecta a fronte usque ad apicem elytrorum ornata; prothorace latitudine longitudini æquali; elytris confertim, sat fortiter punctatis; unguiculis piceis. Long. $7\frac{1}{2}$ lin.

Hab. Natal.

Blepisanis exilis.

B. angusta, nigra, medio elytrorum subcervina, pube pallide grisea sat tenuiter vestita, subtus pilis erectis adspersa; capite rude punctato; prothorace oblongo, postice sensim angustiore, ante medium bicalloso, pube magis elongata vestito; elytris fortiter seriatim punctatis, basi capite vix latioribus; pedibus brevibus, posticis abdomine brevioribus. Long. $3\frac{3}{4}$ lin.

Hab. Natal.

Blepisanis collaris.

B. omnino nigra, prothorace luteo, margine antico nigricante excepto, supra tenuiter erecto-pilosa, subtus pedibusque subtiliter subargenteo-pubescentibus; capite confertim punctato; prothorace transverso, supra bicalloso, in medio lateribusque tumidulo; scutello albido-piloso; elytris confertim punctatis, postice minus sensim angustioribus; abdomine segmentis duobus basalibus singulatim spina acuta armatis. Long. 6 lin.

Hab. Natal.

EXPLANATION OF PLATE XIII.

Fig. 1. *Teledapus dorcadioides.*
Fig. 2. *Phyodexia concinna.*
Fig. 3. *Ochyra coarctata*; 3 *a*, front view of the head.
Fig. 4. *Scotinauges diphysis.*
Fig. 5. *Ægoprepes antennator.*
Fig. 6. *Brephilydia jejuna*; 6 *a*, front view of the head.
Fig. 7. Front view of the head of *Simocrysa discolor.*
Fig. 8. Side view of the head, and first three joints of the antennæ, of *Euthuorus protensus.*

XXXIV.—*On a new Species of* Trichoglossus *from Celebes.* By Arthur, Viscount Walden, F.R.S., P.Z.S.

A large collection of birds obtained by Dr. A. B. Meyer in North Celebes, and kindly placed by him at my disposal for examination, contains several examples of a hitherto undescribed species of *Trichoglossus.* They evidently belong to the same species which supplied the individual referred to by Mr. Wallace (Proc. Zool. Soc. 1862, p. 337) as having been collected by him at Menado, but which was unfortunately destroyed before he had been able to identify it. He referred it, however, with some confidence, to *T. flavoviridis* of the Sula Islands. Dr. O. Finsch, in his well-known work (Papag. ii. p. 850), not deeming the evidence sufficient, restricted the range of *T. flavoviridis* to the Sula Islands; and the examples sent from Menado by Dr. Meyer fully justify this caution. The North-Celebean form, although possessing a general resemblance to *T. flavoviridis,* is a distinct species, chiefly differing by wanting the yellow head and breast and the black chin and nuchal collar of the Sula bird; in it also the bill is shorter and less produced.

Trichoglossus Meyeri, n. sp.

Green; forehead, occiput, and nape dark olive-brown tinged with golden, most marked on the forehead. Cheeks and loreal plumes same as head, but each feather with a yellow border. Ear-coverts bright yellow, forming an isolated, distinct, yellow patch on each side of the head. Under surface one uniform tint of greenish yellow, each feather bordered with dark green. Interscapularies yellow at base, broadly bordered with the prevailing green of the back.

Under tail- and wing-coverts light yellowish green. The ear-coverts are of the same shade of yellow as the breast-feathers in *T. flavoviridis*; and the plumage of the entire under surface closely resembles the abdominal covering of the Sula bird.

"Irides cherry-red, feet greyish blue, bill orange-red" (*Meyer*). Wing 4 inches; tail $2\frac{7}{8}$.

Dr. Meyer informs me that he possesses the bird alive at Menado, from the vicinity of which town his specimens were procured.

XXXV.—*Descriptions of some new Species of Lepidoptera, chiefly from the Collection of* Mr. Wilson Saunders. By A. G. Butler, F.L.S., F.Z.S., &c.

RHOPALOCERA.

Family **Nymphalidæ**, Westwood.

Subfamily *Satyrinæ*, Bates.

Genus Euptychia, Hübner.

1. *Euptychia languida*, n. sp.

Alæ anticæ supra fuscæ; fascia lata media antice convexe abbreviata et ad costam haud attingente, nivea: posticæ niveæ, basi fuscescente; plaga apicali et altera anali semiocellaribus nigrescentibus; lineis antemarginali, submarginali et marginali nigris undatis: corpus fuscum.

Alæ subtus fuscæ, fascia lata media alba: anticæ ocello subapicali et punctis duobus pone eum argenteis; linea antemarginali, apud apicem angulis alternis undata, linea submarginali et marginali nigro-fuscis; areola marginali dilute fusca: posticæ ocellis quinque, primo, secundo et quinto nigris, aliis argenteis, secundo maximo: corpus fuscum.

Exp. alar. unc. 1, lin. 9.

Hab. Bogotá. Coll. Saunders.

E. languida is a beautiful and very distinct species allied to *E. Ocirrhoë*.

2. *Euptychia cyanites*, n. sp.

Alæ supra cæruleæ fere velut in *E. cœlesti* ♂, nigro strigatæ et marginatæ, sed linea interiore anticarum obsoleta; plaga in margine interno squamosa griseo-albida: corpus cinereum.

Alæ subtus fere velut in *E. cœlesti*, fasciis autem magis rufescentibus ocellisque minoribus.

Exp. alar. unc. 2, lin. 2.

Hab. Brazil. Coll. Saunders.

This handsome species may at once be distinguished from *E. cœlestis* ♂ by its superior size and the curious scaly whitish patch on the inner margin of the anterior wings on the upperside; below it chiefly differs in the redder colour of the transverse bands and the small size of the ocelli. It is the tenth described species of a little group of nearly allied and very beautiful forms, *E. Brixiola* (which belongs to this section) being possibly identical with *E. Brixius.*

Genus Lethe, Hübner.

Lethe Alberta, n. sp.

♂. Alæ supra olivaceo-fuscæ: anticæ area apicali abrupte dilutiore: posticæ ocellis quatuor magnis nigris cæcis ferrugineo iridatis; margine externo nigrescente; linea valde indistincta submarginali fusca: corpus cinereo-fuscum.

Alæ subtus castaneo-fuscæ; area apicali pallidiore; linea media nigra extus griseo marginata; altera discali aream basalem limitante, in posticis angulata: anticæ margine roseo tincto; linea submarginali nigra; area discali introrsum rosea, extrorsum fusca; apice cærulescente; ocellis sex discalibus nigris, flavo cinctis, roseo zonatis: posticæ margine externo virescente; linea submarginali nigra; area discali introrsum ochraceo-fusca, extrorsum castanea nigrescente; ocellis septem in serie irregulari, quinto maximo, nigris, flavo cinctis, viridi pallide zonatis.

Exp. alar. unc. 2, lin. 11.

Hab. Benares. Exeter Memorial Museum.

This pretty but sombre species was lent me by Mr. W. S. M. D'Urban. It is allied to *L. Samio, distans*, &c.

Family **Erycinidæ**, Swainson.

Subfamily *Erycininæ*, Bates.

Emesis Clearista, n. sp.

Emesis? Clearista, Doubl. MS. in List Lep. Brit. Mus. ii. p. 9 (1847).

♀. Alæ anticæ rufo-fuscæ vel brunneæ; plaga magna interna triangulari alba, introrsum angulata, extrorsum undata; maculis duabus discoideis; lineola discocellulari et altera discali nigris; ciliis nigris albo variis: posticæ albæ, margine apicali brunneo; ciliis albis, nigro variis: corpus thorace brunneo, abdomine albo.

Alæ subtus pallidiores; punctis submarginalibus nigro-fuscis, albo cinctis: posticæ serie punctorum fuscorum orbiculari media: corpus album.

Exp. alar. unc. 2, lin. 1.

Hab. Honduras (*Dyson*). B.M.

Allied to no other species, and somewhat resembling the species of *Nymphidium* in the character of its markings.

Genus Lepricornis, Felder.

Lepricornis atricolor, n. sp.

♂ ♀. Alæ supra aterrimæ cinereo strigatæ: anticæ area apicali omnino nigra; macula subapicali obliqua alba: corpus nigrum, collo, ano, palpisque aurantiacis.

Alæ subtus strigis internervularibus magis distinctis, partim albis; macula anticarum longiore, aliter velut supra.

Exp. alar. unc. 1, lin. 3 usque unc. 1, lin. 6.

Hab. Brazil (*Rogers*). Coll. Saunders.

This species is allied to *L. melanchroia*, but differs in its smaller size and in the much smaller and shorter subapical band or spot. It has somewhat the aspect of a moth, on account of the thickness of the antennæ; but the aborted front legs prove it at once to be an Erycinide, allied to *Barbicornis*, as determined by Dr. Felder.

Family **Papilionidæ.**

Subfamily *Pierinæ* (Swainson), Bates.

Genus Hesperocharis, Felder.

Hesperocharis fulvinota, n. sp.

♂. Alæ anticæ supra albæ, basi minime flavescentes; costa nigra: apice, stria obliqua subapicali, et margine externo angulis alternis decrescente, nigris: posticæ lætissime flavæ, stria subcostali maculisque sex submarginalibus diffusis fulvis, vel pallide aurantiacis: corpus nigrescens, abdomine a latere flavido.

Alæ subtus fere velut in *H. Hirlanda*: posticæ stria maculari submarginali aurantiaca (vix rubra).

Exp. alar. unc. 2, lin. 10.

Hab. Back of Rio (*Sir W. Smith*). B.M.

Allied to *H. Helvia* and *H. Hirlanda*, and remarkable for the angulated character of the outer margin of the front wings.

Family **Hesperidæ**, Leach.

Genus Telegonus, Hübner.

Telegonus Omphale, n. sp.

Alæ supra nigro-fuscæ, cupreo tinctæ: anticæ basi nitide cæruleo-viridi micantes; fascia postmedia obliqua fulva hyalina, a venis intersecta: posticæ dimidio abdominali nitide virescente; margine interno fulvo tincto: corpus viride, abdomine certo situ grisescente, antennis nigris.

Alæ subtus fere velut supra: posticæ autem latius virescentes.

Exp. alar. unc. 2 usque unc. 2, lin. 3.

Hab. Ega (*Bates*); Venezuela (*Dyson*). B.M.

This is the most brilliant species of the genus; and I wonder that Mr. Hewitson, who has the insect in his collection, has not long since described it.

HETEROCERA.

Family Arctiidæ, Leach.

Subfamily *Pericopinæ.*

Genus Esthema, Hübner.

1. *Esthema Herrona*, n. sp.

Alæ supra viridi-cæruleæ: anticæ nigrescentes, apice ciliis lacteis; fascia decemmaculari postmedia arcuata decrescente alba: posticæ serie macularum septem discalium albarum; ciliis albis, in medio fuscescentibus: corpus cæruleo-viride, antennis nigris.

Alæ subtus clariores, area basali nitide virides, aliter nigræ virescentes, albo fasciatæ: corpus viride, pedibus cingulisque abdominalibus partim albis.

Exp. alar. unc. 2, lin. 8.

Hab. Bogotá. Coll. Saunders.

2. *Esthema Euplœodes*, n. sp.

Alæ supra nigræ: anticæ punctis duobus mediis costalibus cæruleis; serie subterminali macularum novem albis, quatuor quarum superioribus oblique subapicalibus, aliis submarginalibus: posticæ virescentes, maculis septem submarginalibus triangularibus introrsum griseo caudatis: corpus thorace nigro, albo punctato; abdomine cæruleo-viridi ad basin nodulis duobus viridibus.

Alæ subtus nigerrimæ: anticæ velut supra maculatæ: posticæ striis duabus subcostalibus basalibus cæruleis, stria sesquialtera discoidea et octo discalibus albis, apud apicem maculiformibus: corpus thorace cinereo, albo maculato; pedibus albo marginatis; abdomine lacteo.

Exp. alar. unc. 2, lin. 11.

Hab. Colombia (*Chesterton*). Coll. Saunders.

3. *Esthema Uraneides*, n. sp.

♀. Alæ hyalinæ, marginibus venisque nigris: anticæ area apicali nigra; fascia subapicali decrescente quadrimaculari alba, hyalina: corpus supra cinereum; thorace fuscescente, albo punctato; abdomine stria dorsali albida; subtus thorace fuscescente, albo striato; abdomine sordide albo.

Exp. alar. unc. 2, lin. 5.

Hab. Cayenne. Coll. Saunders.

Resembles the female of *Uraneis hyalina* and *Lymnas Jesse.*

Genus Hyalurga, Hübner.

Hyalurga Uria, n. sp.

Alæ supra hyalinæ, margine fusco: anticæ venis fasciaque subapicali fuscis; fascia alam cingente submarginali aurantiaca: corpus thorace nigro albo punctato, tegulis aurantiacis; abdomine fusco serie duplici dorsali macularum aurearum: anticæ subtus fascia aurantiaca fere obsoleta: corpus album.

Exp. alar. unc. 2, lin. 2.

Hab. Ucayale, Peruvian Amazons (*E. Bartlett*). Coll. Saunders.

Genus Pericopis, Hübner.

1. *Pericopis hydra*, n. sp.

Alæ anticæ supra fulvæ, apice late nigro a venis fulvidis partim intersecto, area medio-costali late flavida; area basali nigro strigata; punctis quatuor basalibus ochreis; macula costali, altera triangulari discocellulari et tribus discalibus inter venas medianas nigris; margine anali externo nigro, dentato, flavo bimaculato: posticæ nigræ, costa pallide fusca; macula elongata ad apicem costali flava, altera subapicali aurantiaca et punctis sex submarginalibus flavis vel croceis: corpus thorace nigro, flavo punctato; abdomine cinereo.

Alæ anticæ subtus magis rufescentes; cella discoidali et costa ad nervulum primum medianum nigris fulvo strigatis; striga lata interno-discali nigra; aliter velut supra: corpus thorace nigro, ochraceo et albo punctato; abdomine ochreo.

Exp. alar. unc. 3, lin. 5.

Hab. Ecuador (*Buckley*). Coll. Saunders.

Mimics *Heliconius Aristione*, Hewitson.

2. *Pericopis Ithrana*, n. sp.

Alæ anticæ supra nigro-fuscæ; area basali fulvo strigata; punctis duobus basalibus albis; plaga permagna media, a venis costali, mediana et nervulo suo primo intersecta, flava; maculis quatuor ejusdem coloris decrescentibus subapicalibus, oblique positis; punctis septem submarginalibus albis: posticæ aurantiacæ, nigro venatæ; margine externo late nigro; maculis septem hastatis submarginalibus aurantiacis: corpus thorace nigro, albo punctato; abdomine fusco.

Alæ subtus fere velut supra: anticæ area basali rufo-aurantiaca; cella discoidali ad basin fusca: posticæ maculis submarginalibus cum fundi colore continuis (ita ut margo posticus inter venas ruptus): corpus thorace nigro, albo punctato; abdomine ochraceo-albido, linea a latere nigro.

Exp. alar. unc. 3, lin. 2.

Hab. Amazons. Coll. Saunders.

Mimics *Heliconius Æde*, Hübner, or some nearly allied species.

3. *Pericopis Kenara*, n. sp.

Alæ anticæ supra nigro-fuscæ: anticæ punctis basalibus albis; macula discoidea et striga lata interno-discali luteis; stria subcostali basali fulva; fascia media obliqua quinquefida flava, hyalina; altera quadrifida subapicali, punctisque duobus submarginalibus ejusdem coloris analibus; punctis tribus submarginalibus apicalibus albis: posticæ aurantiacæ, venis nigris; margine late nigro; punctis octo ochreo-albidis submarginalibus: corpus thorace nigro, albo punctato; abdomine sordide ochreo.

Alæ anticæ subtus area basali fulva; cella discoidali ad basin nigro-fusca; punctis submarginalibus omnino albis: posticæ costa nigro squamosa; venis partim nigris, maculis submarginalibus albis, majoribus; aliter velut supra: corpus thorace nigro, albo ochreoque punctato; abdomine ochreo-albido, lateraliter fusco lineato.

Exp. alar. unc. 3, lin. 4.

Hab. S[ta] Marta (*Bouchard*). Coll. Saunders.

Mimics some species near *Heliconius Clara*, Fabricius.

4. *Pericopis fulgorata*, n. sp.

Alæ supra fulvæ: anticæ ad basin flavo punctatæ; area apicali profunde indentata fusca; area subapicali a costa ad nervulum secundum medianum flava; plaga diffusa cellulari cum squamis costalibus et discalibus fasciam obliquam formante, fusca; macula bilobata discocellulari obliqua fusca; area interna nebulosa, venis fuscis; macula diffusa indistincta subanali fulva punctisque tribus submarginali-analibus albis: posticæ venis nigris, fascia cuneiformi media, virgulaque cohærente angulata discoidea nigro-fuscis; margine externo fusco dentato: corpus thorace nigro flavo punctato; abdomine fulvo, ano virescente, fascia dorsali aliisque lateralibus fuscis.

Alæ subtus clariores: anticæ fascia media fusca distincta; punctis tribus apud apicem submarginalibus albis: posticæ punctis octo submarginalibus albis, aliter velut supra: corpus thorace fusco, albo fulvoque punctato; abdomine flavo.

Exp. alar. unc. 3, lin. 4.

Hab. Pará. Coll. Saunders.

Mimics *Melinæa Ishka*, Butler, and is allied to *P. eurocilia*, Cramer.

5. *Pericopis Hazara*, n. sp.

♂ ♀. Alæ anticæ supra fulvæ; margine costali fusco, margine interno late fusco; area apicali introrsum in venas medianas indentata apud apicem a fascia abbreviata flava interrupta, ad angulum ani introrsum dentata, fusca; macula subanali triangulari flava; striga abbreviata discoidea et altera interno-discali duplo longiore fuscis; macula arcuata discoidea cum area apicali cohærente, fusca: posticæ fuscæ; fascia postmedia abbreviata venisque internis fulvis: corpus thorace nigro, albo punctato; abdomine fusco, ochreo maculato.

Alæ subtus clariores: anticæ striga discoidea obsoleta; maculis duabus elongato-lunatis, de area apicali fusca separatis, fuscis: posticæ fulvæ; costa, striga subcostali, margine lato externo, striisque duabus internis, fuscis: corpus thorace fusco, albo fulvoque punctato; abdomine lacteo, stria ventrali fusco.

Exp. alar. ♂ unc. 1, lin. 10; ♀ unc. 2, lin. 2.

Hab. ♂, Villa Nova; ♀, Ecuador. Coll. Saunders.

Probably a mimic of *Ithomia Iphianassa*, Doubleday.

6. *Pericopis formosissima*, n. sp.

♂. Alæ anticæ area apicali sordide hyalino-albida, venis nigro-fuscis; area interna fasciaque submedia obliqua nigro-fuscis; area apicali pallide fusca; fasciola quadrifida subapicali sordide hyalino-albida; puncto basali coccineo; posticæ flavo-lacteæ; venis, marginibus costali et externo virgulaque discocellulari nigris; macula geminata subanali et altera simplici anali obscuratis rufis: corpus thorace nigro, capite albo punctato, collo tegulisque flavis; abdomine cinereo, serie duplici macularum squamosarum flavarum, ano fulvo.

Alæ anticæ subtus fuscæ, hyalino albo trifasciatæ; venis nigris; macula basali coccinea: posticæ macula basali coccinea, maculisque analibus distinctis; aliter velut supra: corpus thorace fusco, albo flavoque maculato; abdomine flavo-lacteo, ano fulvo.

Exp. alar. unc. 2, lin. 5.

♀. Alæ supra fuscæ: anticæ area basali obscuriore; puncto basali coccineo: posticæ nigrescentes; maculis sub septem discalibus inæqualibus (fasciam formantibus utrinque decrescentem) flavo-lacteis; fasciola anali partim maculari obscurata, rufa: corpus nigro-fuscum, capite albo punctato, abdomine ano fulvo.

Alæ subtus fere velut supra: posticæ puncto basali coccineo; area marginali dilutiore fusca: corpus fuscum, palpis albo punctatis, abdomine lateraliter flavo fasciato, ano fulvo.

Exp. alar. unc. 3, lin. 9.

Hab. ♂, Colombia (*Chesterton*); ♀, Ecuador (*Buckley*). Coll. Saunders.

Probably mimics some *Heliconius* allied to *H. Hecalesia*.

7. *Pericopis lunifera*, n. sp.

♀. Alæ supra fuscæ; anticæ fasciis duabus, interna vix distinguenda media, externa obliqua subapicali, subhyalinis fusco irroratis: posticæ nigrescentes fascia lata oblongata anali rosea: lunula trifida subapicali flava: corpus fuscum.

Alæ anticæ subtus macula basali coccinea; maculis duabus squamosis indistinctis subanalibus roseis; fasciis hyalinis supernis magis distinctis flavo squamosis: posticæ macula basali coccinea: corpus fuscum, capite albo punctato.

Exp. alar. unc. 2, lin. 11.

Hab. Bahia. Coll. Saunders and B.M.

Allied to *P. Jansonis* and *turbida.*

8. *Pericopis Thyridina*, n. sp.

♂. Alæ supra hyalinæ, venis nigro-fuscis: anticæ costa fusca; stria cellæ medium transerrante, fasciola discocellulari et margine interno nigro-fuscis; apice et angulo anali cum fasciola discocellulari connectis, fuscis rufo squamosis: posticæ marginibus costali et externo late nigris, virgula discocellulari nigra; area interna flavida; punctis septem submarginalibus albis: corpus thorace fusco, flavo alboque punctato; abdomine fusco, lateraliter flavo fasciato, ano aurantiaco.

Alæ subtus marginibus hic illic fulvo diffuse maculatis: anticæ punctis nonnullis submarginalibus albis; aliter velut supra: corpus thorace fusco; abdomine flavido, fusco lateraliter striolato, ano fusco, pilis aurantiacis.

Exp. alar. unc. 2, lin. 3.

Hab. Ecuador (*Buckley*). Coll. Saunders.

Somewhat resembles *Thyridia Hippodamia*, Fabr.

9. *Pericopis vestalis*, n. sp.

♂. Alæ supra niveæ, cinereo venatæ: anticæ fascia undata submedia et margine externo pallide cinereo-fuscis: posticæ margine externo cinereo-fusco squamoso: corpus thorace sordide albo, palpis fuscis, fronte tegulisque flavo maculatis; abdomine albo, ano aurantiaco hirto.

Alæ subtus venis fasciisque areæ internæ obsoletis; maculis basalibus ochreis: corpus sordide albidum, palpis caudaque aurantiacis.

Exp. alar. unc. 2, lin. 2.

Hab. Brazil. Coll. Saunders.

Has somewhat the appearance of the ermine moths. Felder refers an allied species to the genus *Hyalurga.*

10. *Pericopis Holofernes*, n. sp.

Alæ anticæ nigro-fuscæ, fascia postmedia tenui ochracea utrinque roseo terminata, a venis nigris interrupta: posticæ nigræ, margine externo late sanguineo a venis intersecto; ciliis griseis: corpus thorace nigro-fusco, tegulis coccineo punctatis; abdomine nigro, ano coccineo.

Alæ subtus pallidiores ad basin coccineo punctatæ: anticæ fascia superna sulphureo-flava ad angulum ani roseo squamoso: posticæ fascia marginali pallidiore ad apicem fusco obscurata: corpus fuscum; abdomine serie duplici ventrali macularum flavarum, ano coccineo.

Exp. alar. unc. 2, lin. 10.

Hab. Minas Geraes? Coll. Saunders.

The most beautiful *Pericopis* I have seen, and unlike any other species.

Genus Phaloësia, Walker.

Phaloësia Olympia, n. sp.

Alæ supra nigro-fuscæ: anticæ cella discoidali basique nitide cærulescentibus; costa basali coccineo trimaculata; puncto subbasali, fasciola discoidea trifida, maculis quinque in serie subapicali obliqua, quatuor in serie apicali obliqua et duabus anali-submarginalibus, albis: posticæ, area apicali excepta, nitidissime cæruleo-virescentes; serie macularum septem albarum submarginali: corpus thorace fusco, albo punctato; abdomine viridi-cæruleo.

Alæ subtus area tota basali late cæruleo-viridi nitente; costa basali anticarum coccinea; puncto basali albo obsoleto; maculis albis majoribus; aliter velut supra: corpus fuscum, albo fasciatum.

Exp. alar. unc. 2, lin. 3.

Hab. Brazil. Coll. Saunders.

A lovely new species.

Amongst the other *Pericopides* in Mr. Saunders's collection the following are worthy of note, as they are at present undescribed:—

"*Anthomyza Salvini*," Felder, MS. Polochic Valley (*Salvin*).

"*Anthomyza mimica*," Felder, MS. Upper Orinoco. Mimics *Heliconius Timareta*.

"*Anthomyza histrio*," Felder, MS. Villa Nova [St. Paulo, in B.M.]. Mimics *Melinæa Mælus*.

P. Salvini comes nearer to *P. Kenara* than to any other species, but differs considerably, in the front wings especially.

P. mimica is a fair imitation of *Heliconius Timareta*, and consequently is not nearly allied to any other *Pericopis*.

P. histrio is allied to *P. angulosa*.

It is an interesting fact, in connexion with the dispute respecting the date of publication of the second volume of the 'Voyage of the Novara,' that the plates on which the above species are figured are all antedated. I received a letter from the late Dr. Rudolph Felder, dated Weidling, near Klosterneuburg, August 5, 1869, in which he says:—"Provisional copys of our *Heterocer.* plates you will receive soonly by Mr.

Higgins." Shortly afterwards I received uncoloured proofs of forty-six plates; of these, plates lxxv. to cvii. are lettered, the remainder are unlettered: the lettering of the first eighteen informs the public that they were drawn in 1867 and published 1868; the nineteenth drawn 1868, published 1868; the twentieth and twenty-first drawn 1867, published 1868; the twenty-second to twenty-seventh drawn 1868, published 1868; the twenty-eighth and twenty-ninth drawn 1868, published 1869; the four remaining lettered plates drawn 1868, published 1868; so we are to believe that thirty-one of the thirty-three plates which Felder himself calls "provisional" in August 1869 were published in 1868. So far as can be ascertained from London publishers, the part containing these plates is actually not to be had at the present time, and lepidopterists are beginning to doubt whether it will ever appear at all. When these things are considered, what must of necessity be the feeling with regard to the second part of the same work, of which British lepidopterists at least saw nothing until 1867, but which bears the date 1865?

MISCELLANEOUS.

Notes on Australian Freshwater Tortoises. By Dr. J. E. Gray, F.R.S. &c.

The British Museum has received a series of freshwater tortoises belonging to the family Hydraspidæ, from Mr. Krefft. They are preserved in spirit, and were obtained from Burnett's River.

Chelymys macquaria.

There are six specimens, of different ages, which I believe belong to this species, in the collection. They all agree in having a lead-coloured head, with a broad white streak from the middle of the hinder part of the orbit to the upper front margin of the tympanum, and a similar rather broad streak from the angle of the mouth to the underside of the tympanum.

In general the gullet and throat below this line are white, but in some they are more or less varied with lead-colour. The thorax in all the specimens is much more oblong and convex than in the specimens received from Segou, in the Macquarie River; but they vary both in the outline of the thorax and in the convexity of the back very considerably. The smallest is the broadest, with the back of the shell much elevated in the centre. Indeed no two of the specimens are alike in form and convexity, which induces me to believe that they all belong to one very variable species.

Elseya latisternon (Cat. Shield Rept. Suppl. p. 77).

There are two specimens in Mr. Krefft's collection received from Burnett's River. They differ from the specimens in the British Museum, which I previously described, in the underside being dark-coloured and black-dotted; and the neck of this species is spinous on the upper surface, like *Euchlemys spinosa*, but is known from it by not having any nuchal shield.

Note on Comephorus baicalensis. By Dr. Albert Günther, F.R.S.

The Trustees of the British Museum have lately purchased a collection of fishes from Lake Baikal, and among them four specimens of *Comephorus baicalensis*; another example has been presented by Prof. Peters. Valenciennes denies the presence of pyloric appendages (xii. p. 333); however, I find five, each from 4 to 7 millims. long. With regard to the systematic position of the fish, I still think that it should be placed among the Acanthopterygians, in the division of the *Cotto-scombriformes* (see the "Systematic Synopsis of the Families of Acanthopterygians," Catal. iii. Appendix). In some respects it resembles a Gadoid fish; but there are true spines in the first dorsal fin: the air-bladder and, consequently, a pneumatic duct are absent.

On the Embryo of Macropus major. By H. A. Pagenstecher.

In the first place it may be stated, with regard to the generative organs, that Owen is perfectly right in saying that in *Macropus major* no communication at all exists between the median vaginal cæcum and the portion designated by him as the vestibule, whilst, on the contrary, *Halmaturus ruficollis* (*Bennetti*) in our collection shows a complete open communication. The vaginal vestibule contained a great quantity of thrown-off epithelium, which was accumulated in the very narrow canals of the lateral paired vaginæ, the *uterus anfractuosus* of authors; the median cæcum, which had flabby walls, contained a very small quantity of a turbid fluid.

The left tube contained an embryo, although no yellow body was to be recognized in the ovary. The very vascular decidua separated pretty readily from the walls of the tube, except a few stronger vascular adhesions. The chorion had no connexion at all with the decidua, so that it slipped quite easily out of the envelope. The embryo was exactly of the size and maturity of the specimen of which Owen says that it was born thirty-eight days after copulation, and which he has figured. It was enveloped in the amnios. The length, from the snout to the extremity of the tail, was about 4 centimetres.

The amniotic peduncle contained five spiral convolutions of the intestine. With its inner surface were connected the membranes and vessels of a vesicle over 1·5 centimetre in diameter, which projected from the peduncle and was itself supported on a peduncle nearly a centimetre in length—and of a membranous expansion, likewise projecting from the peduncle, which in its periphery was inseparably amalgamated with the chorion.

I was at first inclined to regard the former vesicle as the yelk-sac. From its mode of union I now think that it must undoubtedly be regarded as the allantois. A fine vascular system was distinctly visible upon it in the fresh state, even to the naked eye. Its contents, which were in other respects limpid, contained a few turbid flakes. Its form was spherical, and, except by its fine long peduncle, the vesicle had no attachments.

The peduncle entered upon the right side into the rounded mouth of the peduncle of the amnios or umbilical cord, and remained for a time quite free. It was only far down that it united with the wall so as to form a fold upon the latter, lying upon the side of the amniotic peduncle turned towards the posterior ventral region (bladder and penis).

The other membranous expansion (Owen's *vasculosa*) appeared to be inseparably united to the left side of the amniotic peduncle from its entrance into the latter. It contained three large vessels, probably two arteries and a vein, which in the peduncle lay on the anterior wall and could be easily separated from the wall. One of these vessels, probably the vein, united itself to the extreme loops of the intestine; the others, the arteries, passed into the interior.

From this we must conclude that these are vitelline vessels, which alone maintain the connexion with the decidua, and to the support of which the vitelline membrane, the outer lamina of the amnios, and the chorion contribute. The state here described must, by comparison with Owen's observations, be regarded as that of the mature embryo. The allantois was therefore at this time very finely developed, constricted into a peduncle, surrounded by delicate vessels, and with no trace of any contact with the periphery of the ovum. In the vascular knots of the vitelline vessels there were scattered whitish deposits. At this time, when the umbilical vessels should take the place of the omphalic vessels, but for want of further development and attainment of attachments do not do so, the early birth takes place.

Nothing was to be observed in the way of a preparation of the median sac for the further retention and nourishment of the ovum, nor any thing of a preparatory dilatation of the lateral passages.

In the ventral pouch the left teat was much longer than the right one; but whether from previous sucking, or as a preparation, I cannot say.

In comparison with other embryos, that of the giant kangaroo is very considerably inferior to an unborn rabbit or a newly born ferret; its size agrees pretty closely with that of an unborn mouse.

In this comparison the small development of the hinder extremities is remarkable. Whilst on the fore feet the five toes are very distinctly formed even to the claw-tips, the hind feet resemble a short-stalked fin, slightly notched into three lobes; the inner lobe is again scarcely perceptibly divided, to correspond with the ultimate number of toes. This imperfection of a subsequently most important pair of limbs, in contrast with the perfection of a pair which are afterwards much weaker, is doubtless in accordance with the general law, according to which early completion of form limits growth.

In the anatomy of the adult animal it may be interesting to mention the existence of a long but fine *ductus Botalli*, showing that even before birth the formation of the partitions of the heart arrives at the same completeness as in Placental Mammals. The dissection of the embryo itself was not made, on account of the rarity of the specimen.

Our investigation of the unborn embryo still in the tuba, when compared with Owen's of the embryo immediately after birth, may make it certain, from the agreement in size and development, that the embryo makes no considerable stay and undergoes no growth and development in the other sexual passages.—*Verhandl. des Naturh. Vereins zu Heidelberg*, v.

On the Oviposition of Mantis religiosa. By Edmond Perrier.

It has long been known that the ova of *Mantis religiosa* are enclosed in a case which has sometimes been described as a silky case. In the course of last September I witnessed the oviposition of these insects, and can give an exact account of the process employed by the female *Mantis* in fabricating her case.

The material of which this shelter is composed has nothing of the aspect of silk. At the moment when it is ejected it is a frothy liquid very similar in appearance to the frothy liquid with which the larvæ of *Cercopis* surround themselves, but rather less transparent. This matter becomes solidified very quickly, and thus forms for each of the eggs a sort of cell, in which it remains enclosed.

To build its case the *Mantis* employs two instruments—the extremity of its abdomen and the extremity of its elytra. The insect, clinging to the stalk of a broom-plant or of a fern, begins to deposit some portions of its frothy liquid, and sustains them by means of the extremity of its elytra, which form a sort of spoon, at first preventing the liquid from flowing downwards, and then constituting an actual natural mould, in which the first layers of the nest are fashioned. Very soon the latter presents a form very similar to that of a swallow's nest. The *Mantis* then moves the extremity of its abdomen upon the circumference of the nest. The terminal filaments are elevated and spread out; they do not appear to play any very important part in the oviposition. In proportion as the extremity of the body is directed towards a point, the contractions of the abdomen drive on both the frothy liquid and the eggs. The elytra remain motionless, although applied pretty strongly to the consolidated part of the nest, upon which we can distinguish the traces which they have left, which forms a sort of median longitudinal ridge. It is evident that by their adhesion to the nest they limit the course of the abdomen, and thus render the form of the *building* regular.

The latter presents externally numerous very irregular, circular, transverse ridges, corresponding to the layers successively deposited by the *Mantis*. It may easily be conceived that these layers remain distinct, as each of the halves of the nest is already consolidated when the *Mantis* returns to it to deposit a new layer of eggs and of frothy liquid. The nest has also a generally ovoid form. While it is still fresh it is of a slightly yellowish-white colour; but in the course of a short time this tint passes into a bright brown, whilst the total volume of the nest diminishes sensibly.

When the oviposition is completed, the *Mantis* quits the nest by climbing up vertically. A certain quantity of liquid continues to be given off, becomes consolidated as the *Mantis* climbs, and thus forms a sort of little column, which surmounts the nest like a lightning-conductor.

The *Mantis* dies two or three days after having accomplished its work. It clings by its anterior feet to a branch, extends its four posterior legs, and remains thus suspended, without motion, or only moving when it is disturbed, until the moment of its death, which does not modify its attitude in any way.—*Annales des Sci. Nat.* 5e sér. tome xiv. art. 10.

Echinococcus *in* Macropus major.
By H. A. Pagenstecher.

The occurrence of *Echinococcus* in a species of kangaroo has been recorded by Davaine. The author found in the thoracic cavity of a specimen of *Macropus major*, killed at the Zoological Garden of Cologne, a great quantity of *Echinococci*. They appeared to be identical with the ordinary *Echinococcus* of man and the ruminants, and, on administering them to two dogs, one of those animals was found on the thirty-sixth day to contain from six to eight specimens of the true *Tænia echinococcus*. The author remarks that, from the wide distribution and the isolation of the species, we may regard *Echinococcus* as a very ancient form of *Tænia*.—*Verhandl. Naturh. Vereins zu Heidelberg*, v.

On a new case of Hypermetamorphosis in Palingenia virgo *in the Larva-state, and Analogies of this Larva with the Crustacea.* By N. Joly.

Having attended for some years to the embryogeny of the Ephemerinæ, and especially to that of *Palingenia virgo*, I was still unable to hatch this neuropterous insect in my laboratory. More fortunate this year, I have at last succeeded in following the development of the insect in the egg, and to procure its exclusion, so as to fill up an important gap which I regretted to find in the interesting memoirs of Swammerdam, Réaumur, and Christian Scheffer. Long since* I

* Comptes Rendus, September 1846.

indicated a very curious case of hypermetamorphosis in the larva of *Œstrus equi.* Von Siebold and Fabre have ascertained two others—one in the larvæ of the Strepsiptera, the second in the Meloidæ. But in the cases cited by these naturalists the hypermetamorphosis was limited to some modification of the external form, the internal organization remaining invariably the same up to the moment of nymphosis. This is not the case in the recently hatched larva of *Palingenia virgo.* In fact, at this period of its existence it is completely deprived of several organs which would seem to be essential and even indispensable to the life of an insect, and the late appearance of which is something surprising. Thus at first it has neither a circulatory apparatus nor special organs for respiration. Its antennæ and caudal setæ have neither the same number of joints nor the villosity which they subsequently acquire; in a word, compared with what it will be a little while before nymphosis, it may be said to be a very incomplete animal.

In this first state *Palingenia virgo* therefore recalls the permanent state of *Nemoura trifasciata* and *variegata*, being, like them, entirely destitute of trachean branchiæ. A little later its branchiæ appear under the form of small tubular cæca placed upon the lateral parts of the first six segments of the abdomen, and of a crystalline transparency, as, indeed, is the entire body. The animal then resembles *Nemoura cinerea*, or, still more, *Sialis lutarius*, being furnished, like the latter, with branchial cæca suspended from the first six segments of the abdomen.

Then, becoming still more complicated, the branchial apparatus of *Palingenia virgo* acquires the form of flattened lamellæ, fringed at the margins after the fashion of the branchiæ of the *Libellulæ*, and traversed, as in the latter, by a principal tracheary trunk subdivided into very delicate branchlets. Lastly, the branchial lamellæ become gradually wider and more strongly fringed; the tracheæ make their appearance with their spiral thread; the blood-globules are formed, and the circulation is set up, as described by Carus.

Here we have, therefore, true metamorphoses perfectly analogous to those which I ascertained in 1844 in a little freshwater shrimp * very common in the Canal du Midi—metamorphoses which, independently of the aquatic mode of life of the *Palingeniæ*, establish a somewhat unexpected transition between Insects and Crustacea. The passage from the one group to the other is rendered still more evident by the singular insect which my son, Emile, was the first to discover in the Garonne, and which Geoffroy, who met with it in the neighbourhood of Paris, and Latreille, who never saw it, erroneously arranged among the Crustacea, as it certainly respires by true tracheæ enclosed between two branchial laminæ†.—*Comptes Rendus*, July 24, 1871, tome lxxiii. p. 276.

* *Caridina Desmarestii.* See Ann. Sci. Nat. 2e sér. xix. p. 34.

† This insect, which my son described to the Natural-History Society of Toulouse (June 15, 1870), is nothing but the excessively rare "*Binocle à queue en plumes*" of Geoffroy (Hist. des Ins. de Paris, tome ii. pl. 21. fig. 3), the *Prosopistoma* of Latreille (Nouv. Ann. du Mus. tome ii. p. 23).

THE ANNALS

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XXXVI.—*On the Evidence of a Glacial Epoch at the Equator.* By JAMES ORTON, of Poughkeepsie, N. Y.*

THE valley of the Amazon is highly interesting to the geologist, from its vast extent and its disputed origin. Probably no other region on the globe, of equal area, has such a remarkably uniform character: 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†. Professor Agassiz was the first geologist of eminence to explore any considerable part of the formation. He ascended the river to Tabatinga (1500 miles in a straight line); and he has well described the successive beds, of which he distinguishes ten. The chief, in the order of superposition, are:—coarse sand, laminated clays of divers colours, ferruginous sandstone, and an unstratified sandy clay; of these, the argillaceous portion is the most important, as it is the most extensive, the sandstone being reduced to isolated hills by denudation. The clays generally are very fine in texture, and without a pebble: they contain a large percentage of iron, but no trace of lime; there are, however, calcareous concretions, nodular or stalactiform, strikingly similar to the marly concretions noticed by Darwin in the Pampean mud. The argillaceous deposits are more conspicuous on the Upper Amazon, and the sandstones on the Lower. The whole formation dips gently to the east, and its total thickness is about 800 feet.

Professor Agassiz considers the valley a cretaceous basin, filled with glacial drift—in other words, that all these clays

* From a separate impression communicated by the Author.

† Professor Agassiz speaks of this clay formation as stretching over a surface more than three thousand miles in length; but he is evidently led astray by the length of the Amazon, with all its windings. The width of the continent at the equator is only 2,100 miles.

and sandstones were deposited underneath a gigantic glacier, which descended from the Andes, grinding into fine powder the materials between it and the solid rock, and leaving an immense moraine across the mouth of the valley. To this theory we make the following objections:—

1. The theory is short of positive proof where we need the most unquestionable evidence. The confession is made that "the direct traces of glaciers, as seen in other countries, are wanting in Brazil." There is not a trace of furrows, striæ, or polished surfaces*. The answer that the rocks are so friable, and disintegration in the tropics so rapid, as to render their discovery hopeless, is not entirely satisfactory. The granitoid rocks which border the valley, and the schists and porphyries on the slope of the Andes, ought to preserve some marks of the glaciation†. The pot-holes in the gneiss plains of Bahia, supposed by Hartt to have been formed by glacial cascades, are "exceedingly well preserved, and have smooth sides;" while all the ploughings and planings of the gigantic glacier over the same rock have been utterly erased by disintegration! The stone structures of Brazil endure remarkably well, while the granite of Quebec exfoliates so rapidly in winter that oil is used to protect the buildings; yet there is no lack of striæ in Canada.

Boulders occur only along the eastern region; none have been observed in the great interior basin. This is a strange inversion: if a continental glacier moved down the Andes to the Atlantic, we would naturally look for porphyritic boulders scattered over the valley, and dwindling in number and size as we near Pará. We are suspicious, also, that these so-called boulders have not travelled. The only genuine erratics seen by Professor Agassiz were found on the northern flank of Ereré; all the others turn out to be "boulders of decomposition." The boulders of Tijuca, in the Rio Province, described by Hartt, were not far-fetched; the majority are of gneiss on gneiss: still they may have been the work of local glaciers. The Ereré erratics are hornblendic and without scratches;

* Professor Hartt likewise acknowledges, "I have nowhere seen either polished or striated rocks."

† The eminent explorer Dr. Spruce describes the Casiquiari Region as "one great sheet of granite and gneiss. There is nowhere any continuous range of mountains or plateau; and, except towards its borders, the granite has been entirely denuded of the stratified rocks that once overlay it, and is now either naked or else overspread in some places with a thin covering of white sand, and in others (chiefly flats, hollows, and rifts) with a thick deposit of the fertile 'terra roxa,' or red loam (decomposed gneiss, mica-schist, &c.), which I have supposed to be lacustrine, but Professor Agassiz says is glacial drift."

the lack of striation, however, is no proof that they are not true boulders.

To complete the glacial picture, it is asserted that a gigantic moraine stretched across the mouth of the valley—though, as Dr. Newberry says, "a moraine can hardly be formed by a glacier, except where there are cliffs and pinnacles along its course;" and as the absence of glacial inscriptions is attributed to disintegration, so it has been found convenient to say that this morainic wall must be looked for in the depths of the Atlantic*. It is worthy of remark, moreover, that fiords, which are conterminous with the drift of high latitudes, are absent from equatorial coasts. Thus we are called upon to believe in the existence of a tropical glacier, 2000 miles in length, moving "for hundreds of thousands of years" over the continent, upon evidence which is singularly defective.

2. We object to the theory because the formation contains Tertiary shells. Previously to the expedition of the writer across the continent in 1867, the vast clay-beds 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 Upper Amazon prove to be highly fossiliferous. At the confluence of the Ambiyacu with the Marañon stands the village of Pebas, about two hundred miles west of Tabatinga, long. 72°. The site is a level tract, about fifty feet above the river; and the formation is wholly of those peculiar variegated clays which we traced far up the Napo, and are continuous with the Tabatinga beds and with those on the Lower Amazon, where they are overlain by sandstone. Imbedded in these clays, several feet below the surface, and incontestably *in situ*, we discovered numerous small shells. They were examined by Mr. Gabb, of Philadelphia, who published † the following species:—*Turbonilla minuscula*, n. sp.; *Neritina pupa*, Linn.; *Mesalia Ortoni*, n. sp.; *Tellina amazonensis*, n. sp.; *Pachydon obliquus*, n. sp.; *P. tenuis*, n. sp.

Before leaving Pebas, we engaged Mr. Hauxwell, the experienced English collector, residing at that place, to search

* It seems to us that if "the waters of the lake were suddenly released," they would have exerted the most denuding force near the outlet; yet along the Lower Amazon we find vast remnants of the sandstone series, as those of Ereré, Obidos, and Almeyrim, while further west the waters seem to have made a clean sweep of it. No table-topped hills like Almeyrim are seen west of Manáos.

† Amer. Journ. Conch. vol. iv. p. 167.

for other localities. In February 1870 he reported a large deposit on the south side of the Marañon, thirty miles below Pebas, at Pichaua, just west of Cochaquinas*. The shells were larger and more plentiful than at Pebas, but were found in the same layers of red and blue clays, from six to twenty feet beneath the soil. A collection (in quantity about half a bushel) was received in August, and submitted to the eminent palæontologist, T. A. Conrad, Esq. His paper, published in the 'American Journal of Conchology,' Oct. 10, contained many additional species, and corrected some mistakes into which Mr. Gabb had fallen from lack of perfect specimens. The following is a complete list, numbered in the order of abundance, No. 1 being the most numerous†:—

Gasteropods.	Conchifers.
5. Isæa (Mesalia) Ortoni, *Gabb.*	3. Pachydon tenuis, *Gabb.*
12. —— (——) lintea, *Conrad.*	2. —— carinatus, *Conrad.*
9. Liris laqueata, *Conrad.*	1. —— obliquus, *Gabb.*
8. Ebora crassilabra, *Conrad.*	6. —— erectus, *Conrad.*
14. —— bella, *Conrad.*	7. —— cuneatus, *Conrad.*
15. Hemisinus sulcatus, *Conrad.*	11. —— ovatus, *Conrad.*
13. Dyris gracilis, *Conrad.*	10. —— altus, *Conrad.*
4. Neritina Ortoni, *Conrad.*	17. Fragments of a singular bivalve, probably allied to *Mülleria.*
16. Bulimus linteus, *Conrad.*	

The *Neritina*, which Gabb made identical with the living *N. pupa*, proves to be a new species. The *Isæa Ortoni* is accompanied by an immense number of small, delicate shells, which Conrad considers its young. He thinks the genus is related to *Tricula*. *Liris* and *Dyris* probably belong to the *Melaniidæ*; and *Ebora* is presumed to be a freshwater genus. Of *Hemisinus* and *Bulimus* there was but one specimen each. *Pachydon*‡ is the most important genus, the collection furnishing seven distinct species. Conrad makes it one of the Corbulidæ, though its spiral beaks are in marked contrast with those of *Corbula*. Some of the species attained con-

* Mr. Hauxwell writes that he has found similar shell-beds on the north side of the Marañon, about a mile inland, both east and west of Pebas, and also at Maucallacta.

† The type series is now in the New-York State Geological cabinet.

‡ As this name is too near *Pachyodon*, Conrad suggests *Anisothyris*. It had an internal cartilage in a pit behind the tooth of the right valve, exactly as in *Corbula*; and Meek is inclined to consider them identical. The only shell observed by Darwin in the Pampean formation was *Azara labiata*, D'Orb., one of the living Corbulidæ. It has no spiral beak. Several species of *Azara* (*Patarnomya*) live in the brackish parts of the Amazon. *Corbulæ* were abundant in the early Tertiary. See Ann. Nat. Hist. for Jan. and Feb. 1871.

siderable size, particularly *tenuis* and *erectus*; a specimen of the latter before us measures 2 by $2\frac{1}{4}$ inches, and is packed with clay crowded with *P. obliquus.* All the specimens are remarkably perfect, except *Bulimus* and the unknown bivalve. The valves of the Pachydons are seldom separated, and scarcely ever broken, and none of the shells show the least abrasion. The *Neritina*, *P. tenuis*, and *P. carinatus* retain the epidermis, the first displaying various patterns of coloured zigzag lines. Many species, as *Isæa lintea*, *Liris laqueata*, and *Dyris gracilis*, are exceedingly delicate, yet perfect. But Agassiz says the Andean glacier must have ploughed the valley-bottom over and over again, grinding all the materials beneath it into a fine powder. How did these shells escape during "the kneading-process the drift has undergone beneath the gigantic ice-plough?" The supposition that they may have been washed in from another locality must be rejected; for they are plainly in place, and none are water-worn. "It seems clear," says Conrad, "that they were not transported from a distance, but lived and died in the vicinity of the spot in which they are found." The shells are filled with the same bluish or drab sandy clay, "holding minute scales of mica, and frequently ferruginous," in which they occur. The Pachydons abound in the indurated and concretionary as well as soft parts of the formation.

Here, then, we have a large collection of shells from localities thirty miles apart, exhibiting seventeen species, all extinct, belonging to nine genera, only three of which have living representatives. The beds, therefore, cannot be later than the Pliocene. There is not one strictly marine genus; Gabb's *Tellina* turns out to be the young of *P. tenuis.* The deposit was probably of brackish-water origin. Only one specimen of the land-shell *Bulimus* was found; and this was about the only one in the collection which appears to have suffered fracture before deposition. The fact that all the parts are so orderly laid down (lignite, clays, and sandstones) points to a quiet formation, and not to a tumultuous flood or debacle. Any subsequent oscillation must have been continental; for the beds are without sign of being unequally tilted or dislocated.

It is quite plain that the drift theory of this formation must be abandoned; but Professor Hartt, to whom science is indebted for many minute and careful observations on the eastern border of Brazil, has propounded a new version. He thinks that the clays and sandstone are very late Tertiary and marine, while the superficial unstratified deposit, covering like a sheet the whole country (plains, campos, and sierras), is drift, the product of a general glacier*. It is doubtful if even local glaciers, of any great extent, existed on the mountains of Minas when they stood at a higher altitude than at present, for the same reason that glaciers are now absent from the equatorial Andes; but, for arguments already given and to follow, we certainly cannot believe in the existence of a vast glacier stretching from the Andes to the Atlantic.

3. We question the possibility of its formation. At the equator there is little variation of temperature. Pará is noted for its equable climate, varying little from 80°. At the Hacienda, on the slope of Antisana, 13,300 feet, the mean temperature in spring is 42°, summer 38°, autumn 40°, winter 41°. The snow-line on the equatorial mountains is therefore stationary; while the oscillation from summer heat to winter cold, in northern latitudes, gives rise to a variable snow-line. In the Alps, the variation, from January to July, is 34°. Now the snow-line at the equator remains throughout the year at 15,800 feet; at the latitude of New York it is only one half of this. Therefore, to bring the snow-limit down to sea-level would require excessive cold†. But this more than polar reduction of temperature, and the uniform climate, would destroy the conditions necessary for the manufacture of the glacier, which must be constantly fed; and the supply depends on an abundant snow-fall, and this, again, on humidity. But an intense unchanging winter would be a dry one. Besides, if a snow-field does not attain a temperature higher than zero, it can never become a glacier; for the particles are as incoherent as sand‡.

Moreover, if formed, we doubt its ability to move. The extraordinary unbroken winter would prevent all movement; for this depends on repeated accumulations of snow and ice at the high sources, and on a change of seasons. All theories of glacier movement are based on the periodical partial liquefaction of the surface. The Alpine glaciers move twice as rapidly in summer as in winter. Then, too, the slope is insufficient. Forbes says a glacier must have an angle of 3° or

* Rounded and angular quartz-pebbles cemented with ferruginous loam are seen in the Pebas district.

† In Europe the most southern glacier which comes down to the sea is on the coast of Norway, lat 67°.

‡ According to Hopkins, if blocks on the Jura were transported from the Alps by the agency of ice, the Alps must have been at least 6000 feet higher than at present. But the lower the latitude, the higher the elevation needed. Who will estimate the altitude necessary to send an Andean glacier to the Atlantic?

4°*. But between Pebas and Pará, a distance of 1600 miles, the slope is only 8′ 5″, or about $2\frac{1}{2}$ inches per mile; and from the tip-top of the Andes to the Atlantic the inclination is 6′ 30″. We conclude, therefore, that if a sheet of ice ever spread from Cotopaxi to the mouth of the Amazon, it remained there, immovable as the mountains.

But difficulties lie beyond this. As the length of a glacier depends greatly upon the speed with which it travels, it will be short in proportion as the angle of the slope is diminished. And, further, suppose the ice-sheet formed and moving, what would be its flow? Even if its rate equalled that of the Mer de Glace, a boulder from the Andes would be over 20,000 years in reaching the Atlantic; but when we consider its feeble slope, and its retardation by the constant trade-winds, we may wonder if it ever completed its journey. Yet this Agassiz glacier is represented as doing a greater amount of work than the high-latitude glaciers, grinding up and covering the vast basin with 800 feet of detritus, "the most colossal drift formation known." And, again, all the slope of any consequence lies between the axis of the Andes and Pebas, a distance of 450 miles. In this abrupt descent (35 feet per mile) it must receive momentum to carry it over an almost level plain of 1600 miles. Why did it not plough up the silt, creating linear lakes like Como and Maggiore, which radiate at right angles to the strike of the Alps? Yet there is no appearance of excavation. The lagunes of the Napo are shallow ponds.

4. The existence of such a continental glacier at the equator would profoundly affect the life-history of the globe. As Newberry says, "Nearly all the fossil plants and mollusks of the strata deposited immediately anterior to the glacial epoch are undistinguishable from species now living in the same region"†. If a mantle of ice ever covered Amazonia, undoubtedly it had lateral branches descending the valleys of the Orinoco and Paraguay: there is a close similarity of the formation in these valleys to the Amazonian clay, which has resulted, we think, from a contemporaneousness, if not identity, of origin; and so low is the watershed, especially on the north, that the two river-systems are joined by natural canals‡.

* The average slope of the Mer de Glace is 14°, that of the Greenland glacier 11°.

† In the opinion of De Candolle, subscribed to by Gray as likely, the greater part of the existing species of plants are older than the present configuration of our continent.

‡ The Casiquiari is only 400 feet above the sea, or about 200 above the centre of the Amazon basin.

The glaciation of the whole earth at the same time is absurd, on biological and hydrological grounds: if, therefore, an equatorial ice-period occurred before or after the ice-period of the high latitudes, we must imagine the temperate regions converted by a change of climate into a conservatory for the rich and peculiar life in the tropics—which is an unwarrantable assumption. Polar types are now living in the intertropical oceanic area; so that their occurrence in any marine deposit is no evidence *per se* of the general extension of glacial action into tropical regions. And we may add that the almost total absence of typical North-American plants in the highlands of the West Indies and on the Andes of the equator does not favour the theory of a glacial migration.

No continent has such a simple geological structure as South America. The monotony of its vast expanses is in strong contrast with the complexity of Europe: witness the unparalleled extension of gneissic rocks from the Orinoco to Paraguay, the long, compact range of the Andes, so eminently porphyritic, and the extraordinary continuity and uniformity of the Llanos, Amazon, and Pampa deposits of ochraceous sandy clay. Yet we have much to learn before it will be wise to speculate on the geological history of South America. Darwin and Hopkins have given us sections across the Cordilleras; and it is much to be regretted that Professor Hartt has failed to give us a physical map, with geological sections and reliable altitudes. We need a careful section from Rio to Pará, and another from Manáos to the mouth of the Orinoco. Barometrical measurements are indispensable; but, so far as we know, the only consecutive observations with a mercurial barometer across the continent are those made by the writer in 1867*.

It is probably safe to say this much:—that South America began with the tablelands of Guiana and Brazil†; that the subsequent upheaval of the Andes left estuary friths now marked by the three river-systems‡; that the Andes did not reach their present altitude until after the deposition of the Amazon formation, though it was a slow movement in mass, for the beds are nowhere unequally tilted or dislocated§; that

* Published in the 'American Journal of Science,' Sept. 1868.

† Bates has shown that the geographical distribution of insects indicates that Guiana was formerly an island.

‡ The sediments from these straits near the ocean would have a purely marine character; and Hartt observes that the clays and sandstones on the coast tie in with those of the Amazon.

§ This certainly follows, if the Pebas and Pichaua shells prove to be early Tertiary. The clay-beds ascend the eastern slope beyond the village of Napo, which stands 1400 feet above Pará, and in long. 77°. The red the archipelago on the north was formerly united to the southern continent, and that it has since been an area of subsidence*; and that simultaneously with this subsidence was created the low watershed which now separates the Amazon and Caribbean waters.

XXXVII.—*On* Acanthopholis platypus (*Seeley*), *a Pachypod from the Cambridge Upper Greensand*. By Harry G. Seeley, F.G.S., St. John's College, Cambridge.

[Plate VII.]

There is no period in English geology in which the rocks themselves have not furnished evidence of the proximity of land to what are now our coasts. Occasionally they prove the present land and the past lands to have in part included each other; and in between these periods of similar altitude the depression is rarely if ever so profound or wide-spread as to remove the land to a distance too great to be measured approximately in miles by the evidence from the distribution of its detritus. But when the stratigraphic teaching becomes difficult to read or unravel in reasoning, then the fossils come to hand, in a rough way cut the knot that could not be untied, and invest the subject with new interest in the distribution of life; for sea-life, land-life, and river-life are in the main so different from each other, that they give evidence of the extent of strata and of the causes which limited them which are second only in usefulness to the lithological and petrologic facts. Among such obscure problems, but for its fossils, would have been the history of the Cambridge Upper Greensand—a mere junction-bed between the Gault and the Chalk; but the fossil fruits, the sea-birds allied to *Colymbus* and the penguins, the flocks of aërial quadrupeds (Ornithosaurs), the schools of Emydian Chelonians, and, lastly, the land-quadruped *Acanthopholis*, point to their home in a not distant country, of which the other deposits between the Gault and Chalk to the south and north help to tell the whereabouts and history.

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clay was not prominent on the Rio Napo till we reached long. 74° and an altitude of 550 feet, where there is a very high bank called *Puca-urcu* or *monte colorado,* containing lignite—"*una mina de carbon de piedra,*" says Villavicencio. This interstratified lignite is traceable eastward as far as Tabatinga. Darwin says that the Pampean formation was accompanied by an elevatory movement.

* This is suggested by the South-American character of the West-Indian mammals and mollusks. There are palæontological reasons for believing (Proc. Acad. Nat. Sc. Philad. 1868, p. 313) that the Caribbean continent was not submerged before the close of the Postpliocene.

Acanthopholis is a genus of Pachypod animals instituted by Professor Huxley, in the 'Geological Magazine' for 1867, for a Scelidosaurian from the chalk-marl of Folkestone—Scelidosaurian rather than Dinosaurian, because the three families typified by *Scelidosaurus*, *Iguanodon*, and *Megalosaurus* seem to show affinities so various as to make it doubtful whether *Scelidosaurus* can be included in the same order with the Megalosaurs.

The genus has occurred sparingly for the last ten years in the Cambridge Upper Greensand, but is rarely represented by any parts except foot-bones, caudal and dorsal vertebræ, and scutes. These fossils indicate, by the difference in the form of the bones, three species, which varied in size from that of a sheep to that of a small ox. They had the tail shorter and smaller than is usual with Iguanodonts, were heavily striped with dermal armour, had large limbs, which do not appear to have been so unequal or so long as among the Iguanodonts; and the animal had not a large head.

To the largest species I have given the name *Acanthopholis platypus*; but, like too many of the osseous relics of the Cambridge Greensand, the remains indicate but a small portion of the animal—in this case the metatarsal bones of one foot, a worn phalange, and six caudal vertebræ. And it is right to remark that the association of these bones as remains of one individual rests on no other evidence than their having been disinterred together in the same pit (at Bottisham), and no other remains of a like kind having occurred near them. And, after study of the specimens and comparison of them with other remains of *Acanthopholis*, I see no reason to doubt the association being natural; and they make known a form of foot-bones and vertebræ of which no other example is known. No materials are available for judging whether this species is identical with or distinct from Prof. Huxley's type species, *A. horridus*, since no teeth have come under my notice which can be referred to the genus and compared with the premolar or incisor teeth figured by Prof. Huxley; and the scutes which that gentleman figures, and the vertebræ described in his memoir, are remains which afford no data for *specific* comparison. I may here express a conviction that in dealing with fossil remains of large animals, the anxiety of naturalists to allow every possible margin of variability to their species rather than risk the creation of a doubtful type, has led, with some orders and among Europeans, to the retaining of groups of Linnean magnitude, where the species are really genera; and thus false conclusions result as to the want of stability of character in extinct types, as to the fewness of genera, and the accuracy of the method of research. It therefore seems desirable that fossil groups should be comparable in magnitude with the genera and species of true (*i. e.* living) Reptilia.

Probably the Folkestone fossil and these from Cambridge occur upon the same horizon; for the Cambridge animals are usually from the upper portion of the phosphatic stratum, and are rarely mineralized with phosphates, while the *Acanthopholis horridus*, according to Mr. Etheridge *, is from the Chalk-marl, about 8 feet above the Upper Greensand; and almost all the marine species found in the bed, except Ammonites and some of the Echinoderms, are also fossils of the Cambridge Greensand.

The English Dinosauroids of which the foot-bones have hitherto been figured are referred to *Hylæosaurus*, *Iguanodon*, *Scelidosaurus*, and *Hypsilophodon*. The metatarsus in *Hylæosaurus* is made of three somewhat slender and greatly elongated bones †. In *Iguanodon* there are three principal metatarsal bones, which are less elongated and relatively much stouter than in the specimen referred to *Hylæosaurus*, while there is also a rudimentary slender fourth metatarsal ‡. In *Scelidosaurus* there are four moderately elongated metatarsals, of which the first is conspicuously short; and there is also, according to Professor Owen, a slender styliform rudiment of a fifth metatarsal, which is adherent to the proximal end of the fourth §; while in the skeleton which Professor Huxley refers to *Hypsilophodon* (Quart. Journ. Geol. Soc. Feb. 1870) the animal is remarked upon as possessing certainly four, and perhaps also a slender fifth metatarsal bone, which, from Prof. Owen's figure ||, appear to be about as long as $2\frac{1}{2}$ centrums of dorsal vertebræ, and rather more slender than the metatarsus of *Scelidosaurus*. When, therefore, the foot of *Acanthopholis* was found to consist of five well-developed bones, of which the fifth appears well capable of carrying phalanges, and the first is singularly massive, the animal was invested with platypodial interest, as probably showing a character new in the order, and offering a new point of affinity.

At the time in which Prof. Owen wrote (1857) some doubt hung over the determination of the terminal segments of the fore and hind limbs; and this doubt is not to be neglected in interpreting the present specimens, notwithstanding the researches of Leidy, Cope, and Huxley on the proportions of the Dinosaurian limbs.

* Geol. Mag. 1867, vol. iv. p. 68.

† Wealden Rept. 1857, part 4, pl. xi.

‡ *Loc. cit.* pls. i.–iii.

§ Oolitic Rept. 1862, part 2, p. 17, pl. x.

|| Wealden Dinos. 1854, pt. 2, pl. i.

The form of the bones, considered by itself and in relation to the other known fossil types, as well as the osteology of recent crocodiles and lizards, would have led me to suspect the metapodium to consist of the metacarpal bones; yet the enormous size of the foot-bones and small size of the caudal vertebræ, and the fact, demonstrated by all other fossils, that the fore foot is smaller than the hind foot, make it *probable* that the inferences from comparison have in this case no importance, and that the bones are metatarsal. From the shape of the bones I should infer that the distal ends of the metatarsals did not approximate towards each other closely, and that the three inner bones and two outer bones were fasciculated.

Another difficulty in the restoration of the foot will occur to the student of Prof. Owen's writings, from the way in which the foot of *Iguanodon* is interpreted in the Palæontographical Monograph for 1857 (Wealden Rept. pt. 4). Here the Professor explains the rudimentary metapodial bone as the first or innermost toe. This interpretation is so much opposed to the analogy of recent crocodiles and lizards and fossil Pachypods, that I venture to suggest that the digit which Prof. Owen has named the fourth is really the first, and that which is named innermost is really outermost; and consequently the bones, instead of belonging to the right foot, would belong to the left. And to account for this inversion we must believe that, in extracting the fossil or by some subsequent accident, the phalanges of the first and third digits came to occupy each other's places, which would be more credible than the interpretation which makes the first Dinosaurian metatarsal a mere rudiment. Moreover the proximal angles of the bones overlap each other, as in the recent Reptilia; only, if Prof. Owen's interpretation were accepted, they would overlap in a reverse direction to that seen in Reptiles or Pachypods, the angles being directed *inward*, according to the figure. This alone seems to me sufficient evidence of the error; and so I would suggest to all possessors of casts of Mr. Beckles's fossil to retranspose the phalanges of the first and third digits, the present arrangement being as much in defiance of osteological experience as any angel or mermaid. It may not be out of place if I remark that no corroborative evidence has yet been published that the fossil foot referred by Prof. Owen to *Iguanodon* really belongs to that genus. The passage "Not far from where the foot-bones were found, the femur, tibia, and fibula of the same *Iguanodon* were extracted—a circumstance which adds to the probability of their belonging to the same limb" is obviously meant to beg the question of the determination, and is not put in as proof. Prof. Owen also speculates that if the claw of the rudimental digit were fully grown, it would probably show the features "which characterize the claw-phalanx which has been mistaken for the horn of *Iguanodon*." That horn has been harped upon so steadily, that I will venture to wind it once more. First, then, it is manifest that the determination quoted is as pure a dream as a midsummer night could invent. But in 1854 (Wealden Dinosauria, part 2) the illustrious author devoted many pages to a consideration upon this horn; and there, too, the bone which Dr. Mantell so confidently exalted is degraded to being the support for an Iguanodon's toe-nail, seemingly because Dr. Mantell had named it a horn. I do not wish to defend Dr. Mantell, though I think that his scientific instinct led to a conclusion which was philosophically good; nor do I wish to underrate the spirit of Prof. Owen's protest that *Iguanodon* can by no means be inferred to have had a horn because such a structure is found in *Iguana*. Even if wrong in this particular case, it was important for the progress of science that uniformitarianism should not creep unopposed into comparative anatomy. But in the elucidation of the truth it is desirable not to neglect facts; and from the time when Prof. Owen observed that "the mutilated basal surface in no wise militates against the supposition of the conical bone having been the terminal unsymmetrical ungual phalanx," &c. &c., to this day no foot has been found containing a bone which resembles it; no indubitable terminal phalange resembles it closely; while it is closely matched by Dinosaurian dermal armour, especially that of *Scelidosaurus*. That it was a nasal horn is highly improbable; but that it is a dermal spine of some Dinosaur seems almost certain after a comparison of the specimens. And if any one, thirty years ago, had had the opportunities which students have now in the national collection, I venture to think that Dr. Mantell's horn would never have been made to claw the dust.

The bones of the metapodium of *Acanthopholis*, placed together, measure over their proximal ends 9 inches from side to side, while the middle bone is about 6 inches long; they are well expanded at the proximal and distal ends; and the shaft becomes more slender from the first to the fourth. The proximal ends of all are flattened, transversely truncated, and slightly twisted outward; while the distal ends are rounded from above downward, and approximate to the usual pulley-shaped articulation. The bones are all slightly worn, and have suffered a little abrasion at their articular surfaces.

The *first* bone is short and strong. The flat *proximal articulation* is shaped in outline like half of a wide pear, with the convex surface external, the vertical cut surface internal, and the compressed apex upward. As preserved, this surface measures

In height.................. $3\frac{3}{4}$ inches.
From side to side where widest $1\frac{7}{8}$ inch.

The *inner* flattened vertical surface of the bone is somewhat triangular in outline; its moderately concave superior margin and its more concave inferior margin approximating towards the distal end, but remaining separated by a convex expanded outline of the distal articulation. The whole inner surface is gently concave from front to back: at the back, where $3\frac{3}{4}$ inches deep, it is flat; in front, behind the articulation, where an inch deep, it is convex from above downward. The *external* surface is convex and oblique from above downward proximally; but at the distal end, by the form of the articulation, it becomes angulated, so that the external slightly convex part is short and vertical, and the superior convex part hangs a little to the inner surface. In length this surface is gently concave. The extreme length of the bone as preserved is, on the inner side, nearly 4 inches. The *distal articular* surface is somewhat abraded. It is in outline concave below, higher on the outside, compressed on the inside, and convex above, so as to be ear-shaped. As preserved, it measures $2\frac{3}{4}$ inches from side to side, and nearly 2 inches high at the outer part. The surface is depressed in the middle towards the under part, where it terminates in an oblique transverse thickening: it is not parallel with the proximal surface, but inclined to it so as to look externally away from the second bone. The *under* surface is rhomboid, half as long again as wide, wider in front than behind, concave in length, and slightly convex from side to side.

Externally the bone shows a few small nutritive foramina; and in a corresponding bone from another species (marked, in the Woodwardian Museum, J. e. 25) foramina are conspicuously numerous on both the proximal and distal ends, though, probably owing to the state of its preservation, no trace of them is seen in the specimen now described.

The *second* bone is strong, longer than the first, and less stout; it is $5\frac{3}{4}$ inches long. The proximal articulation is four-sided, with the sides nearly parallel; it is oblique to the distal articulation, inclining towards the third metapodial bone; it measures $4\frac{1}{4}$ inches in height, and about 2 inches from side to side at the proximal and distal ends, and $1\frac{3}{4}$ inch from side to side in the middle. The long outline towards the first bone is straight, that towards the third bone is moderately concave; the superior outline is slightly convex, and the inferior outline slightly concave. The whole surface seems to be laterally oblique to the shaft of the bone, being inclined towards metapodial bone no. 1; it is not so flat as the corresponding surface in no. 1, being slightly convex both in breadth and length.

The bone contracts between the proximal and distal articular ends, and in the middle of the shaft measures $1\frac{1}{4}$ inch from side to side, and $1\frac{2}{3}$ inch from above downward behind the distal articulation. The lateral and upper and under surfaces are all concave in length. The lateral side towards bone 1 is flat, vertical at the two ends, and very slightly convex in the middle. The lateral side towards bone 3 is concave vertically at the proximal end, flat in the middle, where it approximates on the under surface towards the other lateral side, and flat at the side of the distal articulation; all these parts are in different planes. The superior surface is convex; it is obliquely inclined towards bone 1 at the proximal end, and less inclined towards bone 3 at the distal end. The under surface contracts so as to measure about $\frac{3}{4}$ of an inch from side to side in the middle; at the two ends it is concave from side to side. The distal end is subreniform in outline, being convex above, concave below, and flattened or slightly convex at the sides. It measures $2\frac{1}{2}$ inches from side to side, and more than 2 inches from above downward; it is regularly convex from above downward; and toward the under half a median depression appears and continues increasing in concavity. The articulation does not make quite a right angle with the shaft, being a little inclined towards the first metapodial bone.

In the *third* bone the proximal and distal ends are less expanded than in the second bone, so that its aspect is more slender; it measures $6\frac{1}{4}$ inches in length. The proximal articulation is more quadrate than in the second bone, measuring about 2 inches from side to side, and $2\frac{3}{4}$ inches from above downward; it is set on to the shaft with an obliquity like that seen in the second bone, and similarly has the two pairs of sides parallel and the surface convex. The side towards the second bone is very convex, an inflation running down the middle of the side, and dying away towards the condyle of the distal articulation. Proximally the side of the bone looks as though slightly compressed in fossilization; distally the side is flat. All the sides are concave in length, the upper one least so. The side towards bone 4 is smooth and flat, and inclines inferiorly towards its opposite side, so as only to be divided from it below by a rounded ridge. The upper surface is better defined than in the other bones described; it is concave from side to side behind, and convex from side to side in front. The shaft measures from side to side in the middle $1\frac{1}{4}$ inch, from above downward $1\frac{5}{8}$ inch. The distal end is ovately oblong, convex from above downward, whereas in the other bones the condyles become more marked; as in those bones, the median depression on this surface is only noticeable towards the under part; and, as in the previous cases, the articular surface is *slightly* oblique to the shaft laterally, inclining towards the second bone. The surface measures $2\frac{1}{2}$ inches wide by $1\frac{3}{4}$ inch from above downward.

The *fourth* bone is not well preserved, both articular ends being rubbed. The bone is gradationally more slender than that last described, and has proportionally smaller articular ends; it measures, as preserved, $5\frac{5}{8}$ inches in length. The proximal articular end is triangular, measuring $1\frac{3}{4}$ inch along the horizontal slightly concave superior surface, $2\frac{1}{2}$ inches along the flattened side towards bone 3, and $2\frac{7}{8}$ inches along the flat side towards bone 5. The two sides meet below in a rounded ridge proximally. The side towards bone 3 is gently convex from above downward; the side towards bone 5 is flat from above downward proximally, convex from above downward distally. All the sides are concave in length, the underside and that towards bone 5 most so, the superior surface least so. In the middle the shaft measures less than an inch from side to side, $1\frac{1}{4}$ inch from above downward, as in previously described bones. Towards the distal end the bone from above downward steadily contracts in depth up to the enlargement made by the condyles of the articulation; and, as in the other bones, the distal end expands from side to side, only more noticeably. The distal articular surface is like those already described, and oblong, with the sides convex and the under surface slightly concave; it measures more than 2 inches from side to side, and nearly $1\frac{1}{2}$ inch from above downward.

The *fifth* bone is badly preserved at its articular ends; as preserved, it is $5\frac{1}{2}$ inches long; it is in form much compressed from side to side, and much expanded from above downward at the proximal articulation. It is difficult to give the form of this elongated area; but its outline is flat on the inside of the bone and convex on its exterior side; it measures $3\frac{1}{2}$ inches from above downward, and $1\frac{1}{4}$ inch from side to side, but does not narrow inferiorly as it does superiorly, because the inner angle is inflected so as to support the under part of bone 4. The underside of the bone is very concave from back to front, and well rounded from side to side; but the side-to-side measurement decreases towards the distal end. The inner side, as remarked, is flat, and terminates above in a sharp ridge, which extends down more than two-thirds the length of the bone, and then abruptly terminates. The external side is nearly straight between the articulations, and convex from above downward; but towards the distal end an inflation appears towards the upper part, so as to make it approximate in outline to a vertically elongated oval. The least measurements of the shaft behind the distal articulation are less than $1\frac{1}{8}$ inch from side to side, and less than $1\frac{1}{2}$ inch from above downward. Beyond this the distal articulation expands but little, measuring, as preserved, 2 inches from above downward, and one inch from side to side; so that while the distal articulation in the other bones is transversely oblong, in this fifth digit it is vertically oblong. It is an inference, perhaps not unworthy of consideration, that since the deposit yields two kinds of claws presumably Dinosaurian, one depressed as in Chelonians, the other compressed as in Lizards, the former may have belonged to the first four digits, and the latter to the fifth.

In size and form of the bones this metapodium suggests comparison with the pachypod mammals, and most conspicuously, by the presence of five digits, with the elephant, in which the metapodial bones are equally large. But in the elephant the bones of the fore foot are larger than those of the hind foot, contrary to the rule with Dinosauria. An elephant would similarly have had the proximal ends of the bones transversely truncated; the proximal end would similarly have had a great depth from front to back, and have preserved the same width from side to side. The form of the distal end would have been the same, though the slight mesial depression of that articulation in the fossil would have been represented by a slight mesial elevation in the mammal. The bones would not have obliquely overlapped at the proximal end in the elephant; and in that animal the large massive bone would have been the fifth, and not the first as I have named it, and the shafts of the other bones would not so steadily decrease in size. In *Rhinoceros* and *Hippopotamus* the bones conspicuously have a tendency for the inner to overlap the outer at the proximal ends as in the fossil.

Among birds, not even among fœtal birds, so far as known to me, is there any structure in fore or hind limb which can be compared with this metapodium of *Acanthopholis*. Coming to crocodiles, there is a similar gradational decrease in size of the shaft in bones 1 to 4 in the hind limb; but then in crocodiles the fifth bone is wanting, and the bones are out of all proportion too long. In the fore limb, however, there are five digits, and the proportions of the bones match much better what is seen in the fossil; the angle, however, which the proximal end of the bone makes with the distal end is greater in crocodiles than in *Acanthopholis*, and the fifth bone is shorter and of different shape. In the Nilotic *Monitor* the metapodium includes five elements in both front and back limbs, but only in the front limb is the fifth bone compressed at all as in the fossil; and in the hind limbs the bones are elongated as in the crocodile; and in neither limb is there a gradational decrease in the size of the shaft from within outward. Nor is there a nearer resemblance in *Uromastix*, *Stellio*, *Lacerta*, *Polychrous*, *Iguana*, *Draco*, or any of the typical lizards with which I am familiar.

Among the Emydian Chelonians, of numerous genera the metapodium similarly shows a gradational decrease in the size of the bones from the first to the fifth, with similar proportions for each bone, a similar overlap of the proximal ends, and similarly shaped articular surfaces.

Among frogs the bones gradationally *increase* from the first to the fifth; but the overlap of the proximal ends is usually discernible, so that the right and left feet could not be confounded.

From these comparisons it would seem that the only living animals which throw light on the structure of the foot in *Acanthopholis* are the Elephant, Emydians, and Crocodiles. Since the fossil bones have no epiphyses, have the reptilian form of distal articulation, and have the bones arranged in their relation to each other and to the limb in a markedly reptilian way, it seems probable that the resemblances to the elephant, close and curious as they are, must be classed as a functional modification, and not as a mark of organic approximation of the Dinosauria towards the Mammalia, though with our present imperfect knowledge it may not be easy to estimate the influence of such a pachypodial function in inducing differentiation of the higher vital tissues. The comparison, then, is limited to Emydians and Crocodiles; and, in view of the pachypodial function of the Emydian limb, it will not be surprising if that type is found to be the nearer to *Acanthopholis*: nevertheless the resemblance of the fore foot of the crocodile is such as might well make any one pause in doubting its crocodilian affinity; for in a case where the functions of the parts were presumably dissimilar and the structural resemblance not unlike in both, the affinity is presumably strongest genetically where the functions of the parts are different. In this case such a view would make the crocodilian resemblance at least as important as the resemblance to Chelonians. Yet as the Dinosaurian type would, from our present palæontological knowledge, seem to be at least as old as the recent monimostylican Reptilia, the resemblance throws no light on the Dinosaurian affinities attributable to direct descent, but only demonstrates in the living reptiles collateral divergences from fossil types which have still to be discovered.

But one phalange was found with the metapodium; it, too, recalls the phalange of an elephant, being like the second in the compression of the distal articulation from above downward, and in the shortness of the bone from front to back. As preserved, the proximal articulation measures $1\frac{5}{8}$ inch from side to side, while the distal articulation measures $1\frac{7}{8}$ inch from side to side. The posterior articulation is transversely ovate, slightly concave, and, as preserved, measures an inch from above downward in the middle; but both articulations are worn; the distal articulation does not measure $\frac{3}{4}$ of an inch from above downward. The bone is more compressed on its right side than on the left; and the right measures less from front to back than the left side, the right side being $1\frac{1}{4}$ inch, and the left about an eighth of an inch more. Among reptiles only Chelonians have phalanges of this shape.

The vertebræ associated with these foot-bones are all caudal. The earliest in sequence of the series preserved may be regarded as one of the earlier caudals; for relatively to the others the centrum is shorter and deeper, the transverse process and neural arch (which is not preserved) had a stronger attachment, and the facets for the chevron bone on the hinder margin were wider apart and larger. The anterior articulation is the more concave of the two, and has a central boss similar to that seen in Pliosaurs and certain Plesiosaurs. The outline of the posterior end of the centrum is a depressed pentagon, measuring about $2\frac{1}{4}$ inches from above, and more than $2\frac{1}{2}$ from side to side where widest. From front to back the centrum measures 2 inches.

The second bone of the series is in much better preservation: it measures $2\frac{1}{4}$ inches in length; and the posterior articulation is not so much larger than the anterior articulation. The neural arch is not preserved; but the broken attachment of the neurapophysis is lenticular, about an inch long and a $\frac{1}{4}$ of an inch wide, and placed equally distant from the anterior and posterior margins. The space between the neurapophyses is concave and a little excavated. External to the neural arch on the shoulder of the centrum on each side is a prominent ridge, which arises about $\frac{5}{8}$ of an inch from the anterior margin (where they are $1\frac{3}{8}$ inch apart); they are prolonged horizontally backward, becoming rather more marked and slightly diverging; they make the lateral spaces both above and below them to be concave. Rather lower below this pair of ridges than they are below the neural arch is a second horizontal pair; they do not arise quite so far forward, but extend back, widening and thickening almost to the posterior articular surface; they make the widest part of the centrum. Below these ridges the sides of the centrum converge inferiorly to the hypapophysial ridges; between these limits the depth of the side is $1\frac{1}{2}$ inch; above the middle of this area is a faint horizontal ridge which divides it into two unequal parts and gives it a convex aspect. The narrow under surface is limited by the two faint hypapophysial ridges, which slightly approximate in the middle and diverge towards the two ends, terminating posteriorly in the oblique facet which is confluent with the posterior articulation. The posterior side is unequally six-sided, in every case a long side having a short side opposite to it, there being a long superior margin and a short inferior margin, two short sides above and two long sides below. Both articulations are rather conspicuously concave.

In the third vertebra the centrum is equally long, but is much smaller, the posterior articulation measuring more than $1\frac{1}{2}$ inch from above downward, and nearly 2 inches from side to side; while in the second vertebra the similar surface measures $1\frac{3}{4}$ inch from above downward and $2\frac{1}{4}$ inches from side to side. In the third bone the first pair of ridges become stronger, the second become much fainter, and the obscure third ridge is now a well-marked tumid ridge: in consequence of these modifications the lateral spaces of the sides become more concave from above downward. The hypapophysial ridges have approximated much closer together, and become more elevated, especially in front, showing that the chevron bone now articulates with both the vertebræ between which it is placed; and there is a marked increase in the concavity of this under surface from front to back.

The fourth bone is badly preserved.

In the fifth vertebra the length of the centrum is 2 inches; but the depth of the posterior articulation, including the chevron surface, is $\frac{5}{16}$ inch, while its width from side to side is $1\frac{1}{2}$ inch; the lateral surfaces are markedly concave; and the whole bone looks like a substance contracted and withered. The first and second pairs of lateral ridges have disappeared; and the third ridge is now a strong elevated ridge, dividing the side into two equal parts, and at its terminations making the widest part of the articular ends. The hypapophysial ridges become parallel, rounder; and the whole under surface from back to front is deeply concave. The posterior articular surface is only slightly larger than the anterior end; and the facets for the chevron bones are nearly equal. The intervertebral cup is becoming less deep.

In the sixth bone the centrum is $1\frac{5}{8}$ inch long. The side ridge has become depressed, and the side is rounded, so that the flattened articular end has an aspect of being a little compressed from side to side.

These vertebræ, if really belonging to the same individual as the foot-bones, would indicate a smaller and more mammal-like tail than that attributed to the other Dinosaurs. Judging from Prof. Owen's figures (Palæont. 1862), the early caudal vertebræ of *Scelidosaurus* have the centrum more obliquely inclined forward, a neural arch with a longer attachment, longer and stronger transverse processes placed more anteriorly, and an absence of ridges on the side of the centrum, which has the articular margin more thickened; but the absence of ridges from the centrum is the most marked character of *Scelidosaurus*, which distinguishes its caudal vertebræ from those of this animal.

The caudal vertebræ of *Hylæosaurus* have not been figured by Prof. Owen.

The caudal vertebræ of *Hypsilophodon*, so far as can be judged from Prof. Owen's figure (Palæont. 1854, pl. 1), appear to be not dissimilar, but have the transverse processes from the centrum more developed and placed *anteriorly* instead of posteriorly, while the articular margins of the centrum seem to be greatly developed. In *Iguanodon* (Palæont. 1854, pl. 9, and 1851, pl. 37) the resemblance to the centrum of *Acanthopholis* is much closer (supposing the figured determinations to be satisfactory), and the differences would seem to be chiefly in the proportions of the bones. Presuming that most of the Dinosaurian caudal vertebræ from the Potton Sands are to be referred to *Iguanodon*, it will be noticed that the centrum is more elongated than in *Acanthopholis*, and has but one ridge on the middle of the side of the centrum, while the basal surface is not so concave from front to back, nor the parts of the side so concave or convex respectively from above downward.

In *Hadrosaurus* the centrum, as figured by Leidy, appears to be much shorter from back to front, and not likely to be confounded with *Acanthopholis*.

On comparing the fossil with reptiles, the cup-and-ball articulation, the long attachment of the neural arch, and the strong transverse processes (not to mention the number of vertebræ) show the tail of lizards to be well distinguished from *Acanthopholis*. In *Chelydra* (*Emysaura*), where the Chelonian tail is long and has the vertebræ in some respects comparable, the centrum is opisthocœlian.

Among crocodiles the articular ends of the centrum are flattened instead of being concave, and the centrum differs in most of its details; but of all reptiles the crocodile is least unlike this Dinosaur, though no crocodilian vertebræ have the centrum so short as the early caudals of *Acanthopholis*, and all differ in the neural arch, the transverse process, the absence of horizontal lateral ridges, and greater compression of the body of the centrum from side to side.

In birds the tail is not similar.

But among mammals of many kinds there is a closer approximation to the Dinosaurian tail in proportion, form, and detail of vertebræ than is seen in the crocodile, even the neural arch becoming singularly small in the Dinosaur. These mammalian resemblances, supposing them to be essential Dinosaurian structures, would tend to indicate a common parentage for Dinosaurs and Mammals in the ornithodelphian direction, and not that there were similar vital organs for the Mammalian and Dinosaurian types. And probably the time is near when the student of osteological synthesis, endeavouring to emulate the achievements of the astronomer predicting the orbits of new planets, will be able to characterize orders and perhaps whole classes of extinct and undiscovered animals from the evidence of their structures inherited in the types which survive.

EXPLANATION OF PLATE VII.

Fig. 1. Front view of the metapodium of *Acanthopholis platypus*.
Fig. 2. The proximal ends of the same metapodial bones.

These figures are half natural size, and from photographs by A. Nicholls, Cambridge.

XXXVIII.—*On the Young State of Fishes belonging to the Family of* Squamipinnes. By Dr. Albert Günther, F.R.S.

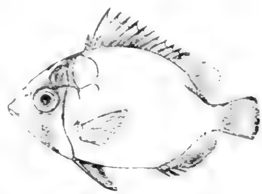
In the first volume of the present series of this Journal (1868, p. 457) I described and figured a very small fish, 11 millims. long, under the name of *Tholichthys*. Its head was armed in a most peculiar manner (by large suprascapular, humeral, and præopercular laminæ); and, although I had but little doubt that the appearance of old or mature examples would be different, I did not think it possible that the osseous plates behind the head would disappear entirely. I considered it to be the type of a Cyttoid genus.

Since that time I have examined several other *Tholichthyes*. Lieut.-Col. Playfair obtained some from Zanzibar (where also the original example was discovered); but they were of the same small size, and did not differ from the first example, except that the dorsal spines appeared to be more numerous and apparently somewhat variable in number.

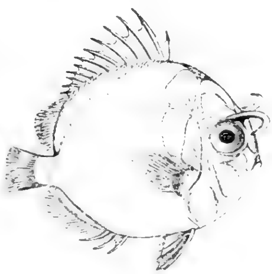
Surgeon Day found other similar fishes at Madras; but they were considerably larger, viz. $1\frac{1}{10}$ inch long (= 28 millims.). Although they retained the peculiar armature of the head, the form of the body and fins had greatly changed, resembling now that of a *Chætodon* or *Holacanthus*; so that Mr. Day felt convinced that *Tholichthys* was the young of a genus of *Squamipinnes* (Proc. Zool. Soc. 1870, p. 687).

It is my object in the present notice to show that this supposition of Mr. Day is quite correct. Unfortunately the specimen deposited by Mr. Day in the British Museum has been mislaid, so that I cannot avail myself of it for comparison with the specimens which I intend to describe here.

1. I have examined two specimens, 30 millims. long, of *Chætodon citrinellus*—one, in the British Museum, from the Feejee Islands, and the other recently obtained from Hr. C. Godeffroy. These examples show all the characters of that species: not only are the fins as well developed as in the mature form, but also the black ocular band and the marginal anal stripe are present. Yet these specimens still retain the scapulary and humeral laminæ, and the præopercular process projects to the root of the ventral. Comparatively, these laminæ appear to be smaller than in *Tholichthyes* of younger age; but this is merely in consequence of the greater development of the body in the more advanced stage, its growth being much more rapid than that of the head.



2. Not only *Chætodon*, but also other Squamipinnate genera appear to have a *Tholichthys*-stage. With the specimen of *Ch. citrinellus* mentioned above, Hr. Godeffroy sent another fish, represented in the accompanying woodcut, and now in the British Museum. The plates on the shoulder and præoperculum are as in the young of *Chætodon*; but the fish is distinguished besides by a remarkably long and curved horn above each orbit; a deep groove runs along the lower side of the horn. The numbers of the fin-rays are, D. $\frac{12}{25}$ and A. $\frac{3}{21}$. There are between 50 and 60 transverse series of scales on the body. Now, although it is possible that the horn above the orbit is also an excrescence lost in the more mature state of the individual, it yet reminds us of those species of *Heniochus* which are provided with more or less



developed orbital processes. Indeed *Heniochus monoceros* and *H. varius* approach our specimen very closely with regard to the numbers of the fin-rays. Yet, without further evidence, it would be hazardous to state whether this fish is a young *Chætodon* or *Heniochus*.

With regard to *Tholichthys osseus*, I have not been able to obtain specimens in a more advanced state of development and to determine the genus or species of which it is the young.

I have but little doubt that *Holacanthus* passes also through a *Tholichthys*-state, and that the præopercular spine by which this genus is distinguished is the permanent remains of the expansion of the præopercular angle, which in other allied genera disappears with age.

Our acquaintance with instances of fishes undergoing great changes in the earlier stages of growth becomes more and more extended. In many cases the young have been described as distinct genera: thus *Priacanthichthys* has proved to be the young of *Serranus*, *Cephalacanthus* that of *Dactylopterus*, *Dicrotus* of *Thyrsites*, *Nauclerus* of *Naucrates*, *Lampugus* of *Coryphæna*, *Stomiasunculus* of *Stomias*, *Porobronchus* of *Fierasfer*, *Acanthosoma* of *Orthagoriscus**, &c.; and I think that before long *Rhynchichthys* will be shown to be the young of *Holocentrum*, *Acronurus* and *Keris* that of *Acanthurus* or *Naseus*, and *Couchia* that of *Motella*.

XXXIX.—*On* Scapia Phayrei. By Dr. J. E. Gray, F.R.S. &c.†

I was very glad to observe that Dr. Anderson at last had had the head of the typical specimen of *Testudo Phayrei* prepared, as stated in the September number of the 'Annals,' and that Mr. Stoliczka had decided, on examination, that the skull is specifically identical with that I have described under the name of *Scapia Falconeri*. I therefore most gladly adopt the previous specific name, and shall henceforth call it *Scapia Phayrei*. This is very satisfactory to me, proving the skull to belong to a species that has never come under my observation in a more perfect state, and at the same time shows that Mr. Blyth and Mr. Theobald made a great mistake when they confounded that species with *Manouria emys*; and the latter, more inexcusable still, has confounded the most perfect specimen of *Testudo Phayrei* with *T. indica* of Gmelin.

* Dr. Lütken has informed me that *Ostracion boops* (Rich.) represents a still younger state of *Orthagoriscus* than *Acanthosoma*.

[† This communication was received on the 26th September—too late for insertion in our October Number.—W. F.]

Mr. Stoliczka's short letter in your September number, p. 212, fully confirms my belief that the skull belonged to a very distinct form of tortoise, which had not come under my observation in a more perfect state.

The synonymy of the species will run thus:—

Scapia Phayrei.

Testudo Phayrei, Blyth, Journ. As. Soc. Calc. xxii. p. 639.
Manouria emys, Theobald, Journ. As. Soc. Calc. 1868, p. 9; Journ. Linn. Soc. x. p. 10 (not Günther).
Testudo indica, Theobald, *l. c.* p. 8 (not Gmelin).
"*Mausuria, Emys*," Theobald, *l. c.* p. 88.
Scapia Falconeri, Gray, Proc. Zool. Soc. 1869; Suppl. Cat. Shield Rept. p. 6, f. 1 (skull only).

Hab. Aracan (*Blyth*).

The following account of the animal and thorax of this genus is given by Blyth:—

"Carapace smooth, as in *T. angulata* and *T. radiata*, but much flatter, oblong, subquadrate, its free marginal plates reverted and moderately serrate. Nuchal plate broader than long; caudal plate *double*; gular plates longer than broad, moderately notched; anal broader than long, and deeply notched. Beak unemarginate. Fore limbs covered with very long, thick, and imbricate scales, much as in a Pangolin. Claws elongate, strong, and thick; similar great elongated scales at the heels, and a group of five principal obtuse spines on either side of the tail, the medial of them remarkably strong and thick; two or more smaller spines or thick elongate scales above the tail."

The genus *Scapia* is very nearly allied to *Manouria*, and chiefly differs from it in the greater width and greater size of its pectoral plates, in the same manner as *Pelomedusa subrufa* differs from *Pelomedusa gehafie*, which are the types of the subgenera *Pentonyx* and *Pelomedusa*.

Until lately Mr. Blyth and Mr. Theobald considered *Testudo emys* (the type of *Manouria*) and *Testudo Phayrei* (the type of *Scapia*) to be synonymous, until I pointed out the difference in the skull; and then they observed the difference in the pectoral plate. At the same time, Mr. Theobald regarded Mr. Blyth's typical specimen of *T. Phayrei* as the same as *T. indica* of Gmelin, thus confounding as the same species the shortest- and the longest-headed tortoises known.

The knowledge of the animal of the genus *Scapia* renders it desirable to make an alteration in the arrangement of the genera of this family which is given in the 'Supplement to the Catalogue of Shield Reptiles,' the alteration being more in the characters given to the two chief sections than in the sections themselves, which remain nearly the same, except in removing *Scapia* to the second section.

Section I. *The two central hinder marginal plates united into a broad caudal plate. Sternal shields* 12, *arranged in pairs on each side. Pectoral plates large, like the others.* Containing Testudinina, Homopina, and Kinixyina, as given on the third page of the Suppl. Cat. Shield Rept.

Section II. *The two central hinder marginal plates separate, as in the generality of freshwater tortoises and turtles.* Manourina.

Scapia. Sternal plates 12, regularly arranged in pairs on each side of the central line. *Scapia Phayrei.*

Manouria. Sternal shields 10, arranged in five pairs. The two pectoral plates small, short, triangular on the hinder side of the axilla. *Manouria emys.*

The history and account of the state of the specimens in the Calcutta Museum is so very contradictory, that I should not be astonished at hearing that the missing head had been discovered there.

Mr. Blyth (Journ. Asiat. Soc. Bengal, 1853, vol. xxii. p. 639), in describing *Testudo Phayrei*, notices two specimens, one large and another rather smaller and having the appearance of great age; and in his pamphlet he adds:—"Its test (carapace) was much deformed, which is the reason I could not describe the species so minutely as I otherwise should have done; and as the general deformity might well have extended to the skull in some degree, this may account for the skull in the British Museum deviating slightly from the normal type."

Mr. Theobald, in the 'Catalogue of the Reptiles of the Museum of the Asiatic Society'* (which I have only just received, as I ordered it believing it to be a separate publication, and I now find it is only an extra number of the 'Journal of the Asiatic Society'), at page 9 makes the following entry:—"Manouria, Gray, *M. emys*, Gray: an adult, much injured; Moulmain (Major Phayre). Formerly a stuffed specimen, and now only a few fragments remain of this rare species." At

* If I had seen Mr. Theobald's Catalogue before, I never should have written any observations on his paper about the skull of *Scapia Falconeri*, and I should have been quite satisfied that Dr. Falconer's memory and my own reputation should have shared with Bell, Jerdon, Günther, Blyth, and other zoologists the ill-tempered personalities with which Mr. Theobald's catalogue and other papers abound. I have lately received a very abusive letter from Mr. Theobald, but am glad to see that he has some discretion; for he has blotted out (before he sent it to me) two lines which he had written—if this was not done by his legal adviser, through whom I received it.

p. 88, under "*Mausuria, Emys*":—"The débris of the specimen formerly exhibited as a stuffed animal, but now only in fragments; heads, legs, &c. &c. missing."

It is to be remarked that no reference is made to its being the *Testudo Phayrei* of Blyth, or where he described it, as is usually stated in the catalogue, and that "Gray," instead of "Günther," is inserted after the name used, which I had not adopted at that time*.

Dr. Anderson, who was the curator when Mr. Theobald made the catalogue, and who is now Director of the Museum, observes that Blyth's type of *Testudo Phayrei* is still in the museum in a perfect state, and that it was referred by Theobald to *T. indica* †; and further on he says it is in "a capital condition."

He refers also to the second specimen mentioned by Blyth as being in the museum, observing, "This is the specimen referred by Mr. Theobald to *Manouria emys* in his catalogue." It "can hardly be said to be in fragments, as the carapace is entire, with the exception of a small portion which has been broken off the anterior margin. The sternum, also, is nearly perfect, as shown in my drawing, although it wants the dermal plates." "The skull and the remainder of the skeleton, however, are absent." He further states, "The names of the sternal plates are in the handwriting of Dr. Falconer."

There is an equal discrepancy about the manipulation which this second or "deformed" specimen has undergone.

Mr. Theobald, according to the statement of Dr. Sclater in the 'Athenæum,' December 3, 1870, p. 723, stated simply that he found "one of the typical specimens of *Testudo Phayrei* in the Indian Museum in a very fragmentary state. On instituting inquiries as to how this had come to pass, he was told that the specimen had been taken away by Dr. Falconer, when engaged in preparing his catalogue of the Asiatic Society's Sewalik fossils, and buried in order to separate the bones."

"The skeleton of the tortoise in question was found to bear the names of the different bones written on them in ink, either by *Dr. Falconer or his assistant Dr. Walker*; and the skull

* I am particular in referring to this point, for it is from a similar accident that Mr. Blyth and Mr. Theobald are so irate at the name of Gray appearing after *T. elongata*. If they referred to my original description in the 'Proceedings' for 1856, they would there find that I give the name of Blyth to the species, and refer to the place where he described it.

† The only specimen in the Catalogue is entered "*T. indica*, Gmelin; a stuffed female. Galapagos Islands." Can this be the specimen referred to, and the habitat a mistake or a guess?

had not been returned to the Asiatic Museum along with the rest of the skeleton, through the *inadvertence* of Dr. Falconer."

Mr. Blyth, in the *brochure* dated the 28th December 1870, which was distributed about the streets of London, says:—"In my presence he [Dr. Falconer] then took to pieces the deformed specimen originally described by me; and, moreover, he took the skull away with him, which I never saw afterwards."

Mr. Grote, the secretary of the Society at that period, tells me that there is no record of this fact in the archives of the Society.

Dr. Anderson states:—"I will also observe that this specimen generally has a decided appearance of having been partially *macerated*, but not to any great extent."

Thus we see that, according to Mr. Theobald, the tortoise was taken away and buried; according to Blyth, it was taken to pieces in his presence; Dr. Anderson thinks it has been macerated; Mr. Theobald says the bones have the names written on them by Dr. Falconer or his assistant, Dr. Walker; and Dr. Anderson says it has the names on the sternal plates in the handwriting of Dr. Falconer, and that the skull and remainder of the skeleton are absent. They all agree in the skull being absent, and upon this they base the whole theory of the skull being retained by Dr. Falconer. I can only say that the skull in the British Museum certainly has no appearance of ever having had any thing written upon it by any person, or of having been buried, and that it shows no indication of any deformities as suggested by Mr. Blyth.

The knowledge of the carapace and skull of the genus *Scapia* shows that the peculiarity in the form of the skull is a proper character of the animal, and not a deformity as Mr. Blyth suggests.

XL.—*On* Testudo Phayrei, Theob. & Dr. Gray. By John Anderson, M.D., F.L.S., F.Z.S., &c.

Had not Dr. Gray's name been attached to the article that appeared in the Ann. & Mag. of Nat. Hist. for August last, I would have taken no notice of it; but as any thing written by Dr. Gray on a zoological question should carry some weight with it, I have to request that you will insert this reply to Dr. Gray's strictures.

Apart from the question of *Trionyx Phayrei*, I might have left the merits of the other charges which Dr. Gray has brought against me to the unbiased judgment of your readers, had I thought that they had all the facts before them and were in possession of my papers. But as it is highly improbable that they are so situated, I shall answer and dispose of Dr. Gray's personalities with the summary brevity which such unfounded statements as those indulged in by him with regard to my work merit from me. It seems to me a degradation of science to allow personal feeling in any way to interfere with and bias the judgment in questions that can be decided only by accurate observation and reason.

The following are the circumstances which have elicited Dr. Gray's remarks. In some short papers contributed by me to the 'Proceedings of the Zoological Society of London' I had occasion fairly to criticise Dr. Gray's definition of the genus *Macroxus* and his division of the squirrels into two genera, *Sciurus* and *Macroxus*, and to suggest that his name for a new genus of Cetacea, which I accepted, should be slightly altered to make it accord with the rules that regulate the formation of Latin words. I also stated that it was my opinion that *Trionyx Jeudii*, Gray, was the *Trionyx Phayrei*, Theobald. Had I stepped out of my way to make these observations, without having any thing to say on these animals, I should certainly have followed a most objectionable course; but as I had some remarks to offer on each, I hold that I did not overstep the bounds of fair criticism.

With regard to *T. Phayrei* (for I will follow the order that Dr. Gray has adopted in his remarks, his article not being confined to the consideration of this tortoise), the specimen which formed the subject of my observations is a specimen which, on the very best authority, I was informed was an adult of the species; so that Dr. Gray was wrong in concluding that I had no better means of determining the species than Theobald's description afforded.

Dr. Gray says that my figure of the sternum of *T. Phayrei* does not accord with my remark that the chief differences that separate it from *T. gangeticus* are the less developed character of the osseous portion of the sternum and the relatively finer character of its sculpturing on both aspects, and proceeds to observe that my drawing represents large and well-developed callosities, not in the slightest degree resembling the small, narrow, linear, lateral callosities found in *Trionyx subplanus* as described by Theobald, but also having large triangular anal callosities and the odd osseous semicircular bone in the front of the sternum covered with a lunate callosity, not even found in *Trionyx gangeticus*; and as the result of these considerations, Dr. Gray arrives at the conclusion that the specimen I described had no connexion with *T. Phayrei*, Theobald.

Now, after another examination of my materials, I repeat the statement that my specimen is distinguished from *T. gangeticus* by the *osseous plates* of its sternum being considerably less developed than in that species, and by the relatively finer character of its sculpturing on both aspects. In *T. Phayrei* the abdominal expansions of the lateral plates of the sternum of the adult are widely separated from each other by a broad cartilaginous area almost as well marked as in Dr. Gray's figure of the so-called *Dogania*, and measuring 4″ 3‴ in its greatest width. It is the presence of this large cartilaginous space, combined with the less developed character of the osseous portion of the sternum as compared with *T. gangeticus*, that led Theobald to state that the sternum presents a remarkable difference in the development of the *bony plates* as contrasted with *T. gangeticus*, and that in general characters it more nearly approaches to *Dogania subplana*. Dr. Gray has become confused between the tubercular callous surfaces of the sternal plates and the plates themselves of *T. Phayrei*, and makes it appear as if Theobald described the former as resembling those of *T. subplanus*; whereas Theobald's words are distinctly these, that the development of the *bony plates* of the sternum of *T. Phayrei* approaches to *T. subplanus*, which is the character of my specimen in respect of its sternal osseous plates; and he does not, as Dr. Gray states, mention any small linear callosities as characteristic of his *T. Phayrei*. Mr. Theobald, moreover, does not compare the tubercular callous surfaces to the small linear callosities of *Dogania* beyond saying that in *T. Phayrei* the former are less developed and more feebly sculptured than in any of its allies; but as a matter of fact he describes them as marginal, without giving any details as to their distribution. How Dr. Gray reconciles this plain statement of fact with his interpretation of it, I leave him to explain. In my specimen the tubercular callous surfaces are coextensive in their distribution with the antero-posteriorly united lateral plates and the surface of the anals and of the odd osseous plate; but as Theobald has not given any detailed account of the distribution of these surfaces beyond what I have quoted from his description, I hold that, under the circumstance that he recognized in my specimen *T. Phayrei*, I did not err in regarding it as an adult in which the marginal granulations had become visible all over the surface of the lateral, anal, and odd osseous plates. Dr. Gray confounds "linear" with "marginal," whereas the latter term embraces the margins of an object; and when that object has an irregular outline, the former term, "linear," cannot be applied to it. If Dr. Gray means by "linear" the straight sides of a square, or even the rounded outline of a circle, it appears to me that the more appropriate term would be "marginal." Calmly estimating the value to be attached to the facts as I have now stated them, I hold that I am entitled to consider that my specimen is an adult *Trionyx Phayrei*, and that as its skull, after carefully comparing it with the skull of *Trionyx Jeudii*, is found to agree with the latter in its structural details, I am forced to accept the conclusion that Gray's *T. Jeudii* is only *T. Phayrei* under another name.

Dr. Gray, after stating that he is aware that the sternal callosities of *Trionyx* change much during growth, again introduces the assertion that Mr. Theobald had remarked that his *T. Phayrei* had the lateral linear callosities of *T. subplanus*, a statement which I do not find, as I have already observed, in any description of Theobald's relating to *T. Phayrei*. How is this discrepancy to be reconciled?

I am perfectly aware that Mr. Theobald does not describe any anal callosities; but I have given such details regarding the callosities and the adult characters of the species as have enabled Dr. Gray, notwithstanding his assertion that I deal only in generic characters, to refer it to the genus *Landemania* and to the species *perocellatus*—by some process of mental legerdemain, if he is consistent in saying that I have not given any specific characters!

At that point in his article where he arrives at the conclusion that the specimen of *T. Phayrei* described by me has no affinity with *T. Phayrei*, Theobald, Dr. Gray unconnectedly diverges to consider my views on the genus *Macroxus*, Cuvier, as accepted by him, and, having stated his views on that subject, betakes himself to *T. Jeudii*, from the consideration of which he again returns to the charge regarding *T. Phayrei*, associating with it some remarks regarding his estimate of the state of science in the Imperial Museum of Calcutta, with a notice of my official position in the capital of India. I shall follow Dr. Gray in his ramble, and first consider his statements regarding the squirrels.

Dr. Gray, in adopting the genus *Macroxus*, does so, to use his own words, "as it is desirable to *separate the squirrels with simple ears*;" and he defines the genus as follows:—"Head moderate, short; nose rounded; ears ovate, covered with short adpressed hairs; front edge of the cutting-teeth compressed, smooth. Limbs free. Tail as long as or longer than the body and head, covered with long spreading hair." And the genus *Sciurus* as follows:—"Ears tufted. Head broad; muzzle short. Feet hairy at the heels. Front upper molar small or often wanting." Dr. Gray says I objected to the genus *Sciurus* being separated into genera by organic characters, such as the shape of the skull and pencilling of the ears. Will Dr. Gray point out where I made such a statement, and will he indicate one single structural character he has enumerated in either of the foregoing definitions that is of the slightest value as such? The character on which Dr. Gray places so much reliance is the absence or presence of a tuft of hair on the ear—a character, I submit, of the most unreliable nature, and subject to every possible amount of variation, even on Dr. Gray's own showing. The relative length of the tail to the body is another character that finds favour with Dr. Gray; but every anatomist is aware that the number of caudal vertebræ is very liable to vary in individuals of the same species. *Macacus lasiotus* should be a warning to Dr. Gray not to place his faith in tails; for they sometimes lead to tales of sad misfortunes in zoology and to most erroneous conclusions. To structural characters properly so called there is not the faintest allusion in Dr. Gray's definition of the above genera, if I exclude a passing reference to the smooth compressed incisors, which Dr. Gray calls cutting-teeth, and to the unstable character of a first molar that is often wanting. Neither do these definitions contain any reference whatever to the skulls, nor does Dr. Gray describe the skulls under the species; yet he counsels me to study structural characters. I have critically gone over every Asiatic squirrel in the British Museum, skins and mounted specimens, to which I believe Dr. Gray refers when he speaks "*of a large series of species, including a large collection of specimens*;" and I have carefully examined the extensive collection of *species and specimens of squirrels* in this museum, and have removed the skull from each species; so that I have had ample opportunities of judging whether any importance is to be attached to Dr. Gray's character of the tufting of the ears in dividing the Asiatic squirrels; and I unhesitatingly say that the conclusion I have arrived at is that there is not. With regard to the lineation of the squirrels, all that I said was, that the Asiatic squirrels, for convenience' sake, without any subdivision of the genus *Sciurus* into genera, as Dr. Gray would seem to think I had suggested should be done, may be grouped as the simply grizzled squirrels, dorsally, laterally, and ventrally banded squirrels. Dr. Gray characterizes this as a retrograde proposal; but in his own Synopsis of his so-called Asiatic *Macroxi*, Dr. Gray divides them on similar principles, selecting the longitudinal streaks as his sole guide, with the single exception of one species founded upon the length of its tail. I hold that my arrangement is in advance of Dr. Gray's, who was unaware of the existence of a longitudinally *belly-banded* group of squirrels; but I am aware that mere external characters are only of value as a means of classifying animal forms preliminary to an extended knowledge of persistent structural modifications.

Dr. Gray on two occasions insinuates that I have described my specimens from native drawings—a suggestion to which I give an unqualified contradiction. But, whatever may be the faults in perspective drawing by native artists, they are capital workers at detail, when properly supervised; and Dr. Gray himself bore witness, in past years, to their accuracy, when, on the faith of the correctness of their representations, he, in his 'Illustrations of Indian Zoology,' founded many species on native drawings; but no Indian zoologist requires to have recourse to them, as he can usually procure the living or recently dead specimens.

With regard to *T. Jeudii*, the next subject animadverted on by Dr. Gray, this species was described by him from a single skull, without his knowing any thing of the carapace or sternum. I have already mentioned, in its proper place, that this skull agrees in every particular with the skull of *T. Phayrei*. The central longitudinal ridge across the front of the concave alveolar surface of the lower jaw in my specimen is, as was to be expected in such a large individual, more strongly developed than in Gray's type. Dr. Gray regrets that I did not show him the skull of *T. Phayrei*, a regret which I share with him; for if he had seen the skull, he would doubtless have been convinced of their identity, and the readers of this Journal would have been spared this unpleasant discussion. If my visit to London had not been so short and hurried, Dr. Gray would have seen the skull; but I was quite competent, with the skull of *T. Jeudii* before me and that of *T. Phayrei* in my hand, to decide whether the two were distinct.

It is not my intention to follow Dr. Gray in his estimate of the state of science in the Imperial Museum, beyond remarking that it seems to me that the opinion of a single man, unsupported by unprejudiced evidence, is powerless to affect its reputation.

Dr. Gray finds fault with my measurements; but his misunderstanding of the formulæ $''\ '''$ does not rest with me, especially as Dr. Gray was formerly in the habit of using the same formulæ for his measurements; and in verification of this I refer to pp. 24–58 of the 'Proceedings of the Zoological Society of London' for 1848, where he uses the foregoing formulæ and inches in the same line. This is an instructive example of the character of Dr. Gray's criticism.

From the subject of measurements Dr. Gray suddenly diverges to make the following observation. Again referring to my paper on *Trionyx Phayrei*, he says, "the sternum is thus described:—'Seven osseous plates, of which five are visible and granular;'" and, seizing on the word "seven," he either believes that I was ignorant of the elementary fact of the number of *plates* that compose the sternum of the tortoise, or twists my words to favour an hypothesis pleasant to himself. He makes the very just supposition that I meant the *nine* sternal bones: but this quibble is unworthy of Dr. Gray; for he had only to look at my figure and he would have discovered the explanation of my using the word *seven*—the transverse suture of the lateral plates being obliterated, the two pairs in this adult specimen being externally resolved into one pair, so that, as I have already observed, only *seven* distinct osseous plates exist. In describing things as they are, it is quite uncalled-for to enter into the first principles of things as they have been.

I regret having encroached so much on your valuable space, and the wandering character of this note, which has been induced, however, by the digressions that distinguish Dr. Gray's article to which this is in reply.

Calcutta, Sept. 16, 1871.

XLI.—*Parasites of the Sponges.* By H. J. Carter, F.R.S.&c.

My dear Dr. Francis,

I hope soon to send you an illustrated paper on the Parasites of Sponges, beginning with Dr. Bowerbank's *Stematumenia*, which, so far as this author's specimen of "fibro-membranous tissue" goes (Brit. Spong. pl. xii. figs. 256 & 260; Annals, 1845, vol. xvi. pl. 14. fig. 1) is no more a sponge, or part of one, than his so-called *Halyphysema*. The latter, as you know, I have long since shown in the 'Annals' to be a Foraminifer, dressing itself out in spicules after the manner of the jackdaw with peacock's feathers, but probably not for the same purpose; and the fibre of the former, illustrative of the so-called "fibro-membranous tissue" in *Stematumenia*, I shall soon show to be an Alga, and probably an *Oscillatorium*, which, from its frequently infesting sponges of different kinds in all quarters of the globe, I propose to name "*Spongiophaga communis.*"

Schmidt (in 1862, Spong. Adriat., and especially in 1864, Suppl.), after having given a great deal of attention to these filaments, which have a cell at one end and a spiral twist throughout, admits that they are different from the sponge-cell *par excellence* (*i. e.* the sponge-animal), and after alluding to Kölliker's doubt in 1866, viz. whether it be a part of the sponge or a parasite, agrees in 1870 (Atlantisch. Spong. Faun.) with Kölliker, that the two structures, viz. the sponge-fibre and the fibrillæ, are different, finally ending with the expression that, after much trouble, he can state nothing further respecting the nature of the latter.

In his critique on the synonymy and species of the Keratospongia, in 1864, Schmidt observes, respecting *Auliskia*, that Dr. Bowerbank's illustration of his so-called "compound fistulose keratose fibre" in this genus (*l. c.* pl. 14. fig. 268, and Annals, *l. c.* pl. 13. figs. 1 & 2) proves that it is nothing more than an "Alga," and therefore, being no genus at all, that the name should be expunged. I came to the same conclusion before finding that Schmidt had done so; but am not sure whether the branched filament is part of the mycelium of a Mucor, or an Alga allied to *Pythium entophytum* among the Saprolegnieæ. Many genera of the Mucedines, especially *Botrytis*, infest the Sponges; but I have not yet, to my knowledge, seen *one* Saprolegnieæ. Dr. Bowerbank's illustrations of his so-called "fibrillated sponge-fibre" of the "Australian sponges" (*l. c.* pl. xvi. figs. 280 & 279) are also of the same kind. In short, no tortuous branched fibres of the sort are proper to the Spongiadæ; and hence all genera based upon them should be suppressed.

The "East-Indian Sponge," too (*l. c.* pl. xx. fig. 307), which Dr. Bowerbank gives in illustration of the "inhalant areas" in this species—Dr. J. E. Gray has correctly stated (Proc. Zool. Soc. May 1867, p. 514) that the latter are nothing more than polypes, "probably a parasite like the genus *Bergia* of Michelotti." But I do not wonder at Dr. Bowerbank's mistake here, when, in the figure 374 following, he represents the polypes of *Hyalonema* as the "oscula of a columnar cloacal system" (!).

Of such parasitic polypes there is one which is entirely isolated, another which is concatenated by a stoloniferous prolongation of the polypidom (viz. that figured by Dr. Bowerbank as "inhalant areas"), a third in groups, as in Schmidt's *Palythoa* on the sponge *Axinella*, and a fourth in a continuous polypidom entirely surrounding the glass rope of *Hyalonema*.

It seems to me absolutely necessary that, if any one would describe a sponge with accuracy, he should be generally acquainted with all, or at all events with most of the known lower forms of both animal and vegetable life, since in proportion as this is the case he will avoid such egregious blunders as those above mentioned.

Indeed this observation holds good not only with the Spongiadæ, but with all the lower divisions of animal and vegetable life.

If a man be not generally acquainted with them, besides being a general histologist, it may be inferred that his writings on them will be more or less inaccurate, and thus fail to be of any scientific value; they will be more for show than for usefulness or truthfulness, and, worst of all, occasion a grievous loss of time to the *bonâ fide* student.

I am, my dear Dr. Francis,

Very sincerely yours,

Henry J. Carter.

"The Cottage," Budleigh-Salterton, Devon.
Oct. 18, 1871.

XLII.—*Preliminary Notice of New North-American Phyllopoda.* By A. S. Packard, jun., M.D.*

The following brief descriptions are extracted from a monographical notice of our Phyllopod Crustacea, which, with the exception of the Branchipodidæ, so thoroughly investigated by Prof. Verrill, have been sadly neglected. It will be noticed that North America is rich in the species of *Apus*, more so than any other quarter of the globe so far as yet known. It is a little singular that no species has yet occurred east of the Mississipi river. The species of Limnadiadæ are probably more abundant than naturalists are aware of; and the attention of collectors of shells is called to these *Cyclas*-like-shelled Crustacea, whose shells may not unfrequently be mistaken and passed by as simply species of *Cyclas*. For the privilege of studying the species of *Apus* I am indebted to Dr. William Stimpson, who has lent me the specimens placed on deposit in the Chicago Academy of Sciences by the Smithsonian Institution, and to Prof. A. E. Verrill, who has contributed the specimens in the Yale Museum; while the Museum of Comparative Zoology at Cambridge has contributed a new *Apus* from Northern India; and for the Limnadiads my acknowledgments are due to Mr. G. W. Belfrage, an industrious collector, and Prof. E. S. Morse, who have given several species to the Peabody Academy of Science.

* From the 'American Journal of Science and Arts,' vol. ii. August 1871. Communicated by the Author.

APODIDÆ.

The known species of *Apus* may be for convenience divided into three sections, characterized in part by the length of the shield, or carapace, the highest forms having the shortest carapace; those with the longest shields, as the European *Apus cancriformis*, approximating in this and other characters to the genus *Lepidurus*.

Section *a* comprises *Apus longicaudatus*, *Lucasanus*, *Newberryi*, and probably *domingensis*.

Section *b* comprises *Apus æqualis* and *Guildingii*.

Section *c* comprises *A. cancriformis* and *himalayanus*.

Apus longicaudatus, Leconte, Ann. N. Y. Lyceum.—Prof. Dana's type specimen, which is now very imperfect, was labelled "Rocky Mountains, near Long's Peak." Four specimens from "Texas, J. H. Clark, No. 3." Three specimens from "pools near Yellowstone river, Dr. Hayden, No. 6." Mus. Chicago Acad. Both sexes occurred, the females having eggs. James's *A. obtusatus* (Long's Expedition) is probably this species. *A. numidicus*, Lucas, from Algeria, in the form of the carapace seems to be allied to *A. longicaudatus*.

Apus Lucasanus, n. sp.—♂ closely allied to *A. longicaudatus*. The frontal doublure rather longer than in *longicaudatus*, and hypostoma a little smaller; maxillipeds shorter and smaller, and telson longer than in the preceding species, with three median spines above; anal stylets less spiny. Number of segments behind posterior edge of shield 33; number behind the last pair of gills (including telson) 13. Length of body (excluding caudal stylets) ·94, of carapace along the middle ·37; total length of carapace ·48; length of tergal carina ·24; distance from anterior end of carina to front edge of carapace ·16; length of caudal stylets ·57, being a little over half the length of body; breadth of shield ·40 inch.

Six specimens in a bottle labelled "Kansas, No. 5," and containing thirteen ♀ *A. æqualis*. Mus. Chicago Acad. They cannot be distinguished from St. Lucas specimens.

♀. Carapace longer than in ♂, and caudal stylets not so heavily spined. Number of segments behind posterior edge of shield 29; number behind last pair of feet 11. Length of body 80, of carapace along the middle ·30; total length of carapace ·40; length of tergal carina ·25; distance from front end of carina to front edge of carapace ·16 (stylet broken); diameter of egg-sacs ·09 inch.

One specimen from "Cape St. Lucas, John Xanthus, No. 4." Mus. Chicago Acad.

Apus Newberryi, n. sp., ♀.—This fine species differs from

A. longicaudatus chiefly in the shorter maxillipeds, and much longer, smooth telson with three instead of four median spines, and in the smooth, finely spinulated caudal stylets, while the carapace is longer. Number of segments behind posterior edge of carapace 29; number beyond last pair of feet 11. Length of body 1·78, of carapace along the middle ·75; total length 1·00; length of tergal carina ·50; distance from front end to front edge of carapace ·30; length of caudal stylets 1·05 inch.

Two specimens from "Utah, J. S. Newberry, No. 1." Mus. Chicago Acad.

Apus æqualis, n. sp., ♂.—In this species the carapace is much longer than in the preceding species, the eyes are larger, the tubercle behind them is smaller, and the gills reach much nearer the telson. Number of segments behind posterior edge of shield 23; number behind last pair of feet 11. Length of body 1·15, of carapace along the middle ·56, breadth ·56; length of tergal carina ·35; distance from front end of carina to front edge of carapace ·21; length of caudal stylets ·75 inch.

Two specimens from "Matamoras, Mexico, General Couch." Mus. Chicago Acad.

♀. The telson has five median spines and is shorter, and the stylets have more numerous and shorter spines than in *A. Newberryi.* The underside of the telson is much smoother than in *A. longicaudatus*, and the outer gill of the first maxillipeds is a little longer and more acute. Number of segments beyond the hind edge of carapace 25; number beyond the last pair of feet 9. Length of body 1·07; length of carapace in middle ·56, breadth ·46; length of carina ·33; length from front end of carina to front edge of carapace ·23; length of caudal stylets ·75; diameter of egg-sac ·24 inch.

Thirteen specimens from "Matamoras, General Couch" and "Kansas, No. 5," Mus. Chicago Acad., and a specimen from Yale Museum labelled "Plains of Rocky Mts., No. 390."

Apus Guildingii, Thompson, Zool. Researches, Jan. 1834, p. 108, belongs to the same section of the genus as *A. æqualis*; but the fourth branch of the first maxillipeds is longer than in any other species known to me, being represented as reaching almost to the end of the caudal stylets. St. Vincent, West Indies.

To the third section of the genus belongs the European species *A. cancriformis*, and the following species from North India. They differ from the North-American species in the longer carapace, the smaller eyes, and round postorbital tubercle, the less spiny telson, the more hairy caudal stylets, and the larger hypostoma.

Apus himalayanus, n. sp., ♀.—Frontal doublure and hypostoma as in *A. cancriformis*; the first pair of maxillipeds are of about the same length as in *cancriformis*; but the joints are more numerous and smaller, there being 80 joints in the longest branch, while in a specimen of *cancriformis* four times as large there are 50. The telson is longer than in *cancriformis*, but the number and arrangement of the spines is the same, as is the underside. The stylets are scarcely as long as the body, while in *cancriformis* they are considerably longer, and the fine spines are a little stouter. Number of segments beyond the hind edge of carapace 19 (in *cancriformis* 19); number behind last pair of feet 7 (in *cancriformis* 6). Length of body 1·00; length of carapace along the middle ·64; length of carina ·45; distance from end of carina to front edge of carapace ·36; length of caudal stylets ·95; diameter of ovisac ·15 inch; ovisacs situated on the eleventh pair of maxillipeds, as in all the other species of the genus known to me.

"Collected from a stagnant pool in a jungle four days after a shower of rain had fallen. For five months previous to this rain there had been no rain upon the earth. Himalaya Mountains, North India, near where the Sutlege river debouches into the plains. April 1870." Mus. Comp. Zoology, Cambridge. Two specimens.

Branchipodidæ.

Streptocephalus texanus, n. sp.—The male differs from *S. similis*, Baird, from St. Domingo, to which it is otherwise closely allied, in the longer branch of the inferior antennæ being much longer and slenderer at tip (according to Baird's figure), while the shorter branch is much narrower. In the female the ovisac reaches to the penultimate segment of the abdomen, while according to Baird's figure it scarcely reaches to the end of the fourth segment from the end; and the second antennæ are represented as being much larger than in our species. The male organs arise from the eighth segment from the telson and the fifteenth of the body, and are simple, unarmed, slender, cylindrical, very long, and curled around (in alcoholic specimens) so as to touch at their insertion. Total length (male) ·65; length of longer appendage of second antennæ ·17 inch; caudal stylets ·13; length of male organs when extended ·13: female ·55 long, caudal stylet ·11, ovisac ·20 inch. "Waco, Texas. Found in the summer in the same pool as the *Limnadia* was taken. The pool was formed by the summer rain, and as it had passed a considerable time in a dry condition, I suppose this species appears much later, or at least not at the same time as the *Limnadia*." (G. W. Belfrage.) It also occurred in April, the females having eggs, like those found in the summer of the year previous.

LIMNADIADÆ.

Limnadia texana, n. sp.—Eyes double, but with the inner edges contiguous; pyriform tubercle behind them one half as large as the eye-bearing prominence; 20 segments behind the forehead, including the telson; 15 pairs of feet. Antennæ with 8 joints on each branch, the seventh and eighth joints subdivided each into two subjoints; the setæ slightly plumose on the basal joints. Telson with 16 fine teeth, not including the terminal acute spine. Caudal lamellæ long and slender, cultriform; under edge slightly curved, fringed with long hairs, those at the base slightly plumose; the upper edge straight; end blunt. Carapace-valves rounded oval, pure white; 5 lines of growth; shells minutely dotted, the markings being coarser at the posterior end of the shell and about the region of the adductor muscle. Length of shell ·27, breadth ·16 inch. It is much longer and narrower than *L. americana*, Morse, and with a less number of lines of growth, the latter having 18; in this respect it is much nearer *L. Hermanni* of Europe, though the shell is much narrower. Compared with Baird's figure of *L. antillarum* from San Domingo, to which our species is nearest allied, the shell is more rounded ovate at each end, being somewhat truncated. While the ends of the caudal stylets are said in *L. antillarum* to be "somewhat curved, sharp-pointed, and slightly serrated on upper edge," the tip in our species is blunt, smooth on the upper edge, and ends in a slight hook. *L. antillarum* is also said to have 9 joints to the rami of the second antennæ, and 18 pairs of feet.

One specimen, Waco, Texas. "Quite common in many places in Western Texas in the early spring. It occurs in muddy pools made after rains, and totally disappears with the first drying of the pools. As far as I have seen, they are only found in the woody bottom lands, and always near creeks. It occurred in the same pool as *Streptocephalus*." (G. W. Belfrage.)

Estheria Belfragei, n. sp.—Rami of the anterior antennæ with 16 joints; 17 pairs of dorsal spines, exclusive of those on the telson, which are 15 in number (in *E. mexicana* they are much more numerous) and the middle one is much larger than those near it. The spines on the telson are fewer in number and larger than Claus represents in *E. mexicana*; caudal stylets longer and slenderer than in *E. mexicana*, and the terminal spine is longer and slenderer, judging from Claus's figure.

Carapace-valves with the umbones situated at the anterior third of the shell; dorsal edge straight behind the umbones, slightly serrate, bent rather suddenly downward at two thirds of the distance from the umbones to the posterior end, the end being full and rounded; anterior dorsal edge slopes rapidly from the umbones, and the anterior end is full and convex. Umbones prominent and rather acute, but not oblique. About 24 lines of growth, between which the shell is coarsely punctate; from 5 to 8 dots (when placed in a straight line) between the lines in the central part of the shell; these punctures are reduced to a single row on the edge. Length ·30, breadth ·23, thickness ·15 inch.

It differs from *E. mexicana*, Claus (Grube's figure) from Zimapan, Mexico, in the umbones being much more prominent, in the prominent angle of the dorsal posterior edge, while there are half as many lines of growth. From *E. Dunkeri*, Baird, also from Zimapan, it differs in the less numerous lines of growth, in the smaller, less tumid umbones, and the more marked angle of the posterior part of the dorsal edge. The punctures between the lines of growth are much more numerous in *Dunkeri*. Six specimens. Waco, Texas, April (G. W. Belfrage).

Estheria Morsei, n. sp.—Shell intermediate in form between *E. Caldwelli*, Baird, from Lake Winnepeg, and *E. Dunkeri*, Baird, from Zimapan, Mexico; shell much swollen, oblong-oval, of a pale horn-colour; umbones large, prominent, larger than in *E. Caldwelli*, and much less oblique, and situated nearer the anterior end of the shell. Dorsal margin shorter than in *E. Caldwelli*, and in front of the umbones, instead of being straight and suddenly curved downward, is regularly rounded as in *E. Dunkeri*. Behind the umbones the shell is narrower than either in *Caldwelli* or *Dunkeri*, the dorsal edge sloping rapidly downward, without the well-marked angle of *Caldwelli* or the continuous full curve of *Dunkeri*. Coarse punctures between the ribs, rather coarser than in *Caldwelli*, there being on an average 5–10 between the ribs in the centre of the valve. Length ·50, breadth ·33, thickness ·24 inch. Six specimens from Dubuque, Iowa, collected by Rev. A. B. Kendig. Dedicated to Prof E. S. Morse, who has indicated to me that the species was undescribed.

Lymnetis gracilicornis, n. sp.—This interesting form may at once be known from *L. Gouldii*, Baird, recently found by Mr. E. Burgess in Cambridge, Mass., by the long slender second antennæ, which have about 20 joints, and are much longer than in that species. The keel on the front of the head does not reach to the front edge, while in *Gouldii* it does. Shell of the same form but much larger than in *Gouldii*. Length of shell ·17, breadth ·16 inch. Texas (Belfrage).

Peabody Academy of Science, Salem, Mass., May 20, 1871.

XLIII.—*On the Injury inflicted on Ships by the Broad-finned Swordfish of the Indian Ocean.* By Dr. J. E. Gray, F.R.S. &c.

The Swordfish of the Indian Ocean, which forms the genus *Histiophorus*, on account of the large high dorsal fin, has a gradually tapering, nearly cylindrical, bony beak, covered with granular skin. These fishes swim exceedingly fast; and when they come into contact with a wooden ship, the beak pierces the timbers, which so closely embrace it that the animal can only disengage itself by breaking away from its snout; for the longer the time that it remains attached, the more firmly it becomes fixed, from the swelling of the wood and the fibres of it attempting to regain their natural position. We have a specimen of the snout fixed in the planks of a ship, in the British Museum; and I have seen two or three specimens of a similar kind, all showing the very firm manner in which the snout is fixed in the wood, and that the snout had been broken from the head of the animal, caused, I believe, by the shock of the collision.

The hole made in a piece of wood by an awl or the conical beak of a swordfish simply presses the grain of the wood aside for its passage, so that when the body is removed which formed the hole, the fibres, especially when soaked in water, strive to regain their natural position, and the hole so made is more or less completely filled up and obliterated.

It is even the same with a bullet or cannon-ball, which either forces its way through a kind of crack in the wood, or regularly breaks away a part of the wood, or crushes it, leaving a very irregular hole. The only way in which a clear circular hole can be made in a plank of wood or side of a ship is by an auger or centre-bit, which removes the wood that filled up the hole: such a hole may contract in size, but it is never filled up by that contraction, as part of the substance has been taken away.

I therefore think that we may conclude that, when a broad-finned swordfish comes into collision with the planks of a ship, it forms a hole or, rather, slit which contracts on the beak and does not allow the escape of the fish so as to leave a circular hole in the ship's side. This is important, because a few years ago there was a trial of an insurance case where a circular hole was found in one of the planks, by which the cargo was injured. It was contended on one side that this hole was formed by the beak of a broad-finned swordfish; and this view was supported by a very celebrated comparative anatomist and a popular writer on natural history, and was supported by one of the most popular writers on astronomy and physics of the day *; and the jury adopted this explanation.

On the other side it was contended that the open circular hole observed in the timber had been made for a tree-nail, and had been left unclosed, and only covered by the copper-sheathing of the vessel; but I do not recollect that any evidence was brought in support of this view, which I believe is the true explanation; for certainly, even allowing that the sword-fish could withdraw its beak, the hole which the beak had made would not have remained circular, but would have become more or less filled up.

May not the whole case be considered an illustration of the want of practical and scientific instruction by what are called the members of several of the most instructed professions?

The swordfish which is supposed to have attacked "the good ship 'Dreadnought'" must have been a very clever fellow, much in advance of his brethren. With his conical bony beak he succeeded in making a cylindrical hole about an inch in diameter through the timbers of the ship, similar to that made by an auger; and having twisted himself into it, he managed, having done the mischief he desired in revenge for having been caught by the ship's crew, to withdraw his beak and to sail away uninjured. He did not do his swimming parallel to the surface of the water (as most fishes do), but he must have done it (judging from the cylindrical hole being found only a few inches from the keel) ascending from the depths, and working at the hole in a nearly perpendicular direction; and if I understand rightly, all this was done while the ship was sailing through the sea.

To me the more simple explanation seems to be that one of the treenail- or bolt-holes, of which there are hundreds in a wooden ship, had been left unfilled. These holes are just about the size and form which the one in the ship is described to have been.

XLIV.—*Notice of a Fossil Hydraspide* (Testudo Leithii, *Carter*) *from Bombay*. By Dr. J. E. Gray, F.R.S. &c.

Dr. Leith has drawn my attention to the description and figure of a fossil freshwater tortoise which he discovered in the freshwater formation of the Island of Bombay, and which is admirably described and figured by my friend Mr. H. J. Carter in his account of the geology of the Island of Bombay, with a map and plates, in the 'Journal of the Bombay Branch

* See "Ship attacked by a Swordfish," Proctor's 'Light Science,' p. 358.

of the Royal Asiatic Society' for July 1853. Mr. Carter calls the species *Testudo Leithii.* He examined the remains of nine specimens, and gives a very good restored figure of the upper and under surfaces of the head, carapace, and feet of the animal. Mr. Carter, though he refers the species to the genus *Testudo*, properly refers the fossil to the "Pleuroderal Elodians" of Duméril and Bibron, and especially compares it to the genus *Sternothærus.* He truly observes that no species of this family has been found in the recent state in Asia. All the specimens are, I believe, left in the Museum of the Asiatic Society of Bombay.

The description and figure of the carapace induce me to believe that the fossil is most nearly allied to some of our existing South-American species of the restricted genus *Hydraspis*; and the remains of the head, which are unfortunately imperfect, lead to the same conclusion: but at present that genus is only found in tropical America.

The genera of this group of tortoises may be artificially arranged by the sternal plates, thus:—

1. Sterno-costal symphysis covered by the outer ends of the pectoral and abdominal shields.
   A. Pectoral plates very large and long. Abdominal plates short and transverse. HYDROMEDUSA*.
   B. Pectoral plates four-sided, moderate, subequal. HYDRASPIS, CHELYMYS, and EUCHELEMYS.
   C. Pectoral plates triangular. PELOMEDUSA.
2. Symphysis covered by the ends of the abdominal plates. Pectoral plates narrow, triangular. STERNOTHÆRUS.

This fossil, according to this artificial table, would be ranged with *Hydraspis*; and it is peculiar among the *Hydraspides* for the large size of the intergular plate, the very small triangular gular plates, and the small size and triangular form of the postgular, the pectoral plates being rather longer than the abdominal ones. It is also peculiar for the underside of the marginal plate opposite the suture between the pectoral and abdominal plates being rather broader than the rest, and angular on the inner edge, which I have not seen in any of the recent species. I propose to name it provisionally *Hydraspis Leithii*, = *Testudo Leithii*, Carter, Journ. Bombay Branch of the Royal Asiatic Society, 1853, p. 1, tab. x. & xi.

It must not be confounded with the *Testudo Leithii*, Günther, which is a true land-tortoise, very nearly allied to *T. marginata* of Europe.

* Some specimens, perhaps males, of *Hydromedusa Maximiliana* have the middle of the hinder part of the sternum deeply conically concave, while the front part of the sternum is quite flat.

XLV.—*Remarks on the Genus* Lichenocrinus. By F. B. Meek*.

Perhaps of all the remarkable types of that protean order of animals known as the *Crinoidea*, there are few more curious and interesting forms (if really the *body* of a crinoid) than that for which Prof. Hall proposed the name of *Lichenocrinus*. Having recently had an opportunity of examining an extensive series of specimens belonging to both of the known species of this type, in the collections of Mr. C. B. Dyer and other gentlemen of Cincinnati, I propose to make a few remarks on the same, that may be of some interest to palæontologists, especially as this fossil is little known, and the specimens now obtained afford the means of giving a more extended description of its characters than that already published.

Prof. Hall's generic description of this crinoid reads as follows:—"Bodies parasitic on shells and other foreign substances. Form discoid or depressed-convex, with a proboscidiform appendage rising from the centre. Disk composed of an indefinite number of polygonal plates, and apparently having no distinct mode of arrangement. Proboscis perforate, and, in the known species, formed of five ranges of short plates alternating and interlocking at the margins."

From the specimens now known, the following more extended description of this fossil may be given:—

Discoid or depressed-plano-convex bodies, growing firmly attached to shells, corals, trilobites, and other marine objects, and entirely destitute of free or recumbent arms or pinnulæ, ambulacral openings, or pectinated rhombs. Free or convex side concave in the central region, and composed of numerous small, non-imbricating polygonal plates, without any definite arrangement; mesial depression provided with a very long, slender, perforated, flexible, column-like appendage, composed of five longitudinal series of short, alternately interlocking pieces. Attached side, when separated, presenting no sutures or openings, but in some conditions showing numerous, distinct, regularly arranged, radiating striæ, corresponding to radiating lamellæ that occupy the whole internal cavity from top to bottom.

Among the more remarkable features of this fossil may be mentioned its very curious system of radiating lamellæ occupying the whole internal cavity, and giving it, when the plates of the upperside are removed so as to expose these lamellæ in place and attached to the adhering side, almost exactly the appearance of the little fungioid coral *Micrabacia*. The entire absence, so far as known, of free or recumbent arms or pin-

* From Silliman's American Journal, October 1871.

nulæ, as well as of the most minute ambulacral or other openings, save the minute perforation into the slender column-like appendage, and the attachment of this appendage to the free side of the firmly adhering disk are also very anomalous features, if we view this disk as the body of a crinoid.

On examining one of these fossils, one of the first questions that suggests itself is, what can be the nature of this long slender appendage, not more than from four to eight or ten hundredths of an inch in diameter and several inches in length? Is it homologous with the so-called proboscis or ventral tube of other crinoids, or with the column of the same? Prof. Hall evidently entertained the former opinion at the time he wrote the diagnosis quoted above, though I was informed at Cincinnati that, after seeing other specimens than those from which his diagnosis was written, he inclined to the opinion that it is a column. That one or the other of these views is correct would almost necessarily seem to be the case; and yet there would appear to be rather strong objections to both of these conclusions, if we view the disk as the body of a crinoid. In the first place, if a column, why should the body, instead of being, as usual, attached by it, be always (when not accidentally detached) found growing firmly by the whole opposite side to foreign bodies, and this long appendage in all cases be left dangling free and, if viewed as a column, apparently useless? Again, if a column, connected with the free side of the body of an attached crinoid, how are we to account for the fact that no traces of any other opening than that passing in through this appendage can be seen, even by a careful examination under a magnifier, in any part of the body? In addition to this, it does not connect with the disk by a series of basal pieces, as is usually the case with the connexion of the column of a crinoid or cystoid to the body of the same, but, on the contrary, the plates of the disk diminish in size inward, and pass by easy gradations into those forming the base of this long appendage.

On the other hand, if we proceed to view this appendage as a proboscis, or ventral tube, connecting with the ventral side of the body, we are met by the objection of its extreme proportional length, slenderness, flexibility, and the fact that it seems to taper off nearly to a point at its free end. In Mr. Dyer's collection there is a piece, apparently of the free end of this organ, about an inch in length, and agreeing exactly in size, form, and structure with that of *L. Dyeri*, that is broken at one end and tapers to a slightly blunted point at the other end, which is composed of very minute pieces drawn together. In other examples, where three or four inches in length of this appendage can be seen attached to the disk at one end, it tapers off until it becomes exceedingly slender at the free broken end. This character of its termination, especially when viewed in connexion with its length, slenderness, and other characters, would seem to be a strong objection to the conclusion that it is a ventral tube or proboscis. Still there might have been a minute opening at the extremity, closed by diminutive pieces, as we often see is the case with the opening of much larger crinoids.

While examining the specimens of this type, several solutions of the mystery of its structure suggested themselves, the first one of which was, that possibly the disk, viewed as the body, might really be only a peculiarly constructed root or base of attachment of a crinoid, the body of which grew at the free end of the long column-like appendage. This suggestion derives some support from the fact that the disk, although usually growing on the flat surfaces of shells &c., is sometimes found growing upon the side of the columns of other, larger crinoids, as well as on other uneven surfaces; and in such cases it is bent around to conform to the curve of the surface of attachment, just as we see in crinoid-roots similarly situated—while its whole interior is so filled with radiating lamellæ as to leave extremely little, if any, space for the viscera of an animal, and is, as already stated, apparently hermetically sealed, excepting the minute canal leading up into the long appendage. It is true that the roots of crinoids are generally formed of thickened and anchylosed rings or segments of the column; but Mr. Billings has figured the root of one type (*Cleiocrinus grandis*), apparently composed of an accidentally folded expansion of minute polygonal plates; and it is worthy of note that the column attached to this root is longitudinally divided by five sutures. It is also true that there is no example, so far as known to the writer, of any such system of radiated lamellæ being connected with the root of a crinoid; but this objection would doubtless apply with even greater force against the conclusion that this disk is the body of one of these animals.

On the other hand, among the strong objections to the suggestion that these disks are roots, may be mentioned their very regular symmetrical form, and the fact that no indications of a body at the free end of the column-like appendage have yet been observed, nor of a detached body with adhering portions of a column agreeing with this; while no free crinoid that might have been attached to this column in its early stages of growth is known in these rocks. In addition to this, the tapering and pointed extremity of this appendage would seem to render it at least improbable that it had ever supported a body at that end.

Two other solutions of the difficulty suggest themselves, one of which is, that possibly the specimens, as we now see them, may not be the mature condition of the animal, but only one of the stages of development of some crinoid, which, if known in its adult condition, is supposed to be an entirely distinct type. The other is that the disks, as we now see them growing fast to other bodies, may be the adult condition of a crinoid that in its earlier stages of growth was supported on its little column, as in other types, being otherwise free, and that at a later period of its growth the column became free at its lower end, and was for a time trailed about by the floating body, which finally inverted itself and grew fast to other objects by what was originally its vault. The fact, however, that these disks attain a diameter of at least half an inch, with the elongated appendage four inches or more in length, would, even if known analogies supported such a view, seem to be a very strong objection to the conclusion that these are immature or embryonic forms; while, to say nothing of other strong objections that naturally present themselves against the last mentioned suggestion, the occurrence of these disks of all sizes, from the largest down to others less than a tenth of an inch in diameter, all alike growing fast to other bodies by the side opposite the column-like appendage, seems to demonstrate that this is their mode of growth from the first*.

In view of all that is now known of this curious fossil, it seems to me, without undertaking to express a positive opinion on the subject, that the weight of evidence (supposing that these disks are really the *body* of the crinoid) favours the conclusion that the long appendage is a ventral tube; but *if the appendage is a column*, then I should incline to the opinion that the disk is a peculiarly organized root, and that the body may be yet unknown, unless as an entirely distinct crinoid.

For the use of specimens of this fossil I am under obligations to Mr. C. B. Dyer, Mr. U. P. James, Mr. D. H. Shaffer, Dr. H. H. Hill, and Dr. R. M. Byrnes, of Cincinnati. Mr. Dyer's collection, however, contains much the most complete

* In a few very rare cases the disk has been found detached and showing the flat side marked by very regular radiating striæ. It is almost certain, however, from the fact that hundreds of specimens have been found growing firmly to other bodies, that these few separated individuals had become detached by the disintegration of the object upon which they grew, and that the radiating striæ are only the edges of the lamellæ within, exposed by weathering, as we also sometimes see on the upper side of weathered specimens.

and instructive series. Full illustrations, showing all its known characters, will be prepared for the reports of the Ohio Geological Survey. The two known species, *L. Dyeri* and *L. crateriformis*, occur in the Cincinnati group of the Lower Silurian, near Cincinnati, Ohio.

XLVI.—*Notes on Coleoptera, with Descriptions of new Genera and Species.*—Part I. By Francis P. Pascoe, F.L.S. &c.

[Plate XIV.]

List of Genera and Species.

TROGOSITIDÆ.

Elestora fulgurata.

OTHNIIDÆ.

Elacatis lyncea.
—— laticollis.

TENEBRIONIDÆ.

Bolitophaginæ.

Atasthalus (*n. g.*) spectrum.
Dysantes (*n. g.*) taurus.
Calymmus (*n. g.?*) cucullatus.
—— asperulus.
Bolitoxenus bifurcus.
Heledona nasalis.

Diaperinæ.

Allophasia (*n. g.*) Fryi.

Ulominæ.

Toxicum grande.

Zopherinæ.

Rhypasma querulum.
—— nanum.
Exeniotis (*n. g.*) collaris.

Ancylopominæ.

Ancylopoma (*n. g.*) punctigera.

Helopinæ.

Œdemutes pretiosus.
—— purpuratus.

Pycnocerinæ.

Odontopus physodes.
—— asperatus.
—— speciosus (*note*).

Amarygminæ.

Cyriogeton (*n. g.*) insignis.

Cyphaleinæ.

Cyphaleus Mastersii.

CISTELIDÆ.

Æthyssius eros.

PEDILIDÆ.

Egestria (*n. g.*) tæniata.
—— suturalis.

ANTHRIBIDÆ.

Nessiara histrio.
Habrissus heros.
Phides (*n. g.*) xanthodactylus.
Phaulimia Schaumii.

Elestora.

(Trogositidæ.)

Caput transversum, obliquum, paulo exsertum; *clypeus* brevissimus, arcuatus, sutura clypeali profunda; *labrum* minutum. *Mentum* brevissimum, antice late emarginatum; *labium* profunde bilobum, margine anteriore ciliatum; palpi articulo ultimo dilatato; *maxillæ* lobo interiore inermi. *Oculi* laterales, postice incurvi, tenuiter granulati. *Antennæ* breves, articulo basali subgloboso, secundo ad octavum brevibus, gradatim latioribus, tribus ultimis valde transversis, clavam perfoliatam formantibus. *Prothorax* transversus, apice fortiter emarginatus, lateribus antice rotundatus, postice constrictus, basi leviter rotundatus. *Elytra* ovata, supra depressa. *Pedes* æquales; *tibiæ* anticæ subdentatæ, apice calcaratæ. *Prosternum* latum, postice truncatum. *Metasternum* apice productum, in medio canaliculatum. *Mesosternum* triangulare.

M. Lacordaire's "tribu iii. Gymnochilides" of the Trogositidæ is distinguished by the "essential character" of the divided eyes, either common, apparently, to both sexes, or peculiar to the male. In *Gymnochila*, *Acrops* (*Anacypta*), and *Narcisa* I have always found them divided, in reality four eyes; in *Leperina* *, including eight species, never. Lacordaire also finds them simple in that genus. Mannerheim, however, out of a hundred individuals of the Siberian species of *Gymnochila*, only obtained a single male; and in this the eyes were completely divided. It would therefore seem to be questionable whether the Australian *Leperinæ* are rightly included in it. So far as the genus before us is concerned, having only one specimen, I am unable to say if the undivided eyes are persistent in both sexes. The genus is perhaps most nearly allied to *Leperina*; but its habit, colour, and clothing are altogether peculiar: the latter is neither scales nor hairs, but appears, particularly on the elytra, to be a densely matted material, like the finest velvet; the scutellum alone is covered with long, closely set, silky hairs. A short diagnosis of this species was given in the 'Proceedings of the Entomological Society,' 1868, p. xi.

Elestora fulgurata. Pl. XIV. fig. 1.

E. aterrima, maculis aurantiacis ornata; capite sat remote punctato; antennis glabris, nitidis; prothorace in medio paulo excavato, lateribus tenuiter sulcato-marginato; scutello pilis longiusculis aurantiacis dense tecto; elytris postice paulo latioribus, dorso planatis, lineis longitudinalibus subtiliter elevatis, maculis magnis quatuor decoratis, singulis una exteriore ante medium, una postice ad suturam fere connexa: corpore infra pedibusque nigris, opacis. Long. $6\frac{1}{2}$ lin.

Hab. Penang.

Elacatis lyncea.

E. pallide testacea, supra pilosula, elytris nigro fasciatis et maculatis; capite prothoraceque fuscescentibus, hoc capite manifeste angustiore, lateribus haud denticulato, angulis posticis rotundatis; elytris prothorace latioribus, sat breviusculis, postice gradatim

* *Leperina fasciculata*, Redt. (Novar. Reise, Col. p. 37, pl. 2. fig. 3), is evidently *L. turbata*, Pasc. Journ. of Entom. ii. p. 29.

angustioribus; corpore infra castaneo; pedibus antennisque, clava nigra excepta, sublutescentibus: oculis valde prominulis. Long. $1\frac{1}{2}$ lin.

Hab. Ceylon.

Allied to *E. delusa*, Pasc. (Journ. of Entom. i. p. 53, April 1860, pl. 2. fig. 5), but, *inter alia*, with a narrower prothorax, not denticulate at the sides, and the two posterior angles not emarginate.

Elacatis laticollis.

E. rufo-testacea fusco-variegata, supra pilosula; oculis minus prominulis; antennis articulis tertio ad octavum gradatim brevioribus, clava fuscescente; prothorace sat fortiter transverso, lateribus subparallelis, angulis posticis obliquis; elytris prothorace haud latioribus, postice gradatim angustioribus, pallide fuscis, maculis rufo-testaceis, nonnullis indeterminatis, notatis; corpore infra fuscescente; pedibus flavo-testaceis; femoribus in medio tibiisque fuscis. Long. 3 lin.

Hab. Batchian.

A larger and darker species than the last, the fusion of the browner shades leaving paler spots at intervals; the broad prothorax, its sides nearly straight and its posterior angles neither emarginate nor rounded, differentiates it from *E. delusa*, as well as from the preceding. *Elacatis* was originally, but hesitatingly, referred by me to Melandryidæ, on account of its heteromerous tarsi and pronotum marked off from the flanks of the prothorax by a narrow ridge. Dr. Leconte, on his recent examination of my collection, at once recognized it as his *Othnius*, a genus founded on a species taken in Nebraska, near the Rocky Mountains; disregarding its heteromerous tarsi, which, he considers, are perhaps peculiar to the males*, he places it near Cryptophagidæ†, as a distinct family. In this I agree with him. The difficulty occurs, as my name is the oldest, whether the name of the family should be changed; but the adoption of Othniidæ will have the advantage of connecting the two names given to a highly specialized form found in such dissimilar faunistic regions as North America and the Indian Islands.

* In *E. delusa*, which was found by Mr. Wallace in Borneo and New Guinea, both sexes are heteromerous. From a note attached to a specimen of this species in the British Museum, it would seem to be very like one from Mexico, named (but not, that I am aware of, described) by Dr. Horn of Philadelphia.

† It is worth noting that *Tetratoma*, to which I compared *Elacatis*, is, together with *Triplax* and *Tritoma*, referred by Dr. Redtenbacher (Faun. Aust.) to this family.

Atasthalus.

(Bolitophaginæ.)

Caput latum, transversum, verticale, ante oculos bicornutum; sutura clypeali invisa. *Palpi* maxillares articulo ultimo elongato, fusiformi. *Oculi* reniformes. *Antennæ* 11-articulatæ, articulo basali modice elongato, secundo longiore quam latiore, cæteris gradatim brevioribus et compressis, 7–10. subcordatis, ultimo obcordato. *Prothorax* gibbosus, in medio bicornutus, lateribus crenatis, postice rotundatis. *Elytra* elevata, parallela, prothorace basi latiora. *Pedes* elongati; *femora* sublinearia; *tibiæ* graciles, sulcatæ; *tarsi* breves. *Prosternum* postice verticale. *Abdomen* breviusculum.

Of this remarkable insect I have seen only a single specimen, and this, without doubt, a male. While in habit it is most like *Bolitotherus cornutus*, Panz., it differs from all other Bolitophaginæ in the last joint of its maxillary palpi being long and fusiform. The epipleuræ of the elytra, as in *Calymmus* and some others, are not well marked off from the flanks of the elytra. As in most other genera of this subfamily, it is probably, in a perfect state, covered with a hard brownish crust, remains of which are still visible.

Atasthalus spectrum. Pl. XIV. fig. 3 (♂).

A. oblongus, niger, setulis subtilissimis sparse adspersus, antennis palpisque ferrugineis; capite cornibus duobus elongatis, singulis apicem versus ramulo breviusculo instructis; prothorace antice latiore, lateribus profunde crenatis, medio cornibus duobus validis subhorizontalibus versus apicem convergentibus; scutello oblongo; elytris seriatim punctatis, tuberculis numerosis, dorso excepto, interjectis; corpore infra vage punctato. Long. 5 lin.

Hab. Malacca.

Dysantes.

(Bolitophaginæ.)

Caput verticale, rotundatum (vix quadrangulare); sutura clypeali invisa. *Palpi* maxillares articulo ultimo subsecuriformi. *Oculi* reniformes. *Antennæ* clavatæ, 11-articulatæ, articulo basali parum incrassato, secundo longiore quam latiore, tertio elongato, quarto breviore, quinto ad octavum longitudine subæqualibus; *clava* compressa, triarticulata, articulis transversis, ultimo præcedente haud distincto. *Prothorax* transversus, antice cornibus duobus horizontalibus instructo. *Elytra* oblonga, parallela, supra paulo depressa, prothorace basi latiora, epipleuris angustissimis. *Pedes* graciles; *femora* vix incrassata; *tibiæ* teretes; *tarsi* articulo ultimo elongato. *Prosternum* postice verticale, apice in incisuram mesosterni recepta. *Epipleura* metathoracis distincta. *Acetabula* postica elytra haud attingentia.

The type of this genus has been published by Dr. Redtenbacher (Novara Reise, p. 127) under the name of *Diceroderes elongatus*. *Diceroderes* is a remarkable Mexican form referred by Lacordaire to Eutelinæ, which is differentiated, *inter alia*, from the Bolitophaginæ by their short metasternum, elytra without epipleuræ, and globose anterior coxæ; the hook to the internal maxillary lobe is also given as a character of the Eutelinæ; but it is absent in *Diceroderes*, as in the Bolitophaginæ. The species described below differs principally from *D. elongatus* in having larger tubercles on the elytra, and the prothoracic horns, instead of being lyrate, are simply curved, approaching a little at the tips, shorter, and stouter at the base.

Dysantes taurus.

D. minus elongatus, fuscus, antennis ferrugineis, articulo quarto quam sequente longiore; prothorace supra quadrituberculato, cornibus validis, tuberculatis, intus arcuatis, apicibus paulo approximantibus; elytris seriatim granulatis, granulis approximatis, tuberculis elongatis numerosis interjectis; corpore infra subtiliter punctulato. Long. $4\frac{3}{4}$ lin.

Hab. Java.

Calymmus.

(Bolitophaginæ.)

Caput antice angustius, sutura clypeali semilunari. *Oculi* reniformes. *Palpi* maxillares articulo ultimo subsecuriformi. *Antennæ* clavatæ, 11-articulatæ, articulo basali paulo incrassato, tertio sequentibus longiore; *clava* triarticulata, articulis transversis, ultimo præcedente haud distincto. *Prothorax* transversus, lateribus crenatus, antice in laminam elongatam productus, basi bisinuatus. *Scutellum* distinctum. *Elytra* oblonga, parallela, prothorace vix latiora; epipleura postice obsoleta. *Pedes* subtenues; *femora* subfusiformia; *tibiæ* marginibus tenuiter granulatis, margine interiore recto; *tarsi* breviusculi. *Prosternum* postice verticale, apice in incisuram mesosterni recepto. *Epipleura* metathoracis distincta.

This is one of the genera of Dejean's Catalogue which seems never to have been described; but it finds a place exceptionally in Gemminger and Von Harold's great work, in consequence of Montrouzier's *Toxicum Berardi* being referred to it by Perroud. This species, according to a specimen in the British Museum, has an antennal club of six joints, and therefore has nothing to do with *Calymmus*.

Calymmus cucullatus. Pl. XIV. fig. 8.

C. elongatus, fuscus, squamulis minutis parce vestitus; antennis tarsisque ferrugineis; capite inter oculos paulo excavato; prothorace fortiter tuberculato, tuberculis conicis irregulariter adspersis; scutello subcirculari; elytris subseriatim punctatis, tuberculis conicis numerosis internatis; corpore infra subnitido, subtiliter punctulato. Long. $4\frac{1}{2}$ lin.

Hab. Rio de Janeiro.

Calymmus asperulus.

C. brevior, fuscus, antennis pedibusque subferrugineis; prothorace, in medio longitudinaliter excavato, elytrisque tuberculis conicis magis adspersis, aliisque minoribus numerosis granuliformibus intermixtis; corpore infra ferrugineo, fere impunctato. Long. $3\frac{1}{2}$ lin.

Hab. Columbia.

Bolitoxenus bifurcus.

B. sat latus, modice convexus, niger, indumento fusco tectus, supra irregulariter tenuiter tuberculatus; capite valde transverso; prothorace duplo latiore quam longiore, antice gradatim angustato, supra ante medium cornibus duobus horizontalibus sublyratis, apice plumosis, armato; elytris breviusculis, parallelis, prothorace paulo latioribus; antennis, palpis pedibusque ferrugineis. Long. $3\frac{1}{2}$ lin. (sine cornibus).

Hab. Penang.

Much narrower than *B. gibber*, Motsch., with two rather long horizontal horns, as in *Dysantes*, but not tapering towards the tip. What I think may be the female has two callosities in place of horns, as in both sexes of *B. gibber*.

Heledona nasalis.

H. (♂) breviter cylindrica, nigra, opaca, squamositate fusca adspersa; capite inter oculos planato, clypeo antice in laminam latam erectam recurvato; antennis palpisque rufo-testaceis; prothorace supra sparse nitide granulato, utrinque crenato, antice cornibus duobus horizontalibus, validis, quadratis, apice truncatis et dilatatis, armato; scutello subsemicirculari; elytris latitudine vix sesquilongioribus, singulis costis novem interruptis instructis; corpore infra pedibusque ferrugineis. Long. $2\frac{1}{2}$ lin.

Hab. Penang.

The female differs only in having the head and prothorax unarmed; a stout species, much shorter proportionally than *H. vacca*, Motsch. (*Bolitophagus*), which has longer and subulate prothoracic horns*.

* There is some confusion in Gemminger and Harold's Catalogue, the Ceylon *Byrsax cornutus*, Fab. (*Trox*), being referred to *Bolitotherus*, Cand., a genus founded on *Opatrum cornutum*, Panz., a North-American insect identical with the subsequently described *Opatrum bifurcum*, Fab.

The following table of the genera of the Bolitophaginæ may be useful:—

Antennæ 11-jointed.
  Eyes divided by the antennary ridge .... *Bolitophagus*, Ill.
  Eyes not divided.
    Legs short, femora not extending beyond the body.
      Elytra expanded or foliaceous at the sides.. *Byrsax*, Pasc.
      Elytra not expanded.
        Body elevated, gibbous above .... *Bolitoxenus*, Motsch.
        Body cylindrical .... *Heledona*, Latr.
    Legs longer, femora extending beyond the body.
      Last joint of the maxillary palpi short, subsecuriform.
        Clypeus separated from the front by a semicircular groove.
          Prothorax entire .... *Ilyxerus*, Pasc.
          Prothorax produced anteriorly (at least in ♂) .... *Calymmus*, n. g.
        Clypeus confounded with the front .... *Dysantes*, n. g.
      Last joint of the maxillary palpi elongate, fusiform .... *Atasthalus*, n. g.
Antennæ 10-jointed.
  Anterior tibiæ compressed and dilated exteriorly. *Oreopagia*, Pasc.
  Anterior tibiæ not dilated.
    Clypeus recurved .... *Bolitotherus*, Cand.
    Clypeus not recurved.
      Prothorax expanded laterally at the base .. *Ozolais*, Pasc.
      Prothorax rounded at the base .... *Mychestes*, Pasc.

Genus mihi invisum *Bradymerus*, Perroud. (Ann. Soc. Linn. de Lyon, 1865, p. 110.)

Allophasia.

(Diaperinæ.)

Caput maris in clypeo cornu conico instructo. *Oculi* tenuiter granulati. *Antennæ* breviusculæ; articulo basali valido, obconico, secundo brevissimo, tertio breviter obconico, sequentibus ad decimum valde transversis, ultimoque clavam magnam perfoliatam formantibus. *Prothorax* transversus, basi sulcato-marginatus, apice (♂) in processum porrectum bilobum terminatus, aliter bicornutus. *Elytra* globosa; *epipleura* postice obsoleta. *Femora* compressa; *tibiæ* margine exteriore denticulatæ; *tarsi* breviusculi, subtus sparse setulosi. *Prosternum* postice cuneato-productum, in incisuram mesosterni receptum. *Abdomen* segmentis tribus intermediis æqualibus.

The only genera with which this may be compared, *Diaperis* and *Arrhenoplita* (= *Oplocephala*, Cast. et Br., *non* Cuv.), have coarsely granulate eyes: in the former, with which it agrees in its antennæ*, the clypeus of the male is unarmed;

* Lacordaire describes the antennæ of *Diaperis* as having the first joint

in the latter, besides the difference of form, the head in the same sex has two strong spines above the eyes. And this is the very remarkable point, that these two spines are transferred to the apex of the prothorax in the insect before us; but, without a close examination, they appear to occupy the same place as in the latter genus. The species here described was found by Mr. Fry, in some numbers, in the hollow of a bamboo; and a pair of these he has kindly presented to me.

Allophasia Fryi.

A. breviter globoso-ovalis, glabra, nitida, fulva; elytris, basi excepta, nigris; capite (♂) inter oculos excavato; antennis pilosulis, articulis tribus basalibus fulvis, cæteris nigris; prothorace impunctato, in medio excavato; scutello triangulari; elytris seriatim punctulatis, interstitiis fere impunctatis; corpore infra pedibusque flavo-lutescentibus. Long. $2\frac{1}{2}$ lin.

Hab. Brazil (Espiritu Santo).

Toxicum grande.

T. oblongum, paulo depressum, nigrum, violaceo nitens: capite ♂ quadricornuto, cornibus duobus anticis elongatis, ellipticis, parallelis, duobus posticis divergentibus, arcuatis, clavatis, apice breviter pilosis; ♀ cornibus posticis carentibus; oculis integris; prothorace modice transverso, cum capite subvage subtiliter punctulato; scutello semiorbiculari; elytris tenuiter seriatim punctulatis; corpore infra nigro, metasterno abdomineque subtilissime punctulatis; pedibus glabris, castaneis. Long. 10 lin.

Hab. Borneo (North).

A fine and very distinct species. The female has the posterior horns very short, and the anterior are reduced to mere tubercles.

Rhypasma querulum.

R. obscure testaceo-brunneum, indumento griseo munitum; antennis brevioribus, articulo ultimo distincto; capite parce granulato? prothorace longitudine latitudini æquali, sat confertim granulato, utrinque basin versus parum angustiore, in medio longitudinaliter excavato, ad latera modice explanato, marginibus crenatis; scutello semicirculari; elytris oblongis, singulis disco quadricostatis, costa secunda a scutello versus apicem evanescente, interstitiis biseriatim conferte punctatis; pedibus asperulis; tarsis posticis reliquis manifeste longioribus. Long. $1\frac{3}{4}$ lin.

Hab. Amazons (Ega).

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short and obconic, the three following of the same form, the fifth to the tenth very strongly transverse. In *D. boleti*, the type of the genus, it is from the fourth to the tenth, as in *Allophasia*.

Resembles *R. pusillum*, Pasc. (Journ. of Entom. i. p. 326, pl. xvi. fig. 3)*, but it has, *inter alia*, considerably shorter antennæ, a prothorax about equal in length and breadth, and the disk of the elytra with four costæ, the second longer and gradually obliterated behind.

Rhypasma nanum.

R. ferrugineum, indumento griseo tectum; antennis articulo ultimo ut in specie præcedente immisso; prothorace transverso, confertim granulato, in medio planato, ad latera parum explanato, marginibus vix crenatis; scutello semicirculari; elytris postice leviter angustioribus, singulis disco quinquecostatis, costa interiore scutellari vel brevi, quatuor exterioribus versus apicem confluentibus, interstitiis biseriatim rugoso-punctatis; pedibus rufescentibus, tarsis posticis reliquis vix longioribus. Long. $1\frac{1}{4}$ lin.

Hab. Amazons (Ega).

The last joint of the antennæ in this species is nearly as obsolete as it is in *Nosoderma*; and the prothorax is not longitudinally excavated above, as in the other two species.

Exeniotis.

Caput parvum, retractum; *labrum* breve, sub clypeo insertum; sutura clypeali nulla; *lobi* oculares elevati. *Oculi* rotundati, fortiter granulati. *Antennæ* validæ, pilosæ, 11-articulatæ, art. primo crassiore, 3 sequentibus longioribus, cæteris ad octavum quadrangularibus, 9., 10., 11. clavam formantibus, duobus primis transversim triangularibus, ultimo rotundato. *Prothorax* oblongus, antice utrinque calloso-lobatus. *Scutellum* invisum. *Elytra* elongata, postice gradatim angustiora. *Femora* linearia; *tibiæ* rectæ, haud calcaratæ; *tarsi* validi, cylindrici, subtus parce pilosi, articulo ultimo cæteris conjunctim fere æquali. *Prosternum* latum, depressum, postice angulatum. *Mesosternum* latum, antice emarginatum. *Metasternum* elongatum. *Coxæ* anticæ parvæ, modice distantes.

The only exponent of this genus is a singular-looking insect covered, in a fresh state, with a crust, masking much of its sculpture. The mentum, as it appears *in situ*, appears to be large, transverse, hiding the maxillæ, as in *Rhypasma*, to which it is allied, and with a broad peduncle attaching it to the jugulum; the palpi and mandibles are deeply seated, and the labium is very small and transverse.

* In this figure the costæ are not connected behind, and the short one (second from the suture) only exists in the shape of a few rather more elevated granules. The sculpture of the three species, however, is masked by the remains of the crustaceous substance with which, probably, they are entirely covered in a fresh state.

Exeniotis collaris. Pl. XIV. fig. 7.

E. angusta, fusca, indumento pallidiore dense tecta; capite supra late depresso; antennis prothorace sesquilongioribus; prothorace pone apicem fere cylindrico, apice ipso utrinque fortiter lobato, supra angulato, depresso, tuberculis setigeris paucis munito; elytris latitudine triplo longioribus, singulis tuberculis conicis setigeris in series tres instructis; corpore infra (sine indumento) piceo-testaceo, granulis distinctis notato; pedibus tenuiter setulosis. Long. $2\frac{1}{4}$ lin.

Hab. Amazons (St. Paulo).

Ancylopoma.

(Ancylopominæ.)

Caput rotundatum, parum exsertum; *clypeus* distinctus, postice arcuatus. *Oculi* magni, prominuli, reniformes, grosse granulati. *Palpi* maxillares elongati, articulo ultimo securiformi. *Antennæ* validæ, quam corpus dimidio longiores, pilosulæ, 11-articulatæ, art. basali brevi, secundo dimidio breviore, cæteris ad decimum obconicis, subæqualibus, quatuor ultimis sensim crassioribus, ultimo ipso ovato. *Prothorax* subobconicus, apice truncatus, angulis anticis utrinque in spinam recurvam productus. *Elytra* oblonga, paulo depressa, prothorace basi duplo latiora; epipleura integra. *Femora* sublinearia; *tibiæ* rectæ, haud calcaratæ; *tarsi* graciles, 4 postici longiusculi. *Prosternum* subangustum, inter coxas elevatum, postice declive. *Mesosternum* depressum. *Processus* intercoxalis angustus, antice rotundatus.

The structure of the mouth and of the intermediate cotyloid cavities technically approximates this genus to such groups as the Zopherinæ, Stenosinæ, &c.; but it wants the essential characters which would authorize its association with either of them. As I have only one specimen, I have not ventured to examine the trophi, except *in situ*; but the mentum appears to be cordiform, leaving part of the maxillæ exposed on each side, and the labium small and somewhat masked by its palpi, which are inserted, apparently, at its base. The sculpture of the elytra, and the slender elongate intermediate and posterior tarsi, especially the latter, are not found in any members of the subfamilies to which the genus is here approximated, while the form of the prothorax is quite unique. I think there can be no doubt that, according to Lacordaire's system, it represents a new subfamily. Like the species of the two preceding genera it is one of Mr. Bates's discoveries.

Ancylopoma punctigera. Pl. XIV. fig. 6.

A. oblonga, brunnea, pilis longiusculis adspersa; capite rugoso-punctulato; clypeo, palpis antennisque testaceo-ferrugineis; oculis supra subapproximatis; prothorace reticulato-punctato, spinis lateralibus margine antico bidentatis; scutello parvo, argenteo-pubescenti; elytris utrinque parallelis, crebre fortiter punctatis, punctis singulis pilum gerentibus; corpore infra castaneo, vix confertim punctato. Long. 2 lin.

Hab. Amazons (Santarem).

(In the figure the second joint of the antennæ is twice too long, and the head is too much exserted.)

Œdemutes pretiosus.

Œ. ovatus, minus convexus, nitidissime aureo-viridis, purpureo lavatus, femoribus tibiisque splendide purpureis, antennis tarsisque nigris; capite inter oculos foveolis tribus subimpressis; prothorace paulo convexo, tenuiter parce punctulato; elytris seriatim, sed minus fortiter foveatis, foveis haud approximatis, plerumque oblongis, nonnullis elongatis, interstitiis lævigatis; corpore infra nitide viridi-nigro. Long. 5 lin.

Hab. Philippine Islands.

Œdemutes purpuratus.

Œ. ovatus, convexus, cyaneo-chalybeatus, purpureo lavatus, femoribus tibiisque splendide purpureis, tarsis antennisque nigris; capite inter oculos foveolis tribus subimpressis; prothorace subplanato, in medio grosse, interrupte, ad latera crebre tenuiter punctato; elytris seriatim fortiter foveatis, foveis haud approximatis, plerumque oblongis, interstitiis lævigatis, lateribus modice rotundatis; corpore infra nitide viridescenti-nigro. Long. 6 lin.

Hab. Philippines.

These species differ from *Œ. tumidus* in being longer and much less convex, with the elytra differently sculptured, &c. The two here described are at once differentiated by the punctation of the prothorax.

Odontopus physodes.

O. ovatus, convexus, nitide metallicus, capite prothoraceque purpureis, inæqualiter subtenuiter punctulatis, hoc parvo, valde transverso; antennis viridibus, articulo ultimo nigro; scutello purpureo; elytris valde convexis, saturate viridibus, crebre fortiter punctatis, sutura elevata, plica epipleurali violacea; corpore infra lævigato, violaceo-nigro; pedibus læte viridi-aureis, femoribus anticis dentibus duobus minutis instructis. Long. 9–10 lin.

Hab. Natal.

Odontopus asperatus.

O. oblongo-ovatus, supra subdepressus, nitide nigrescenti-cyaneus, elytris saturate viridibus; capite antice sat fortiter, vertice subtiliter punctato; antennis nigro-chalybeatis; prothorace modice transverso, irregulariter punctato, pone medium rude biimpresso; scutello nigro, triangulari; elytris manifeste costulatis, interstitiis subbiseriatim fortiter punctatis; corpore infra lævigato, nitide nigro; femoribus anticis infra subbidentatis. Long. 8 lin.

Hab. West Africa (Gold Coast).

These two species and *O. speciosus** differ from the type (*O. cupreus*, Fab.) in their shorter claw-joint, the prothorax not denticulate at the sides, and greater breadth of the prothorax.

Cyriogeton.

(Amarygminæ.)

Ab *Amarygmo* differt: *Lobi* antennarii dilatati; *femora* fusiformia; *tarsi* subtus dense pilosi.

The antennary lobes (or orbits) not being in the form of ears, this genus should, technically, be placed among the Platygenous subfamilies of Lacordaire's second cohort of Tenebrionidæ; it is, however, too nearly related to *Amarygmus* to be separated from it more than generically. Of the two other characters, there are some species of the latter genus in which the femora are scarcely linear, or in which the tarsi are scarcely ciliated, the cilia becoming hair-like and more numerous. *Amarygmus æneus*, Cast. (Hist. Nat. Ins. ii. p. 234), is said to have the tarsi pubescent beneath; it may belong to *Eurypera*, to which also *A. convexus* may be referred. In the fine species described below the clypeus bulges out, forming a transverse fold, which is continuous on each side with the antennary orbits.

Cyriogeton insignis.

C. subellipticus, nitidissime cupreus; capite infra oculos excavato; clypeo prominulo plicam transversam formante; antennis nigris; prothorace lateribus postice parallelis, supra fere impunctato; scutello triangulari; elytris modice convexis, sat obovatis, tenuiter seriatim punctulatis, interstitiis latis, fere impunctatis; corpore

* This is an unpublished name; in Dejean's Catalogue it stands as *Pezodontus speciosus*; the following description will serve to distinguish it:—

Odontopus speciosus.

O. oblongus, modice convexus, nitide cyaneus, aliquando violaceus; elytris vel viridibus, vel cupreis, tenuiter costulatis, interstitiis crebre fortiter punctatis; corpore infra violaceo; prosterno latissimo; femoribus infra unidentatis. Long. 10–12 lin.

Hab. Guinea.

infra nigro-piceo, abdomine confertim punctulato; femoribus anticis infra in medio dente valido, aliquando minore, armatis; tarsis subtus rufescenti-pilosis. Long. 10–11 lin.

Hab. Sylhet.

Cyphaleus Mastersii.

C. late ovatus, supra splendide cæruleo-violaceus, aureo-viridi marginatus; capite sat crebre punctulato; prothorace parum convexo, at lateribus explanato, angulis anticis spinoso-productis, dorso foveis octo vel decem impresso, duobus in lineam mediam, utrinque tribus vel quatuor dispositis; scutello triangulari; elytris prothorace multo latioribus, modice convexis, humeris late oblique truncatis, lateribus pone humeros parallelis, apicem versus rotundatis, apicibus spinosis, singulis punctis magnis subseriatim locatis (seriebus circa 5–6), interstitiis subtiliter sparse punctulatis, epipleuris aureo-viridibus; corpore infra femoribusque atris, nitidis; antennis, tibiis tarsisque nigro-piceis, nitidis. Long. 9 lin.

Hab. Queensland (Port Dennison; Gayndah &c.).

The genera of the Cyphaleinæ are, with two or three exceptions, feebly separated from one another: the above has the sculptured elytra of *Cyphaleus*; but the prothorax is expanded at the sides, as in *Chartopteryx*, from which it differs in the two penultimate joints of the antennæ being transverse (as in *Cyphaleus*) and the anterior humeral angle rounded. I name this handsome species after Mr. Masters, than whom none has been more successful in collecting the animal productions of Australia.

Æthyssius eros.

Æ. nitidissime igneo-rufus aureo lavatus, antennis nigris, supra disperse pilosulus; capite prothoraceque sat remote punctatis; scutello subquadrato, angulis posticis rotundatis; elytris striato-punctatis, interstitiis convexis, parce punctatis, in certo situ quasi transversim plicatis; corpore infra iridescente; pedibus rufo-brunneis, pubescentibus. Long. 6 lin.

Hab. New South Wales.

Differs from *Æ. viridis*, Bois. (*Atractus*), in its pubescence, the sculpture of the elytra, the punctures in the striæ being smaller, less marked, and the transverse intervals between them less distinctly separated by well-defined bars, which are only seen in certain lights, and by the penultimate joint of the posterior tarsi being longer and its sides parallel nearly their whole length. I have previously proposed *Æthyssius* for *Atractus*, Lac., which is the name of an Hemipterous genus. *A. virescens* and *A. columbinus*, Bois., are supposed to be varieties of *Æ. viridis*, which varies from green to red and violet. The male differs in having longer antennæ and the posterior femora toothed in the middle.

Egestria.

(Pedilidæ.)

Caput trigonatum, collo modice angusto; *clypeus* antice angustior, truncatus, sutura clypeali obsoleta; *labrum* breve, apice rotundatum; *jugulum* antice pedunculatum. *Palpi* maxillares articulo ultimo cultriformi. *Oculi* fere integri. *Antennæ* breviusculæ, filiformes, articulo primo modice incrassato, cæteris ad decimum fere subæqualibus, ultimo in mare duobus vel tribus præcedentibus conjunctim longiore, in fœmina paulo elongato. *Prothorax* oblongus, apice tubulatus et transversim sulcatus. *Elytra* elongata. *Femora* vix incrassata; *tibiæ* rectæ, bicalcaratæ; *tarsi* lineares, articulo penultimo parvo, bilobo. *Coxæ* anticæ cylindricæ, exsertæ; *acetabula* antica aperta. *Processus* intercoxalis angustus, triangularis.

It would, I think, be desirable to unite, as J. du Val has done, the "*Pedilides vraies*" of Lacordaire to the Anthicidæ, the only point differentiating the two being the complete contiguity, or nearly so, of the posterior coxæ in the former, a variable character among the Heteromera, and subject to exceptions here. In the present genus the intercoxal process lies below the line of the coxæ, while in *Diacalla*, to which it is allied, this process distinctly separates them, its apex being received into a notch of the metasternum. *Diacalla* (Journ. of Ent. ii. p. 46) was originally referred by me to the Lagriidæ; but on a closer re-examination I find that the anterior cotyloid cavities are open behind, whilst in *Ictistygna* (*l. c.* ii. p. 491), apparently very closely allied to it, they are closed in. This character is supposed to be peculiar to the Lagriidæ and Tenebrionidæ amongst all the families of Heteromera; but in *Ictistygna* it must be considered exceptional, as it would not do to place it and *Diacalla* in two different families. Besides the two species here described, I have five others connected with the genera mentioned above, but not in sufficiently good order for description.

Egestria tæniata. Pl. XIV. fig. 9 (♀).

E. nigro-fusca, pilis griseis modice induta, elytris basi silaceis, singulis vitta flavescenti ab humero usque ad apicem ornatis; capite transverso, crebre punctato; clypeo late triangulari, apice rotundato; labro brevi; antennis testaceo-ferrugineis, versus apicem nigricantibus; prothorace pone medium paulo incurvato, oculato-punctato; scutello elongato-triangulari; elytris ♂ sensim angustatis, ♀ fere parallelis, sat confertim punctatis; tibiis, apice excepto, flavescentibus; tarsis articulo ultimo medioeri. Long. 3½–4½ lin.

Hab. Queensland (Rockhampton).

Egestria suturalis.

E. (♀) fusca, pilis albidis omnino induta; capite oblongo, rugoso-punctato; clypeo transverso, apice late rotundato; labro sat elongato; antennis testaceis, articulo secundo sequentibus manifeste breviore, ultimo parum elongato; prothorace utrinque in medio incurvato, oculato-punctato; scutello subquadrato; elytris parallelis, confertim punctulatis, sutura alba e pilis condensatis; tibiis tarsisque testaceis, his articulo ultimo elongato. Long. 5 lin.

Hab. North Australia.

Nessiara histrio. Pl. XIV. fig. 2.

N. oblonga, atra, capite rostroque pube miniacea dense indutis, hoc in medio leviter carinulato; mandibulis nigris, maxillis, palpis antennisque testaceis, clava fusca; prothorace quam latitudine vix longiore, pube miniacea induto, maculis sex nigris ornato, basi cinereo et maculis duabus nigris notato; scutello parvo, rotundato; elytris depressis, lateribus sensim angustioribus, apice rotundatis, striato-punctatis, postice pube miniacea tectis, interstiis alternis cinereo-pubescentibus, alteris nudis, nigris; corpore infra pedibusque cinereo-pubescentibus; femoribus infra versus basin longius pilosis. Long. 10 lin.

Hab. Philippine Islands.

The males of *Nessiara*, at least of this species and *N. didyma*, have the rostrum broader, and notched or toothed at the sides. *N. planata*, Pasc., appears to belong to *Phlæops*, Lac., which is, apparently, principally differentiated by the angular sides of its prothorax. The species described above is one of the most striking of the Anthribidæ; and it is interesting also from its habitat, the Philippine Islands being probably the north-eastern limit of the Malayan beetle-region, whence so large a proportion of the known insects of this family are derived, of which, however, these islands have hitherto furnished a very insignificant part.

Habrissus heros. Pl. XIV. fig. 5.

H. niger, pube albida fusco variegata dense tectus; rostro lato; oculis ovatis, vix obliquis; antennis nigris, articulo tertio paulo incrassato, sequentibus ad octavum æqualibus, longiusculis, sed brevioribus, clava tenui; prothorace obconico, subfusco, fere obsolete maculatim vario; scutello transverse triangulari; elytris oblongis, prothorace paulo latioribus, striato-punctulatis, interstitiis alternis fusco ocellato-maculatis; corpore infra pube densa grisea induto, segmento ultimo abdominis excepto nudo; pedibus fusco alboque variis; tarsis nigris, anticis articulo primo in medio albo, quatuor posticis articulis primo basi et secundo toto, apice excepto, albis. Long. 11 lin.

Hab. Labuan.

A fine species, differing from *H. pilicornis* in its size, rostrum, eyes, antennæ, and coloration, especially of the tarsi.

PHIDES.

(Anthribidæ.)

A *Plintheria* differt *rostro* in medio carinato, *clava* laxe articulata; *oculis* oblongis; *prothorace* utrinque ampliato-producto. *carina* anteriore a basi remota; *coxis* anticis sejunctis, et *tarsis* brevioribus, dilatatis.

One of my two examples of this genus has the rostrum decidedly longer than the other; if this be the male, then there will be very little difference between the sexes; in *Plintheria* the antennæ in the male are nearly three times as long as in the female*.

Phides xanthodactylus. Pl. XIV. fig. 4.

P. oblongus, niger, saturate cervino-pubescens; rostro capite duplo longiore, versus apicem sensim latiore; antennis capite cum rostro haud longioribus, ferrugineis, art. 3–8. gradatim brevioribus, clava extrorsum fulvicante; prothorace supra inæquali, carina medio instructo, nigro-strigoso, basi ante scutellum macula ochracea ornato; scutello quadrato, ochraceo; elytris prothoracis medio vix latioribus, striato-punctatis, singulis tuberculis circa decem notatis; metasterno, abdomine femoribusque dense silaceo-squamosis; tarsis articulis duobus ultimis flavis. Long. $4\frac{1}{4}$ lin.

Hab. Fiji.

Phaulimia Schaumii.

P. fusco-castanea, pube subtili subgrisea induta, elytris maculis duabus majusculis communibus nigris ornatis, una basali suboblonga, pallide marginata, altera apicali transversa minore: antennis fuscis, clava nigra, art. duobus ultimis funiculi testaceis; pro-

* The sexual distinctions of *Cedus*, a genus of this family, were unknown when I proposed it; nor were they known to Lacordaire. I may therefore say that my specimens at that time were males (they were afterwards sent by me to Lacordaire). In *C. guttatus* the female has antennæ as long as the body, with a slender elongate club: the female of *C. tuberculatus* has much shorter antennæ, with a stout compact club, while some of the males of this species have antennæ four times as long as the body. Lacordaire is probably right in considering *Byastus cephalotes*, Pasc., to be the female of another species of *Cedus*. There is a fourth in the collection of Mr. Lamb, from Pulo Penang.

thorace transversim conico; elytris subtiliter griseo-pubescentibus; pedibus ferrugineis. Long. 2 lin.

Hab. Ceylon.

Longer and less cylindrical than *P. ephippiata*, the basal patch with a whitish border, &c. I received this species from the late, lamented Dr. Schaum.

EXPLANATION OF PLATE XIV.

Fig. 1. *Elestora fulgurata*; 1*a*, mentum and labium and its palpi.
Fig. 2. *Nessiara histrio*; 2*a* (by mistake numbered 12), front view of the head and antennæ.
Fig. 3. *Atasthalus spectrum* (♂).
Fig. 4. *Phides xanthodactylus*; front view of the head and antennæ.
Fig. 5. *Habrissus heros.*
Fig. 6. *Ancylopoma punctigera.*
Fig. 7. *Exeniotis collaris*; 7*a*, head and part of prothorax; 7*b*, side view of head &c.
Fig. 8. *Calymmus cucullatus*; 8*a*, side view of head and part of prothorax; 8*b*, apical lamina of prothorax.
Fig. 9. *Egestria tæniata* (♀).
Fig. 10. Head and antennæ of *Toxicum grande.*
Fig. 11. Prothorax and antenna of *Allophasia Fryi* (♂). The fourth joint of the latter should be transverse, like the one following it.
Fig. 12. See figure 2.

BIBLIOGRAPHICAL NOTICE.

M. Terquem's *Researches on the Foraminifera of the Lias and the Oolites.*

I. *Recherches sur les Foraminifères de l'étage moyen et de l'étage inférieur du Lias.* Par M. Terquem, &c. Metz, 1862. Second Mémoire. Extrait des 'Mémoires de l'Académie Impériale de Metz,' année 1860–61.

M. Terquem, having given some general information about the Rhizopods, taking Schultze's plan of classification, proceeds to particularize the results of his researches in the several stages of the Lias. As a rule, he finds that where Entomostraca occur, Foraminifera are also found, whether in calcareous, marly, or sandy strata. The Upper Lias has as yet proved unproductive of these Microzoa. In the middle stage, the oolitic marls (*marnes à ovoïdes ferrugineux*) have yielded numerous *Ooline* [*Lagenæ*], *Nodosariæ*, *Frondiculariæ*, *Dentalinæ*, *Marginulinæ*, and *Cristellariæ*, arranged in 59 species by M. Terquem. He found a *Glandulina*, too, and an *Orbulina*, which he had previously termed *Orbiculina*; also materials for two new genera, namely:—(1) *Uncinulina*, described but not named in his first memoir (p. 678)—a free, hyaline, slender tube, straight or curved, square in section, without septa, with attenuated equal ends, variously hooked; (2) *Involutina*, English specimens of which were described in 1853 by Rupert Jones with some doubt as *Nummulites liassicus*. M. Terquem's determination of the arenaceous structure and other special characters of this abundant little shell gave him full reason to place it in a new genus.

A form from the Middle Lias that he had previously referred to *Siderolina* he found to be a Polyzoon, *Neuropora*.

In some shales at Montigny-lès-Metz he found *Orbulina*, *Frondicularia*, *Dentalina*, *Marginulina*, *Cristellaria*, *Robulina*, *Rosalina*, and *Involutina*—fifteen species, nine new, and some like those of the beds above; also a new genus, *Annulina*, which has the look of being closely related to, if not the same as, the last mentioned.

M. Piette and M. Terquem together found Foraminifers in all the strata of the Lower Lias of the Departments of the Moselle and the Meurthe, of Luxemburg, Belgium, and the Ardennes. These amount to twenty-three species, some of them new, and some like those of the *marnes à ovoïdes*. Among these are *Webbinæ* [and *Placopsilinæ*], particularly abundant as parasites in a bed of *Gryphæa arcuata*.

In his previous memoir on the Liassic Foraminifera, M. Terquem had noticed a little fossil like the "*Orbis infimus*" of Strickland, and had then referred it to *Serpula*; but in his second memoir he describes its Foraminiferal characters with exactness, and, showing its relation to *Involutina*, names it *I. silicea*. Strickland's minute fossil has also been referred to Parker and Jones's sandy genus *Trochammina*; and Terquem's *I. silicea* has been referred to *T. incerta*, D'Orb. sp., by H. B. Brady (Geol. Mag. vol. i. p. 196), and quite correctly, and without any great violence to M. Terquem's arrangement; for without doubt *Trochammina* and *Involutina* are very close allies, the latter, indeed, being merely a more advanced development from the simple and naked coil of the former.

In the two plates (pls. 5 & 6) illustrating M. Terquem's Second Memoir we have his usual numerous, small, beautifully neat, and natural figures, for which palæontologists owe him many thanks. We doubt the zoological value of all his "species:" and we are sure that many would fall under old names had the veteran author had the opportunity of comparing all the published illustrations of Foraminifera. That is a labour, however, which some younger rhizopodist may undertake, for the sake of a more strict collocation of the Liassic with other forms, and the readier recognition of biological relationship by the reading student. Thus in pl. 5 we easily discern the known species (or, rather, notable varieties) *Nodosaria humilis*, *radicula*, *ovicula*, *Dentalina communis*, &c., under new names.

Fig. 4, *Orbulina liasica* (p. 432), is an interesting reticulated form. Fig. 5, *O. punctata* (p. 432) can scarcely differ from *O. universa*, D'O. Figs. 1, 2, and the woodcut at p. 431, and fig. 12 in pl. 6, present remarkably attenuated *Lagenæ*; whilst fig. 3, *a*, *b* supply the passages towards *L. globosa*. Fig. 6, *Annulina metensis*, must be, as intimated above, a small *Involutina liasica*, such as is figured by H. B. Brady in pl. 9. fig. 3, Geol. Mag. vol. i. Figs. 8, 14, & 19, termed *Frondiculariæ*, are rather *Lingulinæ*; and fig. 13, also "*Frondicularia*," can scarcely be said to have relinquished the Nodosarian type. In pl. 6 some *bizarre* Cristellarians succeed the various Nodosarians of the foregoing plate; and, beside a very doubtful Foraminifer (fig. 10) named *Rosalina polygona*, there are several specimens of *Webbina* (figs. 15, 17, 18, 19) in their characteristic variable forms of growth; also what seems to be a small rough *Placopsilina* (fig. 16, named *Webbina scorpionis*, D'Orb.); the *Involutina* above mentioned; and, lastly, a curious spiral organism, referred to *Cristellaria*, but having much the look of a Sertularian germ-sac.

Without further criticism on these most acceptable results of M. Terquem's enthusiastic industry, whose motto "in tenui labor" well indicates his precision and perseverance, we proceed to the next of his valuable memoirs that we have at hand, trusting to enhance the value of his work by pointing out what seems to be a discrepancy here and there with the notions of other rhizopodists, and thus producing a uniformity whereby the whole may be worked together for the good of palæontology.

The first Memoir on the Foraminifera of the Middle Lias of the Department of the Moselle was published in the Mém. Acad. Imp. Metz, année 1857–58. The series reached to the Sixth Memoir; but they have not come to hand.

II. *Deuxième Série. Premier Mémoire sur les Foraminifères du Système oölithique. Etude du Fuller's-Earthe de la Moselle.* Par M. O. Terquem, &c. Metz, 1867.

In 1867, M. Terquem treated of the Foraminifera of the Oolitic rocks, particularly the "Fuller's-Earthe" of the Moselle; and of these he first described a host of very similar and indubitably related forms under the general term "*Marginulina*." This generic name he adopted with caution, and gave reasons for his plan of arrangement in his "Critical Review of some Genera," at pages 40–58, wherein he shows why he considers it best to merge the broad flat *Vaginulinæ* (*Citharinæ*) with the long *Planulariæ* under *Marginulina*. Eight plates, of thirty figures each, besides edge and end views of these Vaginuline *Marginulinæ*, do not fail to give us an insight into the enormous prolificness of the Foraminifera and their endless versatility of growth (modified in every individual by every passing condition of life), into the richness of the Oolitic fauna in varieties of the great *Nodosarina* genus, and into the extent and energy of MM. Terquem and Piette's labours in both field and cabinet. How individually different, and yet strikingly alike, these 240 specimens really are, with continuous passage-forms among them, can be seen at a glance; and their division by M. Terquem into two sections, five divisions, two subdivisions, and thirty-two "species" (one of which has a whole plate in its illustration) has required his greatest patience and acumen. It would certainly appear easy, to English rhizopodists at least, to group the majority under half a dozen well-known accepted names, beginning with *Vaginulina harpa* and ending with *Dentalina communis*; but, as an example of the difficulty of arranging a large and well-preserved series of Foraminifera under definite zoological names, nothing could be offered to the student of more practical value than this interesting little monograph. M. Terquem first explains the stratigraphical relations of the Bajocian Oolites near Metz: (1) ferruginous limestone below, and (2) coralline and subcompact limestones above; neither these nor their marls give many Foraminifera. Next the Fuller's-earth Oolites are described according to their localities over the now touchingly interesting fields between Metz and Longwy, comprising Romain, Thionville, Gorze, Gravelotte, and especially Fontoy, where the marls are exceedingly rich in Foraminifera. A review of various classifications of, and works on, Foraminifera follows, those of De Haan, Lamarck, D'Orbigny, Dujardin, Schultze, Claparède, and Reuss being chiefly treated of, by way of introduction to the study of the special objects of the work itself and their puzzling changefulness of feature.

III. *Deuxième Série. Troisième Mémoire sur les Foraminifères du Système oölithique, comprenant les genres* Frondicularia, Flabellina, Nodosaria, Dentalina, &c. *de la Zone à* Ammonites Parkinsoni *de Fontoy (Moselle).* Par M. O. Terquem, &c. Metz, 1870.

We have not seen the Second Memoir (treating of *Cristellariæ*) of this Second Series; but we can readily understand that, as M. Terquem states, it demonstrates the great variability and instability of species, showing that in certain forms the shape of the shell, and even the ornament, changes not only among individuals, but often even on the two faces of the same specimen. Seven clear and well-filled plates (pls. 22–29) illustrate this Third Memoir; and they are highly worthy of attention. Pl. 22 contains thirty forms illustrative of the passage of *Frondicularia* into *Lingulina*, or *vice versâ*, according to our views of the degradation or development of the individuals. They pass under the name "*Frondicularia*," in accordance with the author's explanatory remarks on this (subgeneric or really varietal) group. Pl. 23 is half occupied by *Lingulinæ*, here called *Frondiculariæ*; some of them, however, are reproduced as *Linguline*, by correction, in pl. 25. In pl. 23 commences the Flabelline series of about forty specimens, divided into seven divisions and eighteen species, with careful attention to their individual features. There is nothing to separate them essentially.

In figs. 23 & 24 (*Flabellina agglutinans*) we have a very interesting Foraminifer, which, though apparently Flabelline in shape, is really a sandy species belonging to *Textularia* and growing on the Spiroplectine plan—that is, spiral at first and more or less alternate in its segments afterwards. With its terminal aperture it resembles the Textularian *Tritaxia*, *Holostomella*, and *Bigenerina*. It is probably a coarse arenaceous *Spiroplecta* with terminal aperture. It might, however, be Lituoline in structure, a meeting-point of *Textularia* and *Lituola*. Figs. 25 & 26 (*Flabellina dubia*) is a Vaginuliniform *Lituola*, near the Nodosariform *Lituola Soldani*, J. & P. This also is of great interest. Figs. 27–30 are the common, variable, lituate *Lituola* that come under Reuss's genus *Haplophragmium*, as indicated by our author; but they do not require new names.

Pl. 25 has *Lingulinæ* and *Glandulinæ*, figs. 1–11, undeserving of the new names given them. Of figs. 12–20, grouped as *Cornuspiræ* (six new species), we think that figs. 12, 13, 16 are *Trochammina incerta*, varieties; figs. 14, 17, 18, 19, concavo-convex simple *Involutinæ*; fig. 15, apparently identical with D'Orbigny's *Soldania limia* and *S. orbicularis*, which are both referred with doubt to *Cornuspira* by Mr. Parker and his colleagues in Ann. Nat. Hist. Oct. 1871, p. 238, pl. 8. figs. 1, 2. Figs. 20–26 are interesting specimens of *Lagena globosa* and some attenuate varieties, with (fig. 22) a prickly variety. Figs. 27–29, however, though Lageniform, are most probably *Saccamminæ*—that is, rough Lituoline Foraminifers, unilocular in growth. Pl. 26 (thirty figures) illustrates various conditions of *Nodosaria raphanus*. A few such (figs. 1–4) occur also in pl. 27, which is mainly occupied by variations of *N. radicula*, passing into the variable *Dentalina communis* (figs. 5–34). The same may be said of pl. 28. Figs. 1–17 of pl. 29 belong to the same category; but fig. 18 ("*N. agglutinans*") is most likely a Nodosariform *Lituola*. Figs. 19–30 are arranged in three species of *Webbina*; but figs. 19 & 30, though doubtful, must go with figs. 20–23, 25 & 26, as *Nubeculariæ*; whilst figs. 24, 27–29 are *Webbinæ*. Fig. 24 is a curious, heaped, or acervuline *Webbina*. Figs. 25 & 26 may be regarded as typical *Nubeculariæ*.

Lastly, we must remark that both the Liassic and the Oolitic Foraminifera figured in these Memoirs may, with advantage to the student, be compared with the English specimens from the Upper Keuper (Rhætic?) Clay, figured by Jones and Parker in the Geol. Soc. Journ. vol. xvi. 1860, pls. 19 & 20, and with those from the Lias figured by H. B. Brady in the Proc. Somerset. Archæol. Nat. Hist. Soc. xiii. 1867, pls. 1–3. A very large proportion of M. Terquem's species and varieties will be there found, with the old names applied to them. Similar forms occur in the Upper Triassic strata of Saint Cassian and Raibl, as figured by Dr. C. Gümbel in the 'Jahrbuch k. k. geol. Reichsanstalt,' xix. 1869; and Reuss, Schwager, and others have published Jurassic Foraminifera of the same types.

MISCELLANEOUS.

Note on the Ptilornis Alberti. By G. R. Gray.

Mr. Elliot, in the 'Proceedings of the Zoological Society,' just published, has made some remarks on the adoption of a MS. name that I gave some years ago to the Northern-Australian *Ptilornis*, when observing the differences which appeared to exist between it and that of New Guinea. Mr. Elliot is right in remarking that I had never published, but he is wrong in stating that I never "wrote" any account of it. The reasons of the non-publication were:—

1. That Mr. Gould had already fully described and beautifully

figured the bird in question under the old specific name of *P. magnificus*, and therefore it became quite unnecessary to repeat the description.

2. That on showing the examples to my brother ornithologists, they did not agree with my views of the specific distinctions between the specimens from the two localities, but, like Mr. Gould, considered that it was the same as the New-Guinea bird, and therefore should not be formed into a separate species; and it was entirely out of deference to their opinions that I refrained from committing the MS. to press, for which omission I offer no apology.

The sole object I have in view is to put a statement right which had been, no doubt, inadvertently given by Mr. Elliot incorrectly, and also to express that there have existed, and probably do still exist, doubts as to whether the Northern-Australian *Ptilornis* should be regarded as a *distinct species*, as is shown in the 'Hand-list of Birds.'

Notes on Australian Freshwater Tortoises. By Dr. J. E. Gray, F.R.S. &c.

Chelymys Krefftii.

Thorax oblong, scarcely broader behind, very convex. The second, third, and fourth vertebral shields as long as, or rather longer than broad; the second and third nearly square, with only a slight angle near the middle of each side; the fourth contracted behind; the first nearly square, rather broader than long, and rather broader in front. Thorax convex, elevated from the margin, the lateral processes convex. Head large, above olive, with a broad white streak from the back of the orbit to the upper front margin of the tympanum; a broad white streak from the angle of the mouth to the lower part of the tympanum. Beaks very strong and convex. Upper part of neck slightly granular.

Hab. Burnett's River. No. 9, Krefft's MS.

This specimen is coloured very much like the others received from Mr. Krefft, but differs in being oblong and very convex, instead of being broadly ovate and much more depressed, and in the form of the vertebral plates. It also differs in having a much larger head, compared with the size of the body.

It has been suggested that the difference may only be one of sex; but it is very curious that, out of a large series of specimens, this should be the only one of the sex that has come to us.

Chelymys australis.

Hydraspis australis, Gray, in Grey's 'Australia,' t. vi.

The specimen of this genus received from Mr. Gould in 1840 as procured in Australasia, and described and figured by me in Capt. Grey's 'Australia,' t. vi., under the name of *Hydraspis australis*, differs so much, both in its small size, though evidently quite adult, in the form of its dorsal shields, and in the form of its head, from all the species of *Chelymys* that we have since received, that I am inclined to regard it as a distinct species.

Hab. Australasia (*Gould*, 1840).

Damonia oblonga, a new Species of Freshwater Tortoise. By Dr. J. E. Gray, F.R.S.

We have lately purchased of Mr. Edward Gerrard, jun., a specimen of a freshwater tortoise which he received from Batavia.

It is very like *Damonia macrocephala*, from Siam and Cambogia, but differs in being of a narrower oblong form and having very differently shaped shields over the vertebral line, and in the shell being of a more uniform black colour, especially on the underside.

Damonia oblonga.

Shell oblong, elongate, scarcely wider behind; back convex, black, obscurely 3-keeled, the lateral keels being on the upper edge of the costal plates; first vertebral shield longer than broad, urn-shaped—that is, contracted on the front part of the sides; the second nearly quadrangular, as long as broad, slightly angled on the sides; third and fourth hexangular, the fourth rather broader than long, and very narrow behind. Sternum flat, high, and keeled on the sides, black except where worn. Head very large, flat at the top, blackish brown, with a pale streak from above the nostril, continued over the orbit, becoming wider over the temple, and continued along the side of the neck; nose with three perpendicular streaks on each side, the outer ones continued below into a broader streak extending along the side of the jaw under the orbit to the angle of the mouth and on to the neck; under edge of the lower beak and of the shields on the side of the chin pale-edged. Head covered with thin smooth shields, one large plate extending from the nose to the occiput, with small subsymmetrical shields behind it, the shields on the side of the head being largest; a large temporal shield on each side extending from the back edge of the orbit to the front edge of the temple and the angle of the jaw; lower eyelid large, smooth, with two thin band-like plates.

The yellow lines under the nostrils are very similar to those in our largest specimen of *Damonia macrocephala*; but our smaller one of that species has only two perpendicular lines under the nostrils; so that probably the lines in this species also vary in this respect. The head-shields of the two species are very similar; indeed there is no doubt these species are very nearly allied; but they differ considerably in the dorsal shields and general colouring and form of the thorax. The first costal shield elongate, much larger than the same shield in *D. macrocephala*.

Delphinus microps.

Mr. Krefft has sent a photograph of the animal and skull of this species. He observes that the animal, which has not been before described or observed, is marked on the skin exactly like the figure of *D. Forsteri* in the 'Voyage of the Erebus and Terror,' from Forster's drawing in the Banksian Library. There is a darker stripe from the head to the fin: and the animal is about 8 feet long.—J. E. G.

Life in the Wyandotte Cave. By Professor Cope.

An examination into the life of the cave shows it to have much resemblance to that of the Mammoth Cave. The following is a list of the species obtained, which, when compared with that published in the 'Journal' for August 28, will be found to embrace many of the same.

Vertebrata.—*Amblyopsis*, sp. (Blind fish).

Articulata.—Insects: *Anophthalmus Tellkampfii* (beetle); *Anophthalmus* No. 2 (beetle); *Staphylinidæ*, sp. 1 (beetle); *Staphylinidæ*, sp. 2 (beetle); *Phalangopsis*, sp. (crickets); *Flies*, 2 species. Spiders: *Aranea*-like; *Opilio*-like. Centipedes: *Pseudotremia*, sp. Crustacea: *Astacus pellucidus* (blind crawfish); ? aquatic species with egg-pouches external; Lernæidæ, species parasitic on blind fish, 14 species.

The blind fish is very much like that of the Mammoth Cave; and direct comparison will be necessary to determine any difference, if it exist. It must have considerable subterranean distribution, as it has undoubtedly been drawn up from four wells in the neighbourhood of the cave. Indeed it was from one of these, which derives its water from the cave, that we procured our specimens; and I am much indebted to my friend N. Bart. Walker, of Boston, for his aid in enabling me to obtain them. We descended a well to the water, some twenty feet below the surface, and found it to communicate by a side opening with a long, low channel, through which flowed a lively stream of very cool water. Wading up the current in a stooping posture, we soon reached a shallow expansion or pool. Here a blind crawfish was detected crawling round the margin, and promptly consigned to the alcohol-bottle. A little further beyond, deeper water was reached, and an erect position became possible. We drew the seine in a narrow channel, and after an exploration under the bordering rocks secured two fishes. A second haul secured another. Another was seen, but we failed to catch it; and on emerging from the cave I had a fifth securely in my hand as I thought, but found my fingers too numb to prevent its freeing itself by its active struggles.

If these *Amblyopses* be not alarmed, they come to the surface to feed, and swim in full sight like white aquatic ghosts. They are then easily taken by the hand or net, if perfect silence is preserved; for they are unconscious of the presence of an enemy except through the medium of hearing. This sense, however, is evidently very acute; for at any noise they turn suddenly downward and hide beneath stones &c. on the bottom. They must take much of their food near the surface, as the life of the depths is apparently very sparse. This habit is rendered easy by the structure of the fish: for the mouth is directed upwards, and the head is very flat above, thus allowing the mouth to be at the surface. This structure also probably explains the fact of its being the sole representative of the fishes in subterranean waters. No doubt many other forms were carried into the caverns since the waters first found their way there:

but most of them were, like those of our present rivers, deep-water or bottom feeders. Such fishes would starve in a cave-river, where much of the food is carried to them on the surface of the stream. The *Amblyopsis* belongs, with two other genera of imperfect seers, to the family *Hypsæidæ*, which, with the pike, shore-minnow, and mudfish families, form the order of Haplomi. The shore-minnows (*Cyprinodontidæ*) are their nearest allies, and many of them have the upturned mouth and flat head of the blindfish. One of them (*Anableps*) has the special peculiarity of seeing both in the water and above it,—the eye being enlarged; and a dermal band crossing the cornea, divides it into an upper and a lower portion. This band is the "water-line;" for the fish swims at the surface. Fishes of this or a similar family, enclosed in subterranean waters ages ago, would be more likely to live than those of the other; and the darkness would be very apt to be the cause of the atrophy of the organs of sight seen in the *Amblyopsis*.

Of the other animals, one beetle (*Anophthalmus*), the cricket (*Phalangopsis*), a fly, the *Opilio*-like spider, the centipede, and the blind crawfish are probably the same as those found in the Mammoth Cave. Two beetles and two crustaceans are certainly different from those of the latter, and the centipedes are much more numerous. The Gammaroid crustacean which we found in the waters of the Mammoth Cave, and which is, no doubt in part, the food of the blind fish, we did not find; but some such species no doubt exists, as we found an abundance of a lively little tetradecapod crustacean near the mouth of a cave close by. This little creature no doubt inhabits adjacent waters both external and subterranean; but the situation in which we found it is peculiar. It was only seen in water, and near an empty log trough used to collect water from a spring dripping from the roof of one of the chambers.

The Lernæan is a still more remarkable creature. It is a parasite on the blind fish, precisely as numerous species near of kin attach themselves to various species of marine fishes in the salt sea. The Wyandotte species is not so very unlike some of these. It is attached by a pair of altered fore limbs, which are plunged into the skin of the host, and held securely in that position by the barbed or recurved claws. The position selected by the blind-fish Lernæan, was the inner edge of the upper lip, where she hung in a position provocative of attempts at mastication on the part of the fish, and reminding one of the picture of the man on the ass's back holding a fork of fodder before the animal's nose, in illustration of the motto that "persuasion is better than force." The little creature had an egg-pouch suspended on each side, and was no doubt often brought into contact with the air by her host.

The mutual relations of this cave life form an interesting subject. In the first place, two of the beetles, the crickets, the centipede, the Gammaroid crustacean (food of the blind fish) are more or less herbivorous; they furnish food for the spiders, crawfish, *Anophthalmus*, and the fish. The vegetable food supporting them is in the first place Fungi, which in various small forms grow in damp places in the cave; they can always be found attached to excrementitious matter dropped by the bats, rats, and other animals which extend their range to the outer air. Fungi also grow on the dead bodies of the animals which die in the caves, and are found abundantly on fragments of wood and boards brought in by human agency. The rats also have brought into fissures and cavities communicating with the cave, seeds, nuts, and other vegetable matters, from time immemorial, which have furnished food for insects. Thus rats and bats have no doubt had much to do with the continuance of land life in the cave; and the mammals, of the postpliocene or earlier period, which first wandered and dwelt in its shades were the introducers of a permanent land life.

As to the Gammaroid crustacean, little food is necessary to support its small œconomy; but even that little might be thought to be wanting, as we observed the clearness and limpidity of the water in which it dwells. Nevertheless the fact that that water communicates with an outside river, is a sufficient indication of the presence of vegetable life and vegetable débris in variable quantities at different times. Minute freshwater Algæ no doubt occur there, the spores being brought in by external communication, while remains of larger forms, as Confervæ &c., would occur plentifully after floods. On this basis rests an animal life which is limited in extent and must be subject to many vicissitudes. Yet a fuller examination will probably add to the number of species, and of these, no doubt, a greater or less number of parasites on those already known. The discovery of the little Lernæan shows that this strange form of life has resisted all the vicissitudes to which its host has been subjected, that it has outlived all the physiological struggles which a change of light and temperature must have produced, and that it still preys on its host's life-blood, as its ancestors did under more favourable circumstances. That the blindness of the fish is favourable to its "success in life" cannot be denied; but that its own sight has been benefited by the change is very doubtful.—*Indianapolis Journal*, Sept. 5, 1871.

Note on Spongia linteiformis, *Esper.* By Dr. J. E. Gray, F.R.S.

Having sent some specimens of *Spongia linteiformis* from the Philippine Islands, referred to in the 'Annals' for August, p. 142, to Prof. Agardh at Lund, he says:—"I believe it belongs to the genus *Spongocladia* described by Prof. Areschoug in the Acta of the Academy of Stockholm (Œfversigt af Vetensk. Akad. Förhandling. 8vo, 1853, no. 2). But the species of Areschoug was from Mauritius, and somewhat different in form. Yours may be, if compared with that, different almost in the same way as *Codium dilatatum* is different from *Codium tomentosum*. It may be named, *ex analogiâ*, *Spongocladia dilatata*, if you wish that the name may indicate some one of its characters."

On "Sargasso-Seas."

(Extract from a letter to Dr. Gray from Prof. Agardh.)

"On the maps of Capt. Maury there are marked several 'Sargasso-seas.' It is well known that the one in the Atlantic Ocean, between the Cape-Verde Islands and the Azores, consists merely of specimens of *Sargassum bacciferum*; but I think that it is not known of what species the other Sargasso-seas are formed, and that it would be of some interest to have specimens collected there. Would it not be in your power, by the commission of the Admiralty, to have specimens from the different localities collected? and they need be only rudely dried; they may be afterwards easily prepared. I find such Sargasso-seas marked in the following places:—

"West of the Cape of Good Hope, between 30° and 45° lat. S., between 0° and 15° long. W. from Greenwich.

"North from the Falklands, between 45° and 60° long.

"South-east from the Cape of Good Hope, between 45° and 90° long. E., and between 40° and 50° lat. S.

"East from New Zealand, between 45° and 50° lat. S., between 160° and 170° long.

"North from the Sandwich Islands, between 30° and 45° lat. N., 140° and 170° long.

"I think it would be of interest, not only for the algologist, but also for the knowledge of the movements of the sea, the study of currents, &c."

On sending Prof. Agardh's inquiries to Capt. Toynbee, he replies:—

"On referring to Capt. Maury's maps, I do not see so many Sargasso-seas as mentioned by Prof. Agardh.

"During my voyages to India we very frequently met with sea-weed to the S.W. and also to the S.E. of the Cape of Good Hope: it was what is commonly called kelp, having long stalks and broad leaves. It is very abundant near Tristan d'Acunha, the Crozets, &c. I am not aware that there is any part of the sea which has large fields of weed of a kind peculiar to itself, excepting the Sargasso-sea in the Atlantic.

"I see, in his 'Physical Geography of the Sea,' Capt. Maury does give a map of these various patches of weed; but he does not imply that they are of kinds peculiar to those spots, but otherwise. I think I may say decidedly that those of the South Atlantic and Southern Indian Ocean are kelp or something of that kind."

The Chinese Long-tailed Goat Antelope (Urotragus caudatus). By Dr. J. E. Gray, F.R.S. &c.

The long-tailed goat antelope from North China (*Antilope crispa* of Radde, and *Antilope caudata* of Milne-Edwards) agrees with the genus *Capricornis* in having a naked muffle, but differs from it in having no crumen or suborbital pit in the skull in front of the orbit, and from both in its long tail with a tuft of long hair at the end. I propose to make of it a genus under the name of *Urotragus*.

It has a moderate, moist muffle; the tail elongate, reaching to the hocks, hairy above, and with longer hair at the end. Skull flat in front of the orbits; intermaxillary bones very short, not reaching nearly to the nasals.

The genus is very different from *Capricornis* and *Nemorhedus*. The skull of *Capricornis* has a deep circular concavity in front of the orbit; the skull of *Nemorhedus* has only a slight broad depression; *Urotragus* has the same part rather convex, and has the nose of the skull much more produced, and the forehead more convex between the orbits. The tails of *Capricornis* and *Nemorhedus* are short, flat, and goat-like; that of *Urotragus* is elongate.

On the Phosphorescence of the Eggs of the common Glowworm. By M. Jousset.

On the 16th of July last, in very warm weather, I collected in the park of the Château de Monjay two glowworms which shone brilliantly. These two females were coupled, and escorted by a supplementary male. I carried them to Paris in a glass tube; and the next day they laid about sixty eggs, of the size of a pin's head, which is very large in comparison with the size of the insect.

The shell of these eggs is so delicate that they cannot be touched without breaking it. The micropyle is very apparent; and their colour is yellowish.

It is worthy of note, and, as far as I know, has not yet been indicated, that these eggs are endowed with a bright phosphorescence. They are not only phosphorescent immediately after laying, but they remain phosphorescent. Those which I collected as above, presented the phenomenon without any diminution until the 23rd of July—that is to say, for seven days.

I could not continue the observation any further, because, having left the tube containing them open, I found them dried up.

If one of these eggs is crushed in the dark, the liquid which spreads upon the glass is phosphorescent, and continues luminous until it is quite dry.—*Comptes Rendus*, September 4, 1871, p. 629.

Water unfrozen at a Temperature of $-18°$ *Centigrade.*

Boussingault finds that by preventing the dilatation of water, it may be kept unfrozen down to $-18°$ C. He experimented with a gun-barrel of steel, into which a steel ball was dropped before filling it with water. During the cold days of December 26, 27, and 30, last, the temperature fell to $-12°$ and $-18°$, and yet, on shaking the tube, the ball was found to move freely, showing that the water was not frozen.—*L'Institut*, July 12.

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XLVII.—*Memoir on the Hydrographical System and the Freshwater Fish of Algeria.* By Lieut.-Colonel R. L. PLAYFAIR, H.M. Consul General, and M. LETOURNEUX, Conseiller à la Cour d'Appel, in Algeria*.

I. HYDROGRAPHICAL SYSTEM.

In Europe an admirable system of circulation restores to the ocean the waters which the sun has taken from it, and which, having escaped from their aërial reservoirs in the clouds, are poured out on the surface of the earth. In every country a network of natural canals reunites into one central stream, and carries to the sea, the surplus of the rains and snows which have fertilized the soil, in the same manner that the venous system carries back the blood to the heart to be purified and to serve for the regeneration of the bodily organs.

In Algeria, on the contrary, the system is far from being so simple: a very small part of the country is subject to ordinary hydrographic laws; in the rest the waters either return to the clouds without passing through the sea or circulate in vast subterranean lakes.

A glance at the map of Algeria will suffice to show that the country consists of three regions, as distinct in their hydrographical features as in their climate and vegetation: these are the Tell, the High Plateaux, and the Sahara.

The first, occupying the littoral zone, with a breadth of from 50 to 70 miles, is for the most part mountainous, watered by copious rains, tempered by sea breezes, and possessing in a high degree the ordinary Mediterranean features.

The flora and fauna of the eastern portion do not differ essentially from those of Sicily and Sardinia, while in the west they resemble rather those of Spain†.

* Communicated by the Authors, having been read at the Meeting of the British Association in August 1871.

† The separation of Spain from Africa hardly goes beyond the limit of

The watershed of the Tell is as regular as in other countries; and its streams all reach the sea. Although the general direction of the mountain-range is from east to west, the configuration of the ground is very irregular; and confused mountain masses frequently occur, throwing out lateral spurs or buttresses, which in many instances plunge abruptly into the sea. This has caused numerous basins, often narrow and tortuous, and has been the means of confining the watercourses between the perpendicular walls of narrow gorges.

The sources of the principal streams are situated high up, either on the southern border of the Tell, on the first terraces of the High Plateaux*, or on the flanks of the great isolated mountain masses†.

In spite of the meanderings often necessitated by the nature of the ground, the streams of the Tell are generally short: the Chelif alone has a length of 244 miles; but a great part of its course is owing to exceptional causes in the regions of the High Plateaux. It follows that the rivers and streams flowing over a steep incline are, in the rainy season or after a storm, foaming torrents, carrying down in their troubled waters huge masses of stone broken from their beds and trees torn from their banks ‡. During summer, on the other hand, the beds of these rivers are entirely dry in the mountains and in the plains, where their banks are sometimes half a mile distant from each other, inclosing a sandy bed invaded by vegetation; all that remains is a tiny stream in the middle, and here and there a few pools of stagnant water.

The most considerable rivers in Algeria are, the Mafrag, the Seybouse, the Oued-el-Kebir, the Makta, &c., which during flood-time discolour the water for several miles at sea, and have not the strength in summer to force themselves a passage through the banks of sand accumulated in their estuaries by the currents along the coast.

Alluvial plains of any considerable extent are rare in Algeria; they do not form, as elsewhere, in the estuary of a great river. Parallel to the sea they stretch between the foot of the mountains and the isolated groups of hills, once probably islands, such as those at La Calle, to the north of the plain of Tarf, El-Edough in the plain of Bône, the Sahel at Algiers,

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history. DeCandolle affirms the existence of the ancient communication between Numidia and the Italian islands.

* From 2500 to 3000 feet above the sea.

† Jurjura, 7385 feet; Ouarensis, 6425 feet; Bators, 6336 feet.

‡ Freshets in the Seybouse have frequently been known to carry down several hundred trees to the sea, and even wild boar, surprised by the inundation and unable to contend against the strength of the current.

and the Mountain of Lions in the plain of Oran. Rivers traverse these without draining them, and any depressions in their surface are occupied by marshes and shallow lakes, either fresh or salt*.

The region of the High Plateaux extends longitudinally from the east to the west, south-west of Algeria, and is formed by vast plains separated by parallel ranges of mountains.

These terraces increase in height as they recede from the Tell, and again decrease as they approach the Sahara, thus forming a double series of gradients, of which the highest is 3000 or 3800 feet above the level of the sea, much higher, indeed, than the summits of the hills which bound it.

The spurs or projections from the mountains cut up each of these stages into a series of basins, more or less elongated, sometimes circular, like the Hodua, in which the depressions are occupied by lakes, generally salt, known by the name of *Chotts* or *Sebkhas*.

This region is subject to alternations of intense cold and extreme heat; rain waters it less copiously than the Tell; instead of sea-breezes it receives the hot blast of the desert-wind; and it is entirely devoid of trees, save on the southern side of the high mountain-ranges.

During seasons of abundant rain, however, and in places capable of irrigation, it produces abundant crops of cereals; but otherwise it presents to the weary eye of the traveller an unbroken stretch of stunted scrub and salsolaceous plants, on which browse the sheep and camel, the wealth of the wandering Arab.

Here and there a stream of water escapes from the mountains to be lost in the Chotts; sometimes, however, they are absorbed by irrigation in the upper part of their short course; so that for a considerable part of the year the lower part of the beds are entirely dry.

The disposition of the soil in enclosed basins, and the existence of veins of permeable rock of a concave form, gave rise to the supposition that there existed subterranean sheets of water in several parts of the High Plateaux. Acting on this theory, artesian wells were sunk; and in many instances these brought to the surface copious supplies of water, which here is verdure and life.

* The lakes of Houheira and Tonga, near La Calle, are sheets of fresh water, as were those of Oued-el-Maïz in the plain of Bône, and Lake Halloula in the Metidja, now dry. The lake of Mezerguin near Oran is salt, and that of Fezzura near Bône is brackish. The last, in the time of the Romans, poured the excess of its waters into the Seybouse by means of a canal, the remains of which still exist.

Regular as is the general character of the High Plateaux, they still present several anomalies. On the southern border the lower terrace, instead of forming a basin, presents here and there slopes, down which the water flows to the north, and thus becomes the sources of several rivers in the Tell.

Towards the centre the basin of Sersous, filled of old by a vast lake, the traces of which are plainly visible, is now drained by the river Ouassel, which has forced itself a passage near Boghari, between the excavated plateau of Sersous and the foot of the last mountains of the Tell. On quitting the High Plateaux, this river becomes the Chelif, the most important in Algeria.

Towards the south-east the basin which ought to have existed is replaced by the immense mountain of Aurès, of which the central peak attains an altitude of 7800 feet. This protuberance takes the place of a depression; and instead of a salt lake, we find a mountain covered with cedars and alpine vegetation. On the north, Aurès has only moderate slopes, which convey its waters into Chotts of the neighbouring plateau. Towards the south it is prolonged almost in a straight line, and descends like a precipitous wall to the Sahara, which stretches at an immense distance below it.

In the west of Algeria the centre of the country bristles with mountains, which adjoin the great snowy range of Deren. The southern slopes give rise to immense rivers, amongst others the Oued Gheir, which the French expedition under General Wimpffen reached in the spring of 1870, and which, in their admiration, the soldiers compared to the Meuse.

Popular belief pictures the Sahara as an immense plain of moving sand, dotted here and there with fertile oases; and the old simile of the panther's skin is still with many an article of faith. A few details are necessary to dispel this poetical but false idea.

The desert in Algeria consists of two very distinct regions, which we shall call the lower and the upper Sahara:—this a vast depression of sand and clay, stretching on the east as far as the frontier of Tunis; that a rocky plateau, frequently attaining considerable elevation, extending on the west to the borders of Morocco.

The former comprises the Ziban, the Oued Ghir, the Souf, and the Choucha of Ouargla. On the north it is bounded by the mountain-range of Aurès and the foot of the mountains of Hodua and Bou-Kahil; on the east it penetrates into the Regency of Tunis; on the south it rises in a slight and almost insensible slope towards the country of the Touaregs; and on the west it stretches in a point along the Oued Mia as far as Golea, after which it turns towards the north along the plateau of the Beni M'Zab.

The Oued Ghir, the Souf, N'gouça, and the greater part of the Ziban have a less elevation than 100 metres; Biskra and Ouargla are hardly higher, while the Chott Melghir and part of the Oued Ghir are below the level of the sea.

The Chott Melghir, which occupies the bottom of the depression, is sunk in the gypseous soil, and forms a sheet of water salter than the sea. It is of no great depth, and in summer, owing to evaporation, it is partly covered with a thick and brilliant coating of crystals; so that the eye can scarcely distinguish where the salt terminates and the water begins. The bottom is an abyss of black and viscous mud, emitting an odour of garlic, due possibly to the presence of bromides. Nevertheless it is not without veins of more solid ground, forming natural causeways, on which the people of the country do not hesitate to trust themselves.

The rivers of the Aurasic system, essentially torrential in the mountains when confined within steep and narrow gorges, serve to irrigate the oases, where their waters are retained and absorbed by means of dams. That which percolates through these and forms streams lower down their courses is again absorbed by the Sakias or canals of irrigation. It is only after the copious rains of winter, and the melting of the snow in the mountains, that their beds are filled and their waters reach the Chott.

The smaller springs and streams which have their origin at the foot of the mountains are always absorbed by the oases or by the cereals which the inhabitants of the Ziban cultivate wherever a thread of the precious liquid is found.

On the west the Oued Djedi joins the Chott; it rises on the southern slopes of Jebel Amour, fertilizes the oasis of El-Aghouat, and, skirting the plateaux of the higher Sahara, traverses the lower Sahara from west to east. It is only in the upper part of its course that this Oued is a permanent stream; lower down its water is to a great extent dried up by the solar rays or absorbed by barrages; the rest disappears in the permeable strata, or filters through the sand and flows along the clayey bottom which underlies it. Like the rivers of the Aurès, but even more rarely than these, its course is only filled by the melting of the snows, or during the heavy rains on the High Plateaux.

The foregoing remarks apply equally to the other rivers which, rising in the eastern part of the higher Sahara, flow towards the region of N'gouça.

In the south the Oued Mia presents always the appearance of a dry watercourse, below the sand of which water flows along an impermeable bed. The same may be said of the Oued Gghaghar, whose source, never yet visited by Europeans, is in the Touarey country.

These dry watercourses have all enormous beds with deeply worn banks, and they join the central depression by immense estuaries, which prove how great a volume of water they had once discharged as their tribute to the great Lake Tritonis, of which the Chott Melghir and the salt lakes of the Tunisian Sahara are the insignificant remains.

What has drained this great river, and transformed into a series of salt marshes the Lake Tritonis, which, if we can believe Lucan, communicated with the sea?

It is probable that this is mainly owing to a gentle and progressive upheaval of a great part of the Sahara, and partly perhaps to the disappearance of those great forests, once the home of the African elephant.

Whatever the cause, the eastern depression has now no running water except on its northern border. But sheets of water, driven from the surface, still exist, in the bowels of the earth, as a vast subterranean sea, the waters of which are strongly impregnated with saline matter.

From time immemorial artesian wells have existed here, and have everywhere spread with their waters life and wealth.

The water, which in the lowest part of the depression is found at a depth of 20 metres, is, at the edges of the basin, 50, 60, or 100 metres from the surface of the soil.

Its existence, however, is not only indicated by artesian wells: throughout the whole extent of the Oued Ghir, and even to the south of it, depressions are found full of water, which appear to be as it were the spiracles of the subterranean lake; they are styled by the natives *bahr* (sea); the French call them *gouffres*.

In the Souf the water circulates close to the surface of the soil, enclosed in a sandy substratum which is concealed by a bed, more or less thick, of sulphate of lime, crystallized on the upper surface and amorphous in the lower part. One has only to penetrate this layer of gypsum to create a well. When it is intended to plant a date-grove, the industrious *Souafa* remove the entire crust of gypsum and plant their palms in the aquiferous sand beneath. Their green summits rise above the plain around, thus forming orchards excavated like ants' nests, sometimes 8 metres below the level of the ground.

This complicated distribution of water in the lower Sahara gives rise to the different kinds of oases.

Running streams, dammed by barrages and distributed in canals, make the river oases (Ziban).

Water absorbed by permeable strata constitutes (1) the oases with ordinary wells (Oulad Djellal &c.), (2) oases with artesian wells (Tuggart, N'gouça, Ouargla, &c.), (3) the excavated oases (Souf).

Sometimes two systems are found united in the same place.

The higher Sahara extends from the western limits of the lower one to within the frontiers of Morocco; to the south it reaches beyond Goleah, and on the north it is bounded by the last chains of the High Plateaux.

It is principally composed of rocky steppes, only the depressions between which are filled with sand.

Towards the east descends almost perpendicularly from north to south a large promontory which rises below El-Aghouat to nearly 9000 metres, and sinks gradually towards Goleah, separated from the plateau of Tademait by a sort of isthmus 400 metres high. It is in this plateau that the Oued Mia and its affluents arise, which, in French territory at least, contain only slight infiltrations of water under a sandy bed.

In the centre the rocky plateaux fall rather abruptly as far as the zone of the *Areg*, or country of sand-hills, occupying a depression the bottom of which is about 400 metres above the sea.

Finally, towards the extreme west, where the chains of the High Plateaux descend lower, the Saharan plateaux also descend further south, leaving between them numerous valleys.

In each of these three divisions the water-system is different. The eastern promontory, the crests of which are directed towards the west, sends out no spurs towards the zone of the *Areg*; but it is furrowed towards the east by immense ravines, of which the principal bear the names of Oued Ensa and Oued M'Zab. Rain seldom falls in the lower part; and the southern *crevasses* are almost all deep ravines, without water or vegetation. Even in the upper part it is only during severe storms, and when more than usually abundant snow has melted on the High Plateaux, that the waters pouring on the Sahara unite in the deep defiles, forming a mighty wave, which during twenty-four or forty-eight hours precipitates itself into the estuaries of the lower Sahara. When this torrent has passed, nothing remains in its dry bed save a few pools where the gazelle drinks, and a slight subterranean percolation which serves to supply the few wells at which the caravans draw water.

These periodical inundations are quite inadequate to supply the Beni M'Zab, who have established gardens in the very beds of the great ravines which dominate their seven cities. In vain they treasure up a store in their reservoirs; they are obliged to have recourse to deep wells cut in the rock, which collect the infiltration of water in the calcareous strata.

Above the promontory it is only El-Aghouat and Ain Madhi, situated in a depression at the foot of the mountains, that can utilize almost at all seasons of the year, by means of barrages, the upper waters of the Oued Djedi, which flow from east to west.

In the middle, Brezina and several oases placed at the very foot of the mountain-range can also irrigate their date-groves with running water; but further south the water flowing along the rocky plateaux encounters the moving sands of the Areg, which arrest its course and cause pools or marshes (Dhaya), neither usually very large or very deep. These little Chotts present the same phenomena as the greater depressions in the lower Sahara, their ancient banks, now quite dry, attesting a very marked decrease in the volume of their waters.

Towards the east, on the other hand, where the mountains in the plateaux rise to a greater height than 900 metres, and present a vast surface, the ravines are the bed of veritable rivers, which render abundant irrigation possible, and, uniting in two principal streams, form the Oued Mersaoud, which descends southwards to an unknown distance.

Such is the upper Algerian Sahara, of which the greatest depression does not descend to within 400 metres of the sea, while in the lower one there is not a single point attaining that altitude. In the one the plateau is the prevailing feature, in the other the depression; here rocks abound, there they are entirely absent. As to moving sand, which the Arabs compare to a net, it occupies a sufficiently extensive zone in both regions; but still it does not cover one third part of the Algerian Sahara.

II. Distribution of Species.

The ichthyology of Algeria is yet imperfectly known; and future discoveries will probably augment the comparatively small number of twenty-one species, which our researches have established in the fresh and brackish waters of the colony.

The Tell, as might be imagined, is the richest region: there sixteen species, or three fourths of the total number, are found. Of this number only two are common to the three regions, *Barbus callensis* and *Anguilla vulgaris*. The *Leuciscus callensis* is common to the Tell and the High Plateaux; and the *Cyprinodon calaritanus* inhabits equally the brackish waters of Lake Bou-Kamira in the Tell and the salter waters of the Oued Ghir.

There remain, therefore, eleven species peculiar to the littoral, of which the majority occur both in the sea and in fresh water, namely *Gobius rhodopterus*, *G. paganellus*, *Blennius vulgaris*, *Atherina Rissoi*, *Mugil cephalus*, *M. capito*, and *Clupea finta*.

The species found only in the fresh waters of the Tell are *Gasterosteus brachycentrus*, *Salmo macrostigma*, *Carassius auratus*, and *Syngnathus algeriensis*.

Carassius auratus, the common goldfish, is not a native of Algeria, although it abounds in the western rivers on the frontier of Morocco. It is probable that its introduction was due to the caprice of one of the sultans of the Tlemcen dynasty; but, whatever the cause, the fact is that it has been so long and is so widely naturalized, that we have not thought it proper to exclude it from our list, like the carp and tench, which have been in course of naturalization for about twelve years, but which have not yet left the reservoirs where they have been reared for the freer life of the streams or rivers.

We include also amongst the fish of the Tell the *Syngnathus algeriensis*, one of the few species of that genus not found in the sea. It has never been observed within 80 kilometres of the coast; and we therefore consider it purely fluviatile.

The High Plateaux have hitherto afforded only seven species, three of which have been previously cited as common to the other regions; the remaining four are *Cyprinodon iberus*, *Cristiceps argentatus*, *Tellia apoda*, and *Leuciscus callensis*, which last is also found in the Tell; *Cristiceps argentatus* occurs also on the coasts of the Mediterranean; so that two species only are peculiar to this region; and of these, one has been found in Spain. The *Tellia apoda* is a genus and species not represented elsewhere than in Algeria.

The Sahara is not more rich*; and it is only in the upper part, in the rivers which descend from the High Plateaux, that the two species of barbel are found. In the greater part of this vast region the waters are only inhabited by *Anguilla vulgaris* (found everywhere in Algeria), the *Cyprinodon calaritanus* (also found near Bône), and the two species of *Chromis*, *C. nilotica* and *C. Tristrami*.

These last three species have been frequently ejected by artesian wells; and this has formed the subject of numerous

* It is to be regretted that no ichthyologist accompanied General de Wimpffen's expedition, in the summer of 1870, to the south-west of Algeria. It is probable that the abundant waters of the Oued Gheir would have contributed to swell our list.

speculations. It has been concluded that these fish inhabited the vast subterranean sea which occupies the bottom of the Saharan depression; and it has been asked how, if they were destined to live in perpetual obscurity, they were not destitute of eyes like the Sirens of the grottoes of Carniola or the Crustacea of the Mammoth Cave in the United States?

We have already noticed the existence, from Biskrah as far as Temacin, of *bahrs* or *gouffres*, which communicate with the underground sheet of water, and occupy too great a surface to be regarded as the enlarged apertures of fallen-in wells. All these apertures are inhabited by considerable numbers of Cyprinodons and *Chromis*. There they live freely, exposed to air and light, and breed under normal conditions. Their underground life is merely an episode, and as it were an incident in the voyages which they undertake between one *bahr* and another. When they reach the neighbourhood of a well, they are either forced up with the water, or obey an instinct to mount to the surface.

It is less easy to explain the appearance of *Barbus setifensis* in the basin of an artesian well near Miserguin (region of the Tell), and of *Cristiceps argentatus* in the "rigoles d'écoulement" of the Fontaine Malakoff (in the region of the High Plateaux). The former fact is vouched for by the engineers of the Ponts et Chaussées, and the latter by the naturalist Fanton.

Do these barbel come by some concealed communication from the subterranean depths into which the Tafna is engulfed and in which it disappears during a part of its course? The fact is doubtful, but by no means impossible. As to the *Cristiceps*, it appears to us probable that it may inhabit some of the brackish springs at the foot of the mountains round the basin of Zahrez, which doubtless communicate with the artesian water-supply.

If we examine the distribution of Algerian fish with reference to longitude, we observe that the richness of the fish-fauna diminishes sensibly from east to west. The province of Constantine possesses sixteen species, of which five are common to Algiers, Oran, and itself (namely, *Mugil cephalus*, *Clupea finta*, *Barbus callensis*, *B. setifensis*, and *Anguilla vulgaris*), and a sixth (*Blennius vulgaris*) common to Algiers and Constantine; the other ten (*Gobius rhodopterus*, *G. paganellus*, *Mugil capito*, *Salmo macrostigma*, *Leuciscus callensis*, *Cyprinodon calaritanus*, *Syngnathus algeriensis*, *Tellia apoda*, *Chromis nilotica*, and *Ch. Tristrami*) are not found in the other provinces.

This is easily explained by the extent of the zone of the

Tell in this province, the geological variety in its mountains, the abundance of forests producing shade and coolness on its littoral, and, above all, because the whole of the Saharan depression with its *bahrs* is comprised within its limits.

The province of Algiers has only six species, of which four are special to it—*Cristiceps argentatus*, *Gasterosteus brachycentrus*, *Atherina Rissoi*, and *Cyprinodon iberus*.

In the province of Oran an equal number is found; but of these only one, and that the common goldfish, does not occur in the others.

It now only remains to make a few remarks on the area which these twenty-one Algerian species occupy elsewhere in the world.

Amongst those with an extensive geographical distribution, besides the common eel, there is the *Cristiceps*, which inhabits the Mediterranean, the Atlantic, the Cape of Good Hope, and extends as far as Australia; the *Mugil capito*, which frequents the coasts of Europe and Western Africa; the *Clupea finta*, which is found in the Mediterranean, on the west coasts of Europe, and in the Nile; and the two Gobies, common to the Mediterranean and the North Atlantic Ocean.

The *Mugil cephalus* is caught on all the coasts of Africa.

The *Blennius vulgaris*, a Mediterranean sea-fish, is sold as a freshwater one on the banks of the Italian lakes and at Aix-les-Bains.

The *Atherina Rissoi* appears peculiar to the Mediterranean.

The other species, which do not exist out of fresh or brackish water, have a less extended distribution; nevertheless *Cyprinodon calaritanus* inhabits both the north of Africa and the south of Europe. The *Chromis nilotica* extends from Algeria to Mozambique; and the *C. Tristrami* has been found also in the kingdom of the Ashantees.

The *Cyprinodon iberus*, as its name indicates, is of Spanish origin; the *Barbus callensis* has been found in the Tagus; and the *Gasterosteus brachycentrus* is an Italian species.

It is commonly known that China is the home of the *Carassius auratus*.

Algeria possesses five species peculiar to itself:—the *Salmo macrostigma*, which loves the cool and limpid waters of the Oued Z'hour and its affluents, which flow over beds of granite and gneiss, through shady cool forests (this is the most southern species of all the Salmon family); the *Tellia apoda*, which has no known habitat save the spring of Bou-Merzook, from which it never strays more than half a mile; the *Leuciscus callensis*, which peoples all the lakes and springs, both of fresh and brackish water, in the east of Algeria, from La Calle to Philippeville and from Constantine to Tebessa; the *Barbus setifensis*, which is found all over Algeria; the *Syngnathus algeriensis*, peculiar to the Seybouse and the two streams which unite to form it, the Oued Cherf and the Bou-Hamdan.

From the foregoing it is evident that the fish-fauna of the Tell and of the High Plateaux belongs exclusively to the European or Mediterranean system, and that the Sahara alone is linked to the African system by its Chromidæ—conclusions amply borne out by the flora and entomology of those regions.

III. Acclimatization.

Except those which enter the rivers from the sea, the only fish which constitute an appreciable article of food are the eel and the two barbels.

The *Salmo macrostigma*, of which the flesh equals in delicacy that of its European congeners, is only found in a few rivers far from the centres of population, and cannot be easily transported. The Chromidæ, of which the flesh resembles that of the perch, never attain a great size, and are confined to the Sahara, whence it is impossible to convey them to our markets. The others are too small or too rare to be of use as an article of food.

The eel and the barbels are sold in large quantities; but the latter are detestable, and suited only to the accommodating stomach of the hungry soldier, especially when they have attained a considerable size, or have lived in water with a muddy bottom.

It is therefore a great desideratum to substitute or, rather, to add other species more valuable as articles of food.

The Arabs have never shown a very great liking for fish, and have never attempted to naturalize them, except in the case of the goldfish, which was prized rather for its beauty than for its economic value.

The first attempt to introduce European species since the French conquest was made in 1858 by MM. Kralik and Cosson, who brought to Constantine a barrel of young carp and the ova of various Salmonidæ. The latter were successfully hatched; and the young fish developed rapidly in the pure water of the cistern in which they were placed; but no sooner were they launched into the water of the river Rummel than their bodies and eyes seemed to get covered with a sort of calcareous film, and they speedily died. The carp, on the contrary, have succeeded admirably in the basin of Djebel Ouach, and have multiplied amazingly. Some were put into the Rummel; but the Zouaves, informed of their translation, immediately set to work to catch them, and soon destroyed these new denizens of the river.

Attempts at pisciculture have also been made in the province of Algiers, where carp and, more recently, tench have succeeded perfectly in reservoirs.

At this point, however, the experiment has remained stationary, and no effort to naturalize the fish thus bred has been made. The question, as far as relates to the Salmonidæ, appears to us easy to resolve, after the experience gained at Constantine. Fish of this family require fresh and clear water not charged with calcareous deposits. These conditions are only possible on certain points of the littoral, particularly in eastern Kabylia, and partly in that of Babor, where the streams rise on the sides of high mountains, preserving a temperature nearly constant, flowing on a bed of gneiss, granite, or schist, and protected from the rays of the sun by shady forests.

Unfortunately, on the whole of the littoral of the provinces of Constantine and Algiers the mountain-range is broken up into an infinite variety of little basins, very steep, which only supply running water from autumn till June. An extensive zone of acclimatization cannot, therefore, be anticipated for the salmon family; and the small volume of water in those waters will not permit the introduction of the larger species; but the Algerian trout may well be employed to people the few suitable rivers, where it does not already exist.

In this zone also an attempt might advantageously be made to introduce fish of other families, especially of the Percidæ, which delight in clear and limpid water. In the province of Oran these might succeed in the upper part of the Tafna, which flows over a bed of rocks and gravel.

In other parts of the country, where even the most important streams sink, during the hot season, to a mere series of pools connected by shallow rills thoroughly heated by the sun's rays, the carp and tench offer the best chances of success. The latter (which, in Europe, inhabits muddy marshes almost dry in summer, without detriment to the quality of its flesh) might support as well as the barbel the calcareous salts which the majority of rivers in Algeria hold in solution, the rather that they would be free from its natural enemies the larger crustaceans and voracious fishes.

IV. Ichthyology.

1. *Gobius rhodopterus.*

Gobius reticulatus, Cuv. & Val. xii. p. 50; M'Coy in Ann. & Mag. Nat. Hist. 1841, vol. vi. p. 403 (not *Eichw.*).
—— *rhodopterus,* Günth. Fish. iii. p. 16.

D. 6 | 9–10; A. 9–10; L. lat. ca. 38.

Snout rather rounded, with the lower jaw longer than the upper; head longer and broader than high; eyes close together on the top of the head; sides of head naked; teeth of the outer series enlarged; no canines. Height of body from 6 to 7 times and length of head $4\frac{1}{2}$ times in the total length. Scales in about nine longitudinal series; those of the anterior part of the body are imbedded in the skin, those on the tail are much the largest; and the nape is naked. Dorsal fins rather close together, and lower than the body; none of the rays of the pectoral silk-like; ventrals extend nearly as far as the vent; caudal rounded. *Coloration*: brownish olive, irregularly spotted and reticulated with darker, and with an interrupted brown longitudinal band; first dorsal with a large black spot posteriorly; second dorsal and caudal with minute brown spots arranged in lines parallel to their bases; anal immaculate.

Length 1·8 inch.

Hab. The Seybouse, and Oued-el-Cherif, near Guelma. *Mediterranean, Dublin Bay.*

2. *Gobius paganellus,* L.

Hab. The Seybouse near Guelma and the rivers of Eastern Kabylia. *Mediterranean and coasts of Great Britain.*

3. *Blennius vulgaris,* Poll.

Hab. Oued-el-Harach and rivers of Eastern Kabylia. *Mediterranean, lakes of Italy.*

4. *Cristiceps argentatus.*

Blennius argentatus, Risso, Ichth. Nice, p. 140.
—— *Audifredi,* idem, p. 139.
Clinus argentatus, Risso, Eur. Mérid. iii. p. 238.
—— *testudinarius,* idem, p. 239.
—— *virescens,* idem, p. 239.
—— *Audifredi,* idem, p. 240.
—— *mutabilis,* Cocco, Giorn. Sc. Lett. ed Arti Sicil., April 1833. xlii. p. 9, t. 42. f. 2.
—— *argentatus,* Cuv. & Val. xi. p. 354; Guich. Expl. Sc. Alg. Poiss. p. 74.
Cristiceps argentatus, Günth. Fish. iii. p. 272.

Perhaps the most interesting discovery that has yet been made in connexion with the freshwater-fish fauna of Algeria is the occurrence of a well-known Mediterranean Blennioïd in an artesian well on the high plateaux of the province of Algiers. M. Fanton, a naturalist of Algiers, has presented us with a specimen of the common *Cristiceps argentatus*, Risso, which he assures us he caught in one of the "rigoles d'écoulement" of the Fontaine Malakoff, an artesian well excavated in the vast depression which traverses the route between Algiers and El-Aghouat, known as the Basin of Zahrez.

The following is a description of the specimen in question, which differs in some respects from the diagnoses of other specimens with which we have compared it:—

$$\text{B. } 6;\ \text{D. } 3 \mid \tfrac{27}{3};\ \text{A. } \tfrac{2}{17};\ \text{V. } \tfrac{1}{2}.$$

Height of body about 5 times in total length; head 4 times in the same; snout of moderate extent, subconical, with the lower jaw somewhat prominent; no palatine teeth. The width of the interorbital space is half the diameter of the eye; a small but rather broad fringed tentacle above orbit.

Scales rather large and very conspicuous. A well-developed separate dorsal fin on the nape of the neck, supported by three rather stout spines, the middle of which is nearly equal in length to the last of the second dorsal, which latter is united with the base of the caudal.

Colour, after maceration in spirit, olive; two longitudinal rows of large brown blotches, about eight or nine in number, along the base of the dorsal and above the lateral line; a series of white spots below the lateral line; a narrow band from the origin of the first dorsal, through eye, across cheek, behind mouth; fins immaculate.

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

Hab. Ain Malakoff. *Mediterranean, Cape of Good Hope, coast of Australia.*

5. *Atherina Rissoi.*

?*Atherina Rissoi*, Cuv. & Val. x. p. 435.

We think we have recognized in a small *Atherina* from the Metidja a species very imperfectly described by Valenciennes under the above name, and which does not seem to have been recorded since. If it is not identical with that species, it is certainly a new one.

$$\text{D. } 6\text{–}8 \mid \tfrac{1}{11\text{–}12};\ \text{A. } \tfrac{1}{13\text{–}14};\ \text{L. lat. } 48;\ \text{L. transv. } 11.$$

The root of the ventral falls below the origin of the dorsal. Height of body $\frac{1}{6}$ of the total length; length of head $4\frac{1}{2}$ times in the same. Diameter of eye about $\frac{1}{3}$ of the length of the head; it is greater than the length of the snout or interorbital space. Cleft of mouth oblique; maxillary extends beyond the anterior margin of eye; teeth very minute on the jaws, none on the vomer or palatine bones. Depth of extremity of tail rather less than diameter of eye. Distance from extremity of second dorsal to root of caudal less than length of head. From fifty-five to sixty series of scales from occiput to base of caudal; forty-eight only from superior angle of operculum.

A longitudinal silvery band on the fifth series of scales. Upper part of body minutely punctulated with black, generally with larger black spots scattered irregularly over the body.

Length 6 centimetres.

Hab. Streams and ditches of the Metidja; Maison Carrée, Mazafran, Oued-el-Alleng. ? *Nice.*

6. *Mugil cephalus*, Cuv.

Hab. Rivers of Algeria. *Freshwater lakes of Tunis, Nile, Mediterranean, coast of Madeira, West Coast of Africa.*

7. *Mugil capito*, Cuv.

Hab. River Bondjemat, near Bône; Lake Bou-Kamira. *Lakes of Tunis, Nile, coasts of Europe, Cape of Good Hope.*

8. *Gasterosteus brachycentrus.*

Gasterosteus brachycentrus, Cuv. & Val. iv. p. 499, pl. 98. f. 2: Günth. Fish. i. p. 5.

$$D. 1 \mid 1 \mid \frac{1}{12\text{-}13}; \; A. \frac{1}{8\text{-}10}; \; P. 10; \; V. 1/1.$$

Differing from *G. argyropomus*, Cuv. & Val., in having shorter dorsal spines, the length of which is about $\frac{1}{5}$ of the height of the body. There is sometimes the rudiment of a third dorsal spine concealed in the skin. The ventral cuirass reaches to the superior edge of the pectoral fins. From 0 to 4 scaly plates on the sides of the body above that fin; the rest of the body naked. In the adult the ventral spine does not reach much beyond the middle of the distance from its base to the extremity of the pubic bone.

These fish are minutely punctulated with black to a greater or less degree; and some have large black blotches, which are most numerous on the ventral fins.

Length 2 inches.

Hab. Ditches in the Metidja. *Italy.*

Since this description was written we have had the opportunity of perusing the latest paper published by M. Paul

Gervais on the freshwater fish of Algeria*. He there alludes to the discovery of a species of *Gasterosteus* (made, in fact, by us). This he imagines, despite of several secondary differences, to be referable to the variety common in the neighbourhood of Paris, of which Cuvier has made his species *G. leiurus*, and which is undoubtedly only a variety of the common European species *G. aculeatus*.

We have again carefully examined our numerous specimens, and we are convinced that it bears a much closer resemblance to the Italian species to which we have referred it.

Our endeavours to obtain specimens of the Chromidæ found in the salt and brackish waters, and even in the artesian wells of the eastern Sahara, have hitherto been without success; but an examination of the literature of the subject leaves little doubt on our minds that they are the *Chromis nilotica* and *Chromis Tristrami*.

9. *Chromis nilotica.*

Chromis niloticus, Cuv. Règne Anim. &c. &c.
Acerina Zillii, Gervais, Acad. Sc. et Let. Montp. 1848, and Ann. Sc. Nat. 3e sér. x. p. 203.
Coptodus Zillii, idem, Bull. Soc. Cent. Agr. de l'Hérault, 1853, p. 80, pl. 4. f. 5–7, and Zool. et Pal. Gén. p. 204, pl. xlv. f. 3.

This fish has a very wide geographical range, being found from Algeria (if our supposition is correct), certainly from the Nile, to the coast of Mozambique.

10. *Chromis Tristrami.*

Haligenes Tristrami, Günth. Proc. Zool. Soc. 1859, p. 471, pl. 9. f. B; Gervais, Comptes Rend. Acad. Sc. 1866, t. lxiii. p. 7, and Zool. et Pal. Gén. 1869, p. 207.
Chromis Tristrami, Günth. Fish. iv. p. 269.

M. Paul Gervais, writing as late as 1869, persists in quoting Dr. Günther's nomenclature and remarks as contained in the 'Proceedings of the Zoological Society' ten years ago, and completely ignores the corrections which that naturalist has made in his important work, 'Catalogue of Fishes,' vol. iv. p. 269, of the existence of which M. Gervais does not seem aware.

11. *Salmo macrostigma*, Dum.

Hab. Oued Z'hour and its affluents in Kabylia, near Callo.

12. *Cyprinodon calaritanus*, Bonelli.

C. calaritanus, Bonelli, = *C. cyanogaster*, Guich., female, + *C. doliatus*, Guich., male.

Hab. Lake Bou-Kamira, near Bône; Oued Gheir; artesian wells. *Nile*; *south of Europe*.

* Zoologie et Paléontologie Générales, 1869, p. 202, pl. xlv.

13. *Cyprinodon iberus.*

Cyprinodon iberus, Cuv. & Val. xviii. p. 160, pl. 528; Steind. Sitzgsber. Akad. Wiss. Wien, lii. 1865, f. 1–3; Günth. Fish. vi. p. 302.

D. 9; A. 9; L. lat. 30; L. transv. 9/10.

We cannot hesitate to separate this species from the foregoing. Of *C. calaritanus* we have examined several hundred specimens without discovering any appreciable difference from the description of Dr. Günther. But we have received from the spring of Taguin two males, the lengths of which are $2\frac{1}{2}$ and $3\frac{1}{2}$ centimetres respectively, which correspond with Valenciennes's description and figure quite sufficiently for identification with them.

In general appearance they resemble more nearly the female than the male of *C. calaritanus*; but they differ from both sexes of that fish in the number of scales on the lateral line, which are in 30 series.

The height of the body is $\frac{1}{3}$ of the total length without caudal; the length of the head is contained $3\frac{1}{2}$ times in the same. Diameter of eye rather more than length of snout, and equal to half the breadth of the interorbital space; it is one-third of the length of the head. Dorsal and anal as much elevated as in the female of *C. calaritanus*, but less than in the male of that species.

The first dorsal ray is inserted midway between the root of the caudal and the gill-opening, and corresponds to the twelfth scale of the lateral line. The first anal ray is below the second or third of the dorsal. Caudal truncated.

Colour: greenish-olive, minutely spotted with black; about eighteen narrow silvery cross bands on the sides; dorsal, anal, and caudal with very distinct black cross bands.

Hab. Taguin, in the High Plateaux of the province of Algiers. *Spain.*

14. *Tellia apoda.*

Tellia apoda, Gervais, Ann. Sc. Nat. 1853, t. xix. p. 15, and Zool. et Pal. Gén. pl. xlv. f. 6; Val. Compt. Rend. 1858, xlvi. p. 715; Günth. Fish. vi. p. 309.

D. 13–15; A. 13–14, L. lat. 26–28; L. transv. 11.

The genus *Tellia** is very similar to *Cyprinodon*, but has no ventral fins; the mouth is protractile, the lower jaw projects beyond the upper, the teeth are tricuspid in a single series in each jaw.

The height of the body in females is about $\frac{1}{3}$, and in males somewhat less than $\frac{1}{3}$ of the total length; the length of the head is contained about $3\frac{1}{2}$ times in the same. The diameter

* So called, perhaps, because it has *never* been found in the Tell, but only on the High Plateaux.

of the eye equals the length of the snout, and is considerably more than half the interorbital space; it is contained from 3 to $3\frac{2}{3}$ times in the length of the head. Origin of dorsal midway between base of caudal and posterior margin of præoperculum; it corresponds to the eleventh scale on the lateral line.

Female. Body greenish olive, with from nine to twelve darker cross bands more irregular than in males.

Male. Greenish olive, with about eleven distinct lighter cross bars. A black ocellated spot posteriorly on both dorsal and anal fins. Caudal with several indistinct interrupted transverse bands, and a broad whitish margin.

Length 3 to 6 centimetres.

Hab. High Plateaux of Algeria.

15. *Carassius auratus.*

The common goldfish, originally a native of China and Japan, has been everywhere domesticated, and is found in great numbers in the Oued Malouïa, near the confines of Morocco. We have observed nearly every known variety of it: in some the fins are normal; in others the caudal is three- or four-lobed; sometimes the dorsal is reduced to a few rays, and sometimes it is entirely wanting; while every colour, from bright golden to uniform blackish, and every combination of those colours, has been observed. This fish was, no doubt, introduced by the Moors long before the French occupation of Algeria.

16. *Leuciscus callensis.*

Leuciscus callensis, Guich. Expl. Sc. Alg. Poiss. p. 94, pl. 7. f. 2.

D. 10; A. 12; V. 8; L. lat. 45; L. transv. $10/4\frac{1}{2}$.

Body elongated, compressed, its greatest height being contained $3\frac{1}{2}$ times in the total length, without caudal. The head is 4 times in the same. Cleft of mouth oblique, lower jaw slightly prominent, intermaxillary reaching to anterior margin of orbit. The attachment of the branchial membrane takes place behind the posterior margin of orbit. Pharyngeal teeth in a single series on each side, slightly hooked, 5.5. Belly behind ventrals compressed, *covered with scales.* Three series of scales between the lateral line and the root of the ventrals. Dorsal above the space between ventrals and anal. Lateral line complete, considerably below the middle of tail during the greater part of its course, but rising to the middle at the root of the caudal. *Colour*: blackish above, minutely punctulated with black; a broad blackish band along the sides above the lateral line.

Length 3 inches.

Hab. All the streams in the east of Algeria.

17. *Barbus callensis.*

Barbus callensis, Cuv. & Val. xvi. p. 147; Guich. Expl. Sc. Alg. Poiss. p. 93; Günth. Fish. vii. p. 92.

$$\text{D. } \tfrac{3}{8\text{–}9}\text{; A. } \tfrac{3}{5}\text{; L. lat. 42–48; L. transv. } \tfrac{8\text{–}9}{10\text{–}11}.$$

Four barbels; no pores or tubercles on snout. *Third dorsal ray very strong and deeply serrated*, much shorter than length of head. *Six* longitudinal series of scales between the lateral line and root of ventral. Height of body nearly equal to length of head, and rather more than a quarter of the total length without caudal. Eye considerably in advance of middle of head; cleft of mouth subterminal; upper jaw slightly the longer; lips thin; anal twice as high as broad.

Hab. Throughout Algeria. *River Tajo, Spain.*

18. *Barbus setifensis.*

Barbus setivimensis, Cuv. & Val. xvi. p. 149; Guich. Expl. Sc. Alg. Poiss. p. 93; Günth. Fish. vii. p. 99.

$$\text{D. } \tfrac{3}{8}\text{; A. } \tfrac{3}{5}\text{; L. lat. 42; L. transv. } \tfrac{8\text{–}9}{10\text{–}12}.$$

Four barbels; no pores or tubercles on snout. *Third spinous ray feeble and much less strongly serrated than in* B. callensis. *Five* longitudinal series of scales between lateral line and ventral. Height of body equals length of head, and is contained $3\frac{2}{3}$ times in the total length, without caudal. Eye much in advance of the middle of the head. Lips thick; upper jaw prominent. Caudal forked, lobes rounded; anal twice as high as broad. Entire body and fins generally covered with a thick mucus.

Hab. Setif; artesian wells near the salt lake of Miserguin; Oued Tafna; Bou Farik, near Algiers.

M. Guichenot* has noted a third barbel (*B. longiceps*) as existing in Algeria. This species was named by M. Valenciennes from a specimen brought from the Jordan; and several examples from the Lake of Galilee exist in the British Museum.

M. Guichenot asserts that it is found in the thermal spring of Hamam Meskoutin, where it lives with the *Barbus callensis*. We have examined a large series of specimens from that locality, but we have found none which can be identified with the species from Palestine. We have noticed considerable variations in both the Algerian species, especially in the strength and serrature of the third dorsal ray, but we have found one character invariable in each. In *B. callensis* there are always *six* longitudinal series of scales between the lateral

* Explor. Scien. de l'Alg. Poiss. p. 94.

line and the root of the ventral, and in *B. setifensis five*; whereas in the specimens of *B. longiceps* in the British Museum the number is *eight*.

This led us to doubt the fact of the last-mentioned being an African species at all; and we begged M. Guichenot to inform us as to the source whence the specimen in the Paris Museum was obtained, and the number of transverse scales. He states in reply:—"J'ai examiné avec beaucoup de soin les deux individus secs du *B. longiceps*, les seuls que possède notre musée, et sur lesquels j'ai compté les écailles qui se trouvent entre la ligne latérale et l'insertion des nageoires ventrales; elles sont au nombre de 7 ou de 8. Ces deux exemplaires proviennent du Jourdain, et non d'Algérie. Je doute beaucoup de l'existence de *B. longiceps* en Algérie, indiquée d'après une tête en très-mauvais état de conservation que j'ai trouvée dans un des lacs de la Calle lors de mon séjour en Afrique, et que je crois avoir rapportée, mais à tort, à ce poisson."

This proves beyond doubt that *B. longiceps* is not an African species.

19. *Clupea finta*, Cuv.

Hab. Nearly all the rivers of Algeria. *Nile*; *coasts of Europe.*

20. *Anguilla vulgaris*, Turton.

It is certain that the African eel described as a new species by Guichenot under the name of *A. callensis** is identical with the common European species. It is found everywhere in Algeria.

21. *Syngnathus algeriensis*, n. sp.

The last fish on our list is the only new species which we have observed; and it is interesting, as it is rare to find Syngnathidæ in water entirely fresh and beyond tidal influences†.

Head $\frac{1}{8}$ of the total length; snout half the length of the head, and scarcely compressed. Diameter of orbit $\frac{1}{6}$ of the length of the head; space between eyes concave, and less than the diameter of orbit; occiput slightly elevated and raised in a crest, which extends from the first body-ring to the extremity of the snout. Opercles swollen, finely striated, with a small ridge on the anterior portion only. Trunk heptagonal, rather slender, twice and a quarter as long as the head, and, measured from extremity of snout to vent, once and a half in the length of the tail. There are fifteen pairs

* Explor. Scien. de l'Alg. Poiss. p. 111, pl. 7. f. 1.

† Since this was written we have seen the eighth volume of Dr. Günther's Catalogue, at p. 164 of which he describes this species from the specimens sent by us to the British Museum.

of shields from head to dorsal. Tail tetrahedral, tapering, terminating in a moderately large caudal fin. The top surface is considerably broader than the lower one; it has about thirty-four rings, of which about sixteen are occupied by the egg-pouch in males. The dorsal stands on seven tail-rings, and equals the length from extremity of snout to anterior of opercles, measured on the lower surface of the head; it has twenty-six rays. The lateral line joins the upper surface of the tail at the end of the dorsal fin. *Colour*: blackish, with more or less regular series of white points, brown spots, and irregular patches.

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

Numerous specimens were found at the confluence of the Oued Cherif and the Oued Bou-Hamdan, in the province of Constantine (twelve miles above Guelma, and sixty miles from the sea).

XLVIII.—*Notes on* Holopus *and* Pentacrinus. By Dr. J. E. Gray, F.R.S.

Mr. Rawson W. Rawson, C.B., the Governor of Barbadoes, has kindly sent me the following observation:—"I have procured a specimen of a *Pentacrinus* from the north of the Island of Barbadoes, dredged or, rather, picked up in about 5 fathoms water. I enclose a sketch (see figure). It is ink-black, a portion broken so as to show the interior of the contracted armlets and the Pentacrinal formation of the mouth or entrance of the central canals. Do you know what it is? I am under the impression of having seen an engraving of such a zoophyte, but cannot find it."

There can be no doubt that the animal here referred to is very similar to the crinoid described by M. d'Orbigny at the Académie des Sciences, Feb. 27, 1837. The paper is printed at length in the 'Magasin de Zoologie' for the same year, with a plate, under the name of *Holopus Rangii*.

There is a short notice of the characters of the genus in the 'Annales des Sciences Naturelles,' vol. viii. p. 123, and in Wiegmann's 'Archiv' for 1839.

The genus is also noticed in an "Appendix to the History of Crinoids" in Dujardin and Hupé's 'Histoire Naturelle des Zoophytes et Echinodermes,' p. 217. These authors observe:—
"Le seul individu observé avait été rapporté de la Martinique par Sander-Rang et, pour cette raison, nommé *Holopus Rangii*.

"Il était censé avoir été pêché vivant, mais la description a été faite uniquement sur le squelette pierreux, haut de 80 millimètres environ, et on n'a rien dit de la structure intime de ce squelette, d'où l'on eût pu conclure sa nature échinodermique. Aucun autre observateur ne l'a étudié après D'Orbigny, et nous-mêmes il nous a été impossible de le voir dans la collection de ce célèbre paléontologiste, achetée par le Muséum d'Histoire Naturelle. Aussi, d'après la description et la figure* qui ont été reproduites dans les 'Annales des Sciences Naturelles' et dans les 'Archiv für Naturgeschichte' (1839), sommes-nous fortement tenté d'y voir toute autre chose qu'un échinoderme, un cirrhipède, par exemple. Cependant, la pluspart des zoologistes ont admis non-seulement l'*Holopus* comme un genre d'échinodermes-crinoïdes, mais encore comme le type d'une famille distincte qu'on appellerait les Holopides (*Holopidæ*). Mais nulle part ailleurs, chez les Crinoïdes, on n'a vu, comme chez les Cirrhipèdes, au lieu d'une tige articulée, un pied creux contenant les viscères. Nous croyons donc qu'il faut attendre de nouvelles observations" (p. 217).

These observations must have been written from a very indistinct recollection of M. d'Orbigny's excellent and detailed paper and plate; for he not only figures the exterior of the animal, but also gives a longitudinal section of it, showing the inside of the arms, the mouth and the visceral cavity, details of the arms and armlets, and the articulating surfaces of which they are composed. Nothing like these articulations has ever been found in any cirriped.

Mr. Rawson, knowing nothing of any doubt on this subject having been expressed, at once recognized it as a crinoid, showing the justice of Rang's position of it; and the organization of the crinoid is so unlike that of any recent or fossil genera I know, that I think authors have been justified in forming it into a separate family, characterized by its bag-like body covered with a continuous calcareous coat, and attached by its outer surface to submarine bodies.

There are certain points in which the form of the arm in Mr. Rawson's figure is very unlike that of the species from Martinique which D'Orbigny has called *H. Rangii*. I would

* I can find no figure of the genus in my copy of the 'Annales.'

therefore propose to distinguish the Barbadoes specimen by the name *H. Rawsoni*, and hope very shortly to be able to give a more detailed description of this most interesting recent discovery in crinoidal genera.

Mr. Rawson observes:—"I have only procured one specimen of the *Pentacrinus caput-medusæ*, and it was the first; I am therefore more uncertain about the place where it was procured than I am about the habitat of the *Pentacrinus Mülleri*. But I believe that they are all procured on the same bank, which, instead of five or six miles from the shore, as I was first informed, cannot be more than a mile, within the hundred-fathom line."

XLIX.—*On the Coleoptera of St. Helena.* By T. Vernon Wollaston, M.A., F.L.S.

Since the publication of my memoir on the Coleoptera of St. Helena, two years ago, another batch has been placed in my hands by Mr. J. C. Melliss, who has lately returned from the island, and has brought with him a small additional collection, of considerable interest. Although a very large proportion of this last consignment is made up of species which are manifestly naturalized (having been taken, clearly, in and about the town), there is nevertheless a certain modicum of unmistakably endemic forms; and these, along with a few others of more doubtful origin, I propose to describe in the present paper.

The total number of species in the collection which has lately been entrusted to me by Mr. Melliss is 39; and of these as many as 21 were not included in my enumeration in 1869. Amongst the 21 additions, however, to the catalogue, there are *ten* which we may be quite certain have found their way into the island through the medium of commerce, and have therefore no connexion whatever with the aboriginal fauna. Such species as these figure in the local lists of nearly every civilized country; and as they are invariably admitted, on the tacit understanding that they have unquestionably been naturalized, we can scarcely refuse them a place in the St.-Helena enumeration. The ten to which I allude are as follows:—

Carpophilus dimidiatus.
—— hemipterus.
Trogosita mauritanica.
Cryptophagus badius.
—— gracilipes.
Silvanus surinamensis.
Curtomerus pilicornis.
Coptops bidens.
Homalota coriaria.
Philonthus longicornis.

Of the remaining eleven additions, *four* I should consider of rather more doubtful origin; for although I believe them to have become established (like those just alluded to) through indirect human agencies, this may or may not have been the case. They are:—

Thea variegata.	Oxytelus alutaceifrons.
Xantholinus morio.	—— nitidifrons.

We now come to the remaining *seven* in Mr. Melliss's consignment; and these I feel no hesitation in asserting are veritable *autochthones* of the soil. Indeed, with the exception of a *Longitarsus* on an unmistakably St.-Helena type, they all belong to either the *Curculionidæ* or the Anthribids—indeed to the four genera *Microxylobius*, *Nesiotes*, *Notioxenus*, and *Homœodera*, each peculiar to the island, and of very anomalous structure. These seven, of conspicuously native origin, and which I may be permitted to call *ultra*-indigenous, are:—

Microxylobius dimidiatus.	Notioxenus ferrugineus.
—— angustus.	Homœodera coriacea.
—— cossonoides.	Longitarsus Mellissii *.
Nesiotes horridus.	

In my enumeration, two years ago, of the Coleoptera which had been detected up to that date (so far as I was able to ascertain) at St. Helena, I recorded 74 species. Hence the 21 which the more recent reseaches of Mr. Melliss enable me now to add will augment the entire number to 95. In drawing any geographical conclusions, however, from the general character of a fauna, it is clear that those species which have *without doubt* become established through the immediate instrumentality of commerce and other direct human agencies should be left out of the question; and consequently, when tabulating, in 1869, what I looked upon as emphatically the "St.-Helena Coleoptera" (including under that title not merely the actual *autochthones* of the soil, but likewise those for the presence of which in the island the common modes of ordinary dissemination, through various articles of merchandize, would not directly account), I withdrew no less than 26 out of the entire 74, leaving a residuum of 48. Hence since, on the same principle, 10, out of the 21 now added, have to be removed, the "48" from which I deduced my conclusions

* The number of species, however, which I have regarded in this paper as new to science is eleven,—the *Cryptophagus gracilipes*, *Xantholinus morio*, *Oxytelus alutaceifrons*, and *Oxytelus nitidifrons* having, in addition to these seven "*ultra*-indigenous" forms, been defined as novelties.

two years ago must now be increased to 59; and it will be interesting to notice whether the relative proportions of the twelve great sections under which the Coleoptera are usually supposed to be classified have, in consequence, been much disturbed. Tabulated as before, the divisions will accordingly arrange themselves thus:—

Rhynchophora	31
Cordylocerata (*i. e.* Lamellicorns &c.)	6
Geodephaga	5
Brachelytra	4
Heteromera	3
Phytophaga	3
Pseudotrimera	3
Philhydrida	2
Necrophaga	1
Priocerata	1
Hydradephaga	0
Eucerata	0
	59

Now, looking at this synoptical enumeration, the first fact that strikes us is the still greater preponderance, numerically, than even before, of the *Rhynchophora* over every other section. Indeed the more we investigate the Coleopterous fauna of St. Helena, the more pronounced appears the tendency to this strange and undue development of certain anomalous types of the Curculionids and *Anthribidæ*. And I may add that this is in perfect accordance with my original conjecture, made now more than ten years ago, that the exponents of those particular groups would be found eventually (judging from the remarkable difference in configuration of the very few which had then been brought to light) to be the most numerous and the most characteristic in the whole fauna of the island.

After these few remarks, I will proceed to place on record the 21 additions to the list, and will then give an emended systematic enumeration of the 95 species which constitute the Coleopterous fauna of St. Helena as hitherto ascertained †.

† As in my former paper, I shall place an asterisk (*) against all those species (both in the enumeration itself and in the systematic catalogue) which I should look upon as *unquestionably* naturalized—whether through the medium of commerce or through the various other methods of accidental dissemination which are so readily traceable throughout the greater portion of the civilized world.

Fam. **Nitidulidæ.**

Genus CARPOPHILUS.

Stephens, Ill. Brit. Ent. iii. 50 (1830).

*Carpophilus dimidiatus**.

Nitidula dimidiata, Fab., Ent. Syst. i. 261 (1792).
Carpophilus auropilosus, Woll., Ins. Mad. 117 (1854).
—— *dimidiatus*, Murray, Mon. Nitid. 379 (1864).

A widely diffused insect, which appears to have been naturalized, through the medium of commerce, in most parts of the civilized world, and which has established itself in the Madeiran, Canarian, and Cape-Verde archipelagos. It has been taken by Mr. Melliss at St. Helena, but is, of course, totally unconnected with the true fauna of the island.

*Carpophilus hemipterus**.

Dermestes hemipterus, Linn., Syst. Nat. ii. 567 (1767).
Carpophilus hemipterus, Murray, Mon. Nitid. 362 (1864).
—— ——, Woll., Col. Atl. 108 (1865).

Likewise captured by Mr. Melliss at St. Helena, and equally diffused with the last species (through human agencies) over the civilized world. It is common, chiefly in the warehouses and stores, throughout the Madeiran, Canarian, and Cape-Verde groups.

Fam. **Trogositidæ.**

Genus TROGOSITA.

Olivier, Ent. ii. 19 (1790).

*Trogosita mauritanica**.

Tenebrio mauritanicus, Linn., Syst. Nat. ii. 674 (1767).
Trogosita mauritanica, Woll., Col. Atl. 116 (1865).
—— ——, Id., Col. Hesp. 66 (1867).

Of course totally unconnected with the true fauna of the island, yet, having been taken by Mr. Melliss, it would seem at any rate to have established itself in the storehouses and granaries of St. Helena, in like manner as it has done in most regions of the civilized world. It is very common throughout the Madeiran, Canarian, and Cape-Verde archipelagos.

Fam. **Cucujidæ.**

Genus SILVANUS.

Latreille, Gen. Crust. et Ins. iii. 19 (1807).

*Silvanus surinamensis**.

Dermestes surinamensis, Linn., Syst. Nat. ii. 565 (1767).
Silvanus surinamensis, Woll., Col. Atl. 135 (1865).
—— ——, Id., Col. Hesp. 69 (1867).

A single example of this almost cosmopolitan *Silvanus* is amongst the collection of insects taken recently by Mr. Melliss at St. Helena; and although, of course, totally unconnected with the native fauna of the island, yet, as the species is allowed to figure in the local list of nearly every civilized country, we can scarcely deny it a place in our present enumeration.

Fam. **Cryptophagidæ.**

Genus Cryptophagus.

Herbst, Käf. iv. 172 (1792).

*Cryptophagus badius**.

Cryptophagus badius, St., Deutsch. Fna, xvi. 96, t. 317. f. A (1845).
—— ——, Erich., Nat. der Ins. Deutsch. iii. 357 (1846).

Amongst the St.-Helena Coleoptera of Mr. Melliss there is a single example of what seems to be the common European *Cryptophagus badius*; and I may add that Mr. Rye is likewise of opinion that it should be referred to that species. I have therefore little hesitation in recording the *C. badius* amongst the insects which have been naturalized in the island through the medium of commerce, though the individual now before me presents perhaps a *slight* shade of difference from the ordinary type†.

*Cryptophagus gracilipes**, n. sp.

C. oblongo-ovalis, ferrugineus, subnitidus, ubique densissime et valde profunde punctatus, et pube elongata suberecta albida præsertim in elytris obsitus; prothorace convexo, transverso, postice vix angustiore, angulis anticis elongato-incrassatis, ad apicem retrorsum acutiusculis, ad latera minutissime æqualiter subserrato (interdum fere simplici); elytris convexis; antennis pedibusque elongatis, gracilibus, paulo pallidioribus.

Long. corp. lin. vix 1.

Several examples of this most distinct and interesting little *Cryptophagus* are amongst the Coleoptera collected at St. Helena by Mr. Melliss; but whether they were taken in the houses and stores about the town I am unable to say—though, as the *Cryptophagi* are insects which are so eminently liable to transmission through the medium of commerce, this is most likely to have been the case. At any rate, however, it differs very essentially from every member of the genus with which I am acquainted; and Mr. Rye, who has paid unusual atten-

† After a careful examination of this specimen, Mr. Rye says:—"The St.-Helena *Cryptophagus* is, I think, *badius* without doubt. The only little point in which it seems to differ is in the outline of the sides of the thorax behind the middle denticle, which is scarcely so obliquely *straight* as in the *badius* type, being a *trifle* irregular near the posterior angles: but I trace similar tendencies in some of my undoubted *badius*."

tion to the *Cryptophagi*, assures me that he is not aware of any species upon record with which it can be made to agree. Apart from its rather small size, convex body, and dark rufo-ferruginous hue, its most distinctive features consist in its extremely coarsely and densely punctured surface, which is beset all over (though especially on the elytra) with very elongate and nearly erect, soft, whitish hairs. Its limbs, too, are marvellously slender—even more so, perhaps, than is the case in the particular section of the group (represented by the *C. vini* in Europe, and *C. hesperius* in the Canarian archipelago) to which it belongs. Its incrassated anterior prothoracic angle is rather largely developed, with the hinder point of it more or less acute; but there seems to be no central lateral denticle, the sides being merely minutely crenulated—so minutely, indeed, as sometimes to appear nearly simple.

Fam. **Elateridæ.**

Genus Anchastus.

Leconte, Trans. Am. Phil. Soc. x. 459 (1853).

Anchastus atlanticus.

Anchastus atlanticus, Cand., Mon. Elat. ii. 409, t. 3. f. 8 (1859).
Heteroderes puncticollis, Woll., Ann. Nat. Hist. iv. 317 (1869).

It would appear that the Elaterid which I described two years ago under the name of "*Heteroderes puncticollis*" is the *Anchastus atlanticus* of Candèze's Monograph; so that the above correction in its synonymy becomes necessary. Mr. Janson informs me that its general *facies* is almost exactly that of a *Heteroderes*, and it is not surprising, therefore, that I should have referred it to that group; and he further adds that it is totally unlike any *Anchastus* with which he is acquainted.

Fam. **Curculionidæ.**

(Subfam. Cossonides.)

Genus Microxylobius.

Chevrolat, Trans. Ent. Soc. Lond. i. 98 (1836).

Of this interesting little Cossonideous group three additional exponents have been brought to light, through the careful researches of Mr. Melliss, since my enumeration of the St.-Helena Coleoptera two years ago. They all of them belong to the first section of the genus, regarded by me as the typical one, in which the femora are totally unarmed; and one of them (the *M. cossonoides*) is so large compared with the remainder, and so dissimilar in the elongation of its rostrum and limbs, as still to justify my original conclusion that many species even yet remain to be detected.

I may here add that the members of the second of the two sections under which I distributed the *Microxylobii* have an acute, more or less conspicuous spine towards the base of the *upper* edge of their femora; and for this, lest hereafter it should perchance be found desirable to separate it as a distinct group, I proposed the subgeneric name of *Thaumastomerus*. It would appear, however, that in 1858 Boheman (Res. Eugen. 141, tab. ii. f. 7) published one of the exponents of that particular section (according to Lacordaire, Gen. vii. 327, note 2, my *M. Chevrolatii*) under the name of "*Acanthomerus armatus*;" so that if ever the two divisions should be treated as distinct genera, the title of the one with armed thighs will have to be *Acanthomerus*, and not *Thaumastomerus*. My own belief, however, is, that the whole of the species which compose the two sections are so intimately connected that it would be exceedingly unwise, on account of the spinose femora of some of them, to attempt to draw a line of generic demarcation between them. But, be this as it may, the *specific* title, at any rate, of my *M. Chevrolatii* will (assuming Lacordaire's identification as correct) be compelled to yield to that of *armatus*, under which it was previously published by Boheman.

The three species above alluded to, which have to be added to the St.-Helena list, may be enunciated as follows:—

Microxylobius dimidiatus, n. sp.

M. ovato-fusiformis, niger, nitidulus: capite rostroque parce et leviter punctatis; prothorace magno, convexo, subquadrato-ovali, in medio rotundate latiusculo, profunde sed vix confertim punctato; elytris breviusculis, rugulosis, punctato-striatis, interstitiis uniseriatim punctatis, interdum (saltem postice) setulis minutis cinereis (vix observandis) parce obsitis; antennis rufo-piceis; pedibus breviusculis, piceis.

Long. corp. lin. $1\frac{1}{4}$–$1\frac{2}{3}$.

Two examples of this little *Microxylobius* were amongst a former small collection (transmitted to me more than a year ago by Mr. Melliss) from St. Helena. Although with abundant distinctive features of its own, in certain respects it is slightly intermediate between the *lacertosus* and *lucifugus*, combining somewhat the size and outline of the former with the less opaque and more punctured surface of the latter: yet neither in outline nor in sculpture is it in any wise identical with either of them. It is a small species (apparently not much, if at all, larger than the *lacertosus*), and has a faint tendency, under a high microscopic power, to be studded posteriorly with minute cinereous pubescence. Instead of being opaque, alutaceous, and tuberculated, like the *lacertosus*, it is, as in the case of the *lucifugus*, faintly shining and punctured. Its punctures, however, are not so densely crowded together, or so coarse, as in the latter species; and its elytra (which are scarcely so long as the anterior portion of the body) are more conspicuously striate, and with a single row of punctures down each interstice. Its legs are exceedingly short, like those of the *lacertosus*; and its prothorax is very largely developed—indeed, more so, perhaps, in proportion to the size of the insect, than in any of the other members of the genus which have hitherto been brought to light.

Microxylobius angustus, n. sp.

M. angustus, subcylindricus, æneus (interdum subvirescenti-æneus), nitidulus, calvus; capite punctato, rostro densius ac profundius punctato, oculis prominulis; prothorace sat dense et profunde punctato, ad latera parum rotundato, basi evidenter anguste marginato; elytris elongatis, subparallelis, postice gradatim attenuatis et ibidem (oculo fortissime armato) minutissime sed parce pubescentibus, sat profunde substriato-punctatis.

Long. corp. lin. circa 2.

Judging from three examples now before me, which were taken by Mr. Melliss, the present species appears to be rather larger than the *M. debilis*, as also relatively longer, narrower, and more cylindrical, the elytra (instead of being considerably rounded outwards behind the middle) being very little expanded at the sides. Its punctation likewise is altogether deeper and closer, its eyes are appreciably more prominent, its prothorax is more evidently margined behind, its elytra have less indications of minute asperities at their base, and its surface is a little less shining*.

Microxylobius cossonoides, n. sp.

M. elongatus, fusiformis, æneus (aut subvirescenti-æneus), nitidulus, minute et parce (in elytris evidentius ac seriatim) cinereo-pubescens; capite dense et argute punctato, rostro elongato gracili; prothorace ovato, basi truncato et ibidem evidenter marginato,

* I may just mention that five individuals from the late collection of Mr. Melliss, and which I have no hesitation in referring to the same species as the single example which I formerly described under the name of *M. debilis*, are a *trifle* less evidently punctured (at any rate, on the prothorax) than my type of the latter, and the minute asperities at the base of their elytra are not quite so developed. In all probability, however, the two forms represent but very slightly modified or local races of a single species. Judging from these five examples, also, the *M. debilis* would appear occasionally, like most of the brassy forms, to become darker in hue—indeed nearly black.

sat profunde, dense, et argute punctato; elytris profunde striato-punctatis, interstitiis irregulariter biseriatim punctatis; antennis pedibusque elongatis, gracilibus, illis rufo-piceis, funiculi art° 2do longissimo, his obscurioribus, femoribus asperatis, tarsis elongatis art° 3tio late bilobo.

Long. corp. lin. $3\frac{3}{4}$–$4\frac{3}{4}$.

Mas rostro paululum breviore et crassiore, ad antennarum insertionem subquadrate ampliato.

Fœm. rostro longissimo, gracillimo, tereti, ac paulo levius punctato.

Var. *β. obscurus.*—Omnino piceus, subminor (?), ac fere calvus.

The comparatively gigantic size and elongated rostrum and limbs of this fine *Microxylobius* would of themselves suffice to distinguish it from every other member of the group which has hitherto been brought to light; and although equally brassy with several of the other species, its general aspect is somewhat more in accordance with the subfamily *Cossonides* than is the case with its numerous (and more or less eccentric) allies. The construction of its rostrum, indeed (which, although in both sexes elongated and narrow, is particularly so in the females, whilst in the males it is considerably dilated at the insertion of the antennæ), is tolerably suggestive both of *Mesites* and *Cossonus*; and its tendency to be minutely pubescent (at any rate on the elytra) is another feature which deserves to be especially noticed. Three examples of it are amongst the insects which have been consigned to me by Mr. Melliss, two of which are a typical male and female, whilst the third is of a dark-piceous hue and less evidently pubescent. This latter individual, however (the "var. *β. obscurus*" of my diagnosis), I cannot believe to be any thing more than a variety of the other form—a conclusion which is all the more probable, since it is the manifest tendency of many of the species to have both a metallic and a darker state*.

(Subfam. Synaptonychides.)

Genus Nesiotes.

Wollaston, Journ. of Ent. i. 211 (1861).

Nesiotes horridus, n. sp.

N. elongato-ovatus, niger, subnitidus, squamis magnis fulvo-cinereis setisque suberectis grossis plus minus vestitus; prothorace ante

* Until the recent collection of Mr. Melliss had been placed in my hands, I had barely remarked this tendency to a twofold coloration in the *M. Chevrolatii* (*i. e.* the *armatus*, Boh.), which had been looked upon by me as an emphatically brassy species. Several examples of it, however, which are now before me are very *nearly* as black as the *M. lucifugus* and *lacertosus* and the dark variety of the *debilis*.

medium rotundato-ampliato, postice angustiore et oblique subrecto, ubique profunde et dense rugoso-punctato (punctis magnis); elytris pone medium rotundato-ampliatis, grosse striato-punctatis; antennis (art^is^ 1^mo^ et præsertim 2^do^ elongatis) longiusculis, gracilibus, rufo-ferrugineis, clava obscuriore; pedibus elongatis, squamosis, tarsis clarioribus.

Long. corp. lin. 2–2½.

Several examples of this distinct and interesting *Nesiotes* are contained in the St.-Helena collection of Mr. Melliss; and the species which they represent, as pertaining to one of the most characteristic and anomalous of the native groups, cannot but be regarded as a very significant addition to the fauna. It is considerably larger than either the *N. squamosus* or the *asperatus*; and (although but slightly shining) it differs also in being less opaque and very coarsely *punctured*, and in being more regularly beset (in addition to the decumbent scales) with longer and more robust suberect setæ. Its outline is more elongate-ovate; and its limbs are less abbreviated, the first and second joints of the antennæ being especially longer.

Fam. **Anthribidæ.**

(Subfam. NOTIOXENIDES.)

Genus NOTIOXENUS.

Wollaston, Journ. of Ent. i. 212 (1861).

Notioxenus ferrugineus, n. sp.

N. ovato-oblongus, angustus, opacus, ferrugineus, pube grossa demissa cinerea dense vestitus; capite prothoraceque confuse et leviter punctato-rugulosis, hujus linea subbasali curvata et valde elevata; elytris punctato-striatis, sutura, linea discali (plus minus interrupta et antice evanescente) necnon margine ipso laterali plus minus obscure nigrescentibus; antennis breviusculis, rufo-testaceis, ad apicem paulo obscurioribus; pedibus crassiusculis, rufo-testaceis.

Long. corp. lin. 1–1½.

This remarkable and most interesting accession to one of the most characteristic of the St.-Helena genera is due, like the other species enumerated in this paper, to the indefatigable researches of Mr. Melliss; and its excessive distinctness from the four other *Notioxeni* which have hitherto been met with induces a similar suspicion in my mind to that which I have already recorded under the equally anomalous group *Microxylobius*, that in all probability many additional exponents remain yet to be detected. At first sight, indeed, it might well nigh be supposed to form the type of a different genus from its allies; but its elevated prothoracic line and the other details of its structure show it to be a true *Notioxenus.*

Compared with the four species which have already been defined, the present one may immediately be known by its narrower and more oblong outline and pale ferruginous hue, the elytra only being obscurely decorated with a darker suture and a more or less interrupted and anteriorly evanescent discal line, both of which are sometimes barely traceable and at others conspicuous. Indeed the outer lateral margin is likewise often blackened; and there are frequently indications of one or two small cloudy dashes placed longitudinally (as though formed by an evanescent broken-up line) on either side of the interrupted discal band. Its antennæ are rather short, and its legs somewhat incrassated; and its entire surface is opaque and densely clothed with a coarse, decumbent, cinereous pubescence. Its head and prothorax are roughened, and its elytra are deeply punctate-striate, the striæ extending from the base to the apex.

(Subfam. Homœoderides.)

Genus Homœodera.

Wollaston, Ann. Nat. Hist. v. 23 (1870).

Homœodera coriacea, n. sp.

H. subovalis, nigra, coriacea, esculpturata (nec punctata, nec striata), subopaca, pube grossa demissa cinerea parce vestita; capite paulo magis nitidulo; elytris subter squamis subcyanescentibus; antennis pedibusque nigrescentibus, illis ad basin clare rufo-ferrugineis, clava paululum compacta.

Long. corp. lin. $\frac{3}{4}$.

A single and rather imperfect specimen of a small *Homœodera*, which was taken at St. Helena by Mr. Melliss, is so very remarkable in its nearly opaque, *coriaceous* surface, and its total freedom from sculpture, that I have no hesitation, even from such scanty material, in describing it as new. The example before me is manifestly a rubbed one, and is consequently almost black (there being merely a slight cyaneous tinge on the elytra); but a few coarse, whitish, decumbent scales would seem to indicate that the species is normally more or less clothed. Its antennæ and legs appear to be dark, the former (of which the club is perhaps somewhat more compact than is usually the case in the allied members of the group) having merely the basal joints rufo-ferruginous.

Fam. **Cerambicidæ.**

Genus Curtomerus.

Stephens, Man. Brit. Col. 269 (1839).

*Curtomerus pilicornis**.

Callidium pilicorne, Fab., Ent. Syst. ii. 327 (1792).
—— *luteum* (Mshm), Steph., Ill. Brit. Ent. iv. 249 (1831).
Curtomerus luteus, Id., Man. Brit. Col. 275 (1839).

Three examples of this pale reddish-brown subcylindrical Longicorn are amongst the St.-Helena Coleoptera which have been submitted to me by Mr. Melliss; and there can be no doubt, I think, that the species has been introduced into the island. They were captured in Jamestown, near the sea, "flying into a house at night;" and Mr. Melliss himself observes that "from its locality the species is probably an imported one." It is the opinion likewise of Mr. Pascoe that it is not truly a native of St. Helena; for he informs me that its proper country is the West Indies, and that it is so liable to accidental transportation (I presume along with timber) that it has been taken alive on one or two occasions even in England. Mr. Pascoe adds that the insect "is very variable in size, and slightly so in the comparative thickness of its femora."

Fam. **Lamiidæ.**

Genus Coptops.

Serville, Ann. de la Soc. Ent. de France, 64 (1835).

*Coptops bidens**.

Lamia bidens, Fab., Ent. Syst. ii. 291 (1792).

This robust *Lamia*-like Longicorn has been captured occasionally by Mr. Melliss in the houses in Jamestown; and he is of opinion that, like the *Curtomerus pilicornis*, it has probably been naturalized at St. Helena. I am indebted to Mr. Pascoe (who equally believes it to have been imported into the island) for identifying it with the *Lamia bidens* of Fabricius.

Fam. **Halticidæ.**

Genus Longitarsus.

Latreille, Fam. Nat. 405 (1825).

Longitarsus Mellissii, n. sp.

L. elongato-ellipticus, obscure æneo-viridis, nitidus; capite fere impunctato; prothorace punctato, utrinque ad latera late transversim biimpresso et distincte marginato, angulis anticis incrassatis subferrugineis, posticis rotundatis; elytris profunde et rugose punctatis, ac distincte marginatis; antennis pedibusque longissimis, dilute testaceis, illis versus apicem et interdum femoribus posticis paulo obscurioribus.

Mas, prothorace sensim nitidiore et minutius punctato, tarsis anterioribus art° 1mo magno, valde dilatato.

Long. corp. lin. $1\frac{1}{2}$.

Obs.—Species *L. Helenæ* affinis, sed certe distincta. Differt corpore majore, magis elongato, nitidiore (nec alutaceo), et paulo obscurius colorato, punctura densiore ac profundiore; prothorace et elytris evidentius marginatis, illo utrinque late biimpresso necnon angulis anticis incrassatis subferrugineis.

Two examples (a male and a female) of this *Longitarsus* have been communicated to me by Mr. Melliss, who remarks that he took them (along with the *L. Helenæ*) from the foliage of native plants, at an elevation of about 2700 feet. It belongs to precisely the same type as the *L. Helenæ*, and resembles it very much also even in colour; nevertheless it is totally distinct from that species. Apart from its larger size and relatively more elongate outline, it is a little obscurer in tint than the *L. Helenæ*, and it is also more shining (its surface *not* being alutaceous), and very much more deeply and closely punctured. Its prothorax and elytra are more broadly margined; and the former (which has the margin at its anterior angles more thickened and slightly ferruginous) is impressed on either side by two broad transverse grooves, which make the surface extremely uneven.

Of the *L. Helenæ* I have seen hitherto only the males, and therefore I cannot tell whether the same sexual distinctions (apart from the enlarged basal joint of the four anterior feet) will hold good in *that* species as appear to do in the present one; but in the *L. Mellissii* the male prothorax is not only more shining, but also less coarsely and less closely punctured than is the case with the opposite sex.

I have had much pleasure in naming this interesting addition to the island fauna after its captor, whose researches at St. Helena, in various departments of natural history, have been so eminently successful.

Fam. **Coccinellidæ.**

Genus Thea.

Mulsant, Species des Sécurip. 206 (1851).

Thea variegata.

Coccinella variegata, Fab., Sp. Ins. i. 99 (1781).
—— *cognata*, Dej., Cat. 457 (1837).
—— *nassata*, Erich., in Wiegm. Archiv, ix. 266 (1843).
Thea variegata, Muls., *loc. cit.* 206 (1851).

Several examples of this pretty Coccinellid were bred by

Mr. Melliss from larvæ which he took from grape-vines at an elevation of about 2000 feet above the sea; and he tells me that the larvæ are occasionally very abundant, under similar circumstances, in various parts of the island. It is a species which occurs at the Cape of Good Hope, and which was recorded by Erichson from Angola; and it is not improbable, therefore, that it may have been introduced into St. Helena from perhaps the former of those localities.

Fam. **Staphylinidæ.**

(Subfam. Aleocharides.)

Genus Homalota.

Mannerheim, Brachél. 73 (1831).

*Homalota coriaria**.

Homalota coriaria, Kr., Nat. der Ins. Deutsch. ii. 282 (1856).
—— ——, Woll., Col. Atl. 469 (1865).
—— ——, Id., Col. Hesp. 223 (1867).

There are several examples of the undoubted European *H. coriaria* amongst the St.-Helena Coleoptera of Mr. Melliss; and, geographically, it is a very interesting addition to the fauna, seeing that there is scarcely any member of the *Staphylinidæ* which has acquired for itself so wide a range throughout the various sub-African Atlantic groups. In the Madeiran and Canarian archipelagos it literally swarms; and we met with it, though more sparingly, in each of the Cape-Verde Islands (six in number) which we had an opportunity of investigating.

(Subfam. Staphylinides.)

Genus Philonthus.

Stephens, Ill. Brit. Ent. v. 226 (1832).

*Philonthus longicornis**.

Philonthus longicornis (Kby), Steph., *loc. cit.* 237 (1832).
—— *scybalarius* et *fuscicornis*, Nordm., Symb. 94, 96 (1838).
—— ——, Woll., Col. Atl. 492 (1865).
—— ——, Id., Col. Hesp. 237 (1867).

Two examples of this common European *Philonthus* have been taken by Mr. Melliss "in flower gardens," at St. Helena, at an elevation of about 2000 feet; and, like the *Homalota coriaria*, they are of considerable interest geographically on account of the wide range which the species has acquired throughout the various Atlantic groups. It is recorded from the Azores by Mr. Crotch; and it has been captured abundantly by myself and others in the Madeiran, Canarian, and Cape-Verde archipelagos; and it was met with by the late Mr. Bewicke even at Ascension.

(Subfam. XANTHOLINIDES.)

Genus XANTHOLINUS.

Dahl, in Encycl. Méthod. x. 475 (1825).

Xantholinus morio, n. sp.

X. linearis, niger, nitidus; capite prothoraceque subtilissime alutaceis, illo parce fortiter punctato, hujus seriebus dorsalibus e punctis 6–7 compositis; elytris confuse et laxe subseriatim punctatis; antennis piceo-fuscis, art^is^ 1^mo^ et 3^tio^ nigrescentioribus; pedibus nigro-piceis.

Long. corp. lin. $2\frac{2}{3}$.

The single example, taken by Mr. Melliss, from which the above diagnosis is compiled has been carefully examined by Mr. Rye, who remarks that it is unknown to him, but might nevertheless perhaps prove to be the European *atratus* of Heer. Judging from the description, however, of that species, it would appear to be not only smaller and blacker than the *atratus*, and with darker limbs, but (as I imagine) to have its head more sparingly punctured, and the dorsal punctures of its prothorax more numerous. In the absence of a type of the *atratus* from which to form a more decided opinion, I feel that it would be extremely unsafe to identify it with the St.-Helena species, and I have consequently enunciated the latter as above.

(Subfam. OXYTELIDES.)

Genus OXYTELUS.

Gravenhorst, Col. Micropt. 101 (1802)

§ I. *Antennarum art^is^ 7 ulterioribus gradatim incrassatis.*

Oxytelus alutaceifrons, n. sp.

O. niger, nitidus, elytris sæpius paulo dilutioribus (plus minus testaceo tinctis), pedibus spinulosis saturate testaceis; capite (subtriangulari) prothoraceque profunde et dense striguloso-punctatis, illo postice canaliculato, antice in medio impunctato grosse alutaceo opaco depresso et anguste marginato, oculis prominentibus sed haud magnis, hoc profunde trisulcato, postice angustato; elytris breviusculis, profunde et dense punctato-strigulosis; antennis nigris, basi vix dilutioribus.

Long. corp. lin. $1\frac{3}{4}$–vix 2.

An *Oxytelus* which is in some respects allied to the European *O. luteipennis* (and less so to the *O. piceus*), but at the same time differing in many important respects from that species. Thus it is not only a little smaller, rather less shining, and more deeply and closely punctured and strigulose, but it is remarkable for its head (instead of being bifoveolated behind; having simply a short channel in the centre, and with the frontal space between the antennæ opaque and coarsely alutaceous, and quite free from even scattered additional punctures. Its prothorax also is less developed, and more narrowed behind, and its elytra perhaps are a trifle shorter. It has been examined by Mr. Rye, who considers it totally distinct from any thing with which he is acquainted. Two examples, which were captured by Mr. Melliss at St. Helena, are all that I have yet seen.

§ II. *Antennarum artis 3 (vix distincte 7) ulterioribus incrassatis.*

Oxytelus nitidifrons, n. sp.

O. nitidus, capite piceo-nigro, prothorace elytrisque rufo-ferrugineis, his postice obscurioribus, abdomine rufo-brunneo postice obscuriore, pedibus minus spinulosis rufo-testaceis; capite prothoraceque brevibus, transversis, confuse et vix dense rugoso-punctatis, illo antice in medio impunctato nitido (vix alutaceo) convexo, a fronte conspicue transversim diviso, oculis haud prominentibus et sat parvis, mandibulis elongatis porrectis rufo-ferrugineis, hoc confuse trisulcato (sulcis exterioribus postice evanescentibus), postice vix angustiore; elytris brevibus, profunde et dense punctato-strigulosis; antennis brevibus, nigris, basi clare rufo-ferrugineis.

Long. corp. lin. vix $1\frac{1}{2}$.

A most extraordinary little *Oxytelus*, which, from its abbreviated head and prothorax, and the fact of its antennæ having the *three* apical joints (rather, perhaps, than the usual seven) conspicuously thickened, might seem at first sight almost to merit generic separation. In many respects, however, it is a good deal on the same type (particularly in colour and the large development of its mandibles) as the *O. insignitus*, an American species which has established itself in the Madeiran group; but (judging from the single type now before me, which was taken by Mr. Melliss) it is apparently a little smaller than that insect, and its head, prothorax, and elytra are all of them shorter and less developed. Its mandibles are elongated, pallid, and porrect, as in the *insignitus*; but its prothorax (which is not only more abbreviated, but less narrowed behind) has its outer grooves more confused and posteriorly evanescent; and its clypeal space, between the antennæ, is not only unpunctured and more polished, but is more evidently separated from the head by a transverse basal line. In its rufo-ferruginous prothorax and elytra it is *nearly* the same as that species; but the latter seem to have their hinder region, particularly about the outer angles, clouded or darkened. Its eyes also are smaller, and more *frontal* in position.

CATALOGUS SYSTEMATICUS (*auctus*).

CARABIDÆ.
Haplothorax, Waterh.
1. Burchellii, *Waterh.*
Calosoma, Weber.
2. haligena, *W.*
3. Helenæ, *Hope.*
Pristonychus, Dej.
4. complanatus, *Dej.*
Bembidium, auct.
5. Mellissii, *W.*

SPHÆRIDIADÆ.
Dactylosternum, W.
6. abdominale, *Fab.*
Sphæridium, Fab.
7. dytiscoides, *Fab.*

NITIDULIDÆ.
Carpophilus, Steph.
*8. dimidiatus, *Fab.*
*9. hemipterus, *Linn.*

TROGOSITIDÆ.
Trogosita, Oliv.
*10. mauritanica, *Linn.*

CUCUJIDÆ.
Læmophlœus, Erichs.
*11. pusillus, *Schön.*
Cryptamorpha, W.
12. musæ, *W.*
Silvanus, Lat.
*13. surinamensis, *Linn.*

CRYPTOPHAGIDÆ.
Cryptophagus, Hbst.
*14. badius, *St.*
*15. affinis, *St.*
*16. gracilipes, *W.*

MYCETOPHAGIDÆ.
Mycetæa, Steph.
*17. hirta, *Gyll.*
Typhæa, Steph.
*18. fumata, *Linn.*

DERMESTIDÆ.
Dermestes, Linn.
*19. cadaverinus, *Fab.*
*20. vulpinus, *Fab.*
Attagenus, Lat.
*21. gloriosæ, *Fab.*

HISTERIDÆ.
Tribalus, Erichs.
22. 4-striatus, *W.*
Saprinus, Erichs.
23. lautus, *W.*

APHODIADÆ.
Aphodius, Illig.
*24. lividus, *Oliv.*

RUTELIDÆ.
Adoretus, Castln.
25. versutus, *Harold.*

DYNASTIDÆ.
Heteronychus, Burm.
26. arator, *Fab.*
Melissius (Bates), W.
27. eudoxus, *W.*
28. adumbratus, *W.*

ELATERIDÆ.
Anchastus, Lec.
29. atlanticus, *Cand.*

CLERIDÆ.
Corynetes, Hbst.
*30. rufipes, *Thunb.*

PTINIDÆ.
Gibbium, Scop.
*31. scotias, *Fab.*

ANOBIADÆ.
Anobium, Fab.
*32. velatum, *W.*
*33. paniceum, *Linn.*
*34. striatum, *Oliv.*
*35. confertum, *W.*

BOSTRICHIDÆ.
Rhizopertha, Steph.
*36. bifoveolata, *W.*
*37. pusilla, *F.*

TOMICIDÆ.
Tomicus, Lat.
38. æmulus, *W.*

HYLESINIDÆ.
Hylurgus, Lat.
*39. ligniperda, *Fab.*

CURCULIONIDÆ.
(Cossonides.)
Stenoscelis, W.
40. hylastoides, *W.*
Microxylobius, Chevr.
41. Westwoodii, *Chevr.*
42. vestitus, *W.*
43. lacertosus, *W.*
44. dimidiatus, *W.*
45. lucifugus, *W.*

Microxylobius, Chevr.
46. terebrans, *W.*
47. obliteratus, *W.*
48. debilis, *W.*
49. angustus, *W.*
50. cossonoides, *W.*
(*Acanthomerus*, Boh.)
51. armatus, *Boh.*
52. conicollis, *W.*
53. monilicornis, *W.*
Pentarthrum, W.
54. subcæcum, *W.*

(Rhynchophorides.)
Sitophilus, Schönh.
*55. oryzæ, *Linn.*

(Synaptonychides.)
Nesiotes, W.
56. horridus, *W.*
57. squamosus, *W.*
58. asperatus, *W.*

(Trachyphlœides.)
Trachyphlœosoma, W.
59. setosum, *W.*

(Otiorhynchides.)
Sciobius, Schönh.
60. subnodosus, *W.*
Otiorhynchus, Germ.
*61. sulcatus, *Fab.*

ANTHRIBIDÆ.
Aræocerus, Schönh.
*62. fasciculatus, *De Geer.*
Notioxenus, W.
63. Bewickii, *W.*
64. rufopictus, *W.*
65. dimidiatus, *W.*
66. alutaceus, *W.*
67. ferrugineus, *W.*
Homœodera, W.
68. rotundipennis, *W.*
69. alutaceicollis, *W.*
70. pygmæa, *W.*
71. coriacea, *W.*

BRUCHIDÆ.
Bruchus, Geoffr.
72. rufobrunneus, *W.*
73. advena, *W.*

CERAMBICIDÆ.
Curtomerus, Steph.
*74. pilicornis, *Fab.*

LAMIIDÆ.
Coptops, Serv.
*75. bidens, *Fab.*

HALTICIDÆ.
Longitarsus, Lat.
76. Mellissii, *W.*
77. Helenæ, *W.*

CASSIDIDÆ.
Aspidomorpha, Hope.
78. miliaris, *Fab.*

COCCINELLIDÆ.
Cydonia, Muls.
79. lunata, *Fab.*
Thea, Muls.
80. variegata, *Fab.*
Epilachna, Chevr.
81. chrysomelina, *Fab.*

HOPATRIDÆ.
Hopatrum, Fab.
82. hadroides, *W.*

ULOMIDÆ.
Alphitobius, Steph.
*83. diaperinus, *Kugel.*
*84. piceus, *Oliv.*
Gnathocerus, Thunb.
*85. cornutus, *Fab.*
Tribolium, MacLeay.
*86. ferrugineum, *Fab.*

TENEBRIONIDÆ.
Tenebrio, Linn.
*87. obscurus, *Fab.*
Zophobas, Blanch.
88. concolor, *W.*

MORDELLIDÆ.
Mordella, Linn.
89. Mellissiana, *W.*

STAPHYLINIDÆ.
(Aleocharides.)
Homalota, Mann.
*90. coriaria, *Kr.*

(Staphylinides.)
Philonthus, Steph.
*91. longicornis, *Steph.*
Creophilus, Steph.
*92. maxillosus, *Linn.*

(Xantholinides.)
Xantholinus, Dahl.
93. morio, *W.*

(Oxytelides.)
Oxytelus, Grav.
94. alutaceifrons, *W.*
95. nitidifrons, *W.*

L.—*On the Early Stages of* Terebratulina septentrionalis (*Couthouy*). By Edward S. Morse, Ph.D. &c.*

[Plates XV. & XVI.]

There is hardly a group among the lower animals (if we consider the relatively small number of species represented by it) that has attracted the attention of so many naturalists as the Brachiopoda. The names of Cuvier, Owen, Vogt, Huxley, Hancock, Gratiolet, Lacaze-Duthiers, Bouchard-Chantereaux, Müller, Davidson, Carpenter, King, D'Orbigny, and a host of others are sufficient evidence of the interest felt in a group whose organization links them so closely with the past.

The desire to interpret, through a knowledge of its living forms, the many species which are now extinct, as well as to ascertain the relations it bears to the other divisions of the animal kingdom—the contemplation of a group whose maximum development in genera and species was attained in the Devonian age, though its representatives are strewn through the rocks of all ages since the dawn of life upon the globe—the remarkable fact that among the earliest forms of organic life known are genera whose species can hardly be distinguished from present existing forms—all explain the attractions its study has afforded alike to zoologists and palæontologists.

The splendid memoirs upon the Brachiopoda by some of the authors just mentioned, more particularly those of Albany Hancock†, Vogt, and Gratiolet, offer but little encouragement to one entering the field with the expectation of gleaning any thing new. While, however, the anatomy and histology of the adult animal of several species has been carefully worked up, little or nothing has been done toward elucidating the embryology or the early stages of the class. Fritz Müller‡ has given in a short note a description and two figures of what he considers an early stage of a species of *Discina*; and Lacaze-Duthiers § has made some extremely interesting observations on the embryo of *Thecidium*. Apart from these two papers, we know of nothing whatsoever relating either to the embryology or the early stages of the Brachiopoda. The importance and necessity of some information regarding the embryology of these animals has been urged by many writers;

* From the 'Memoirs of the Boston Society of Natural History,' vol. ii. Communicated by the Author.

† "On the Organization of the Brachiopoda," Phil. Trans. Roy. Soc. Lond. 1858, vol. cxlviii. part 2.

‡ Reichert und Du Bois-Reymond's Archiv für Anat., 1860, p. 72.

§ "Histoire de la *Thécidie*," Ann. des Sc. Nat. sér. 4. tome xv. p. 262.

for it was believed that the relations between them and the Polyzoa, as urged by Agassiz, Milne-Edwards, Huxley, Hancock, Dana, and others, would be verified when the development of the Brachiopoda was known. In this path of inquiry the investigator will find an open field.

For a long time I have been interested in the relations of the class under consideration, and in an early paper, entitled "Hæmal and Neural Regions of Brachiopoda"*, and later, in a paper "on the Classification of Mollusca, based on the Principle of Cephalization"†, urged the intimate relations existing between the Brachiopoda and Polyzoa. With the hope of learning something about the early stages of one of our native species of Brachiopods, I visited Eastport, Maine, in the early part of June 1869; and this communication embraces a summary of the incomplete observations there made —incomplete, as I was unable to secure any data on the embryology of the species. At the outset my microscope proved altogether inadequate to the work before me, though the minute size of the objects examined, coupled with the complicated texture of the shell through which the soft parts had to be observed, rendered the work at the best laborious and difficult. In every case, however, the figures given in the accompanying plates are correct transcripts of the drawings made from the animal: in no instance is there given any combination of several unfinished sketches to make a more intelligible or perfect whole. This will explain the absence of detail and completeness in many of the figures presented; at the same time it is believed that the outlines will be more valuable from the fact that they are not schematic or composite.

For a clear exposition of the organization of the Brachiopoda, I would refer to the exhaustive memoir of Albany Hancock above referred to—a memoir which justly merited the honour conferred upon him in the award of the Royal medal.

On the Early Stages of Terebratulina septentrionalis, *Couthouy*‡.—The specimens upon which the following examinations were made were dredged in fifteen-fathoms water in the harbour of Eastport, Maine, in the first week of June 1869. The species occurs in great numbers at various depths, and has also been collected at low-tide mark, by Dr. Stimp-

* Proc. Boston Soc. Nat. Hist. 1862, vol. ix.

† Proc. Essex Instit. Salem, 1865, vol. ix. part 6. Also reprinted in Amer. Journ. Sc. & Arts, 1866, vol. xlii. no. 124.

‡ A brief *résumé* of this paper was published in the 'American Naturalist,' 1869, Sept. No. vol. iii. Since reprinted in Amer. Journ. Sc. and Arts for Jan. 1870.

The general results were communicated at the 18th Annual Meeting of the American Association for the Advancement of Science, Aug. 1869.

son and Prof. Verrill. The specimens were found attached to stones brought up in the dredge, and also adhering to the lower valve of adult individuals, generally near the peduncle. An examination of adult individuals showed that while the ovaries in some specimens were empty, in others they were fully charged; in some the ovaries would be partially empty, in others the ovaries of one side would be nearly empty while those of the other side would be quite full. Specimens collected by Prof. Verrill in August were found with eggs; and eggs were also noticed in specimens less than three sixteenths of an inch in length. The eggs (Pl. XV. fig. 1) were generally kidney-shaped, though very irregular as to form and size; they were spermaceti-white in colour, and opaque, though having a central area translucent and apparently depressed. In general outline they suggest the kidney-shaped eggs of *Fredericella*. No intermediate stage was observed between the ovarian egg and the stage represented in fig. 2. This form recalled the general proportions of *Argiope* and *Megerlia*, in being transversely oval, in having the hinge-margin wide and straight, and in the presence of a proportionally wide foramen. This stage was exceedingly minute; and only two individuals were discovered; they were attached to the rock, resting on the broad hinge-area. Nothing could be traced of the structure, except an appearance of granular contents, as indicated in the figure; the shell showed nothing of the scale-like structure so characteristic in later stages. Between this stage and the next (fig. 3) the shell rapidly elongates, while the hinge-margin remains nearly the same in width; this is also shown in the concentric lines of growth seen faintly on the surface, indicating a rapid increase in the length of the shell, while no corresponding increase takes place in the widening of the hinge-margin. The peduncle is longer than the shell, having distinct walls apparently enclosing a clear interspace, the end slightly dilating and forming a pear-shaped adhering disk. The structure of the shell, of which more will be said in subsequent pages, showed clearly the scale-like structure, with the cæcal tubules of the pallial lobes perforating it. The anterior margin of the pallial lobes gave rise to seven setæ of variable lengths, all of them projecting forward. These setæ, in nearly all instances, were clothed with Desmids, and were probably available in attracting sustenance to the animal; they resembled in structure the setæ of the adult, as figured by Hancock; and the longest of them was as long as the shell. The future position of the calcareous loop was indicated by a strongly arched process midway the length of the shell, from which sprang six short and stout cirri, all of them curving towards the mouth, which occupied the centre of the base from which the cirri sprang. The digestive sac hung from the mouth, and was twice as long as broad, having a strong constriction in the centre, forming two chambers, the lowermost one being globular in shape and having its walls coloured a light reddish brown, this coloured portion evidently indicating hepatic cells. The cavity next the mouth indicates the stomach, while the lowermost cavity indicates the future intestine or *cul-de-sac*. The cirri moved frequently and in various directions, though generally performing a grasping motion, as if securing some bit of food, imitating precisely the movement of the cirri in Polyzoa; and this resemblance was more complete from the fact that the tentacles were densely clothed with cilia (fig. 4), and their movements caused visible currents in the water. The two cavities of the digestive sac were also ciliated; and little pellets of food were seen rapidly circulating back and forth from one cavity to the other. The cavities were alternately dilating and contracting. At this stage the lower cavity of the digestive sac was diverted to the larger valve, as represented in fig. 4.

In this stage, and several succeeding stages, the outline of the shall is remarkably like that of *Lingula*; and this resemblance is more striking from the proportionally long peduncle.

In another stage, numerous irregular-shaped calcareous spicula lined the outer margin of the cirri, while the future position of the calcareous loop, or crura, was indicated by a row of irregular-shaped spicula.

Fig. 8 represents portions of two cirri highly magnified, in which correct outlines are given of the spicula. It is by the presence of these calcareous particles that we must account for a certain rigidity noticed in the texture of the cirri. In these slightly advanced stages the peduncle becomes much shorter in proportion to the length of the shell, though the shell presents the same *Lingula*-like form, differing, however, from *Lingula* in the much greater length of the neural valve, which is always perforated and rostrated from the outset.

In all these stages the peduncle has very slight adhesion to the rock or whatever substance it may be attached to, in this respect differing greatly from the adult, which often requires great force to detach it, frequently leaving the peduncle separated from the body and adhering to the rock.

In side views of the shell at this period (see fig. 5) the flatness of the valves will be observed, again resembling *Lingula* in this respect; the under valve is much flatter than the upper one. I was fortunate in observing an individual at this age in motion. The animal whirled quickly on its peduncle; when at rest the shells were always closed, and rested on the rock; from this position it turned slowly more than halfway round, raising the body at the same time almost erect; this movement being completed, the valves would very slowly open, and the cirri expand as if to perform a grasping motion; in no case, however, were they projected beyond the margin of the valves. The cilia lining the cirri produced gentle currents in the water. In this position, with the valves widely open and cirri expanded, the animal would remain motionless for twenty or thirty seconds, and then, with an abrupt closing of the valves, suddenly assume its first position. These two positions are represented in fig. 5, where the animal is seen from the side, and in fig. 6, where it is seen from above. The outline marked A represents the shells closed and at rest, while B represents the shells open.

In watching these motions for a long time, one could not help being impressed with the fact that caution was evidently indicated in the slow and careful movements made in elevating and opening the shell, while the prompt closing of the valves, and the alert manner in which the animal regained its first position, seemed to show that food had been secured and further caution was unnecessary.

In another stage (fig. 7) the tentacles were seen of various lengths, some of them just budding from the lophophore. A fold upon each side of the stomach was first noticed; these folds are the first appearance of the liver. At this time the hepatic folds expand and contract independently of each other.

In another view of the same individual the upper portion of the digestive sac, or that portion which answers to the œsophagus and stomach, was in a contracted state, while the lower portion was widely expanded. A peculiar constriction appears at times between the two chambers of the digestive sac, which recalls the cardiac or œsophageal valve as seen in the Phylactolæmatous Polyzoa; it has no coniform projection into the stomach, and really appears more distinctly as an annular dilatation. All traces of it disappeared during certain expansions and contractions of the gastric walls. All portions of the sac and the lateral folds were strongly ciliated; and the food, now gathered into round pellets and again scattered in granules, was violently impelled back and forth.

In an alcoholic specimen there was first seen a set of muscles, rendered visible by their contraction in alcohol and consequent greater density. They were probably the divaricator muscles, though somewhat in advance of what their position would be in the adult state.

Owing to the contraction of the digestive sac, its diverticular cavities were sharply defined, and the globular appearance of the lower cavity was marked. In another alcoholic specimen of the same age, a band, evidently one of the lateral gastro-parietal bands, was made out. As this could not be verified in other specimens of the same age, the figure is not given.

A still more advanced stage is shown in fig. 12. The shell is now becoming proportionally broader; and the cirri increase in number, though still forming a simple circle around the mouth. The crura have also begun to form.

In fig. 13 a considerably more advanced state is shown. The valves have been forcibly separated, and the smaller one is thrown back. The cirri are more numerous, numbering thirty-one; two of them are seen encroaching upon the circular lophophore; and at this stage the lophophore has begun to assume its hippocrepidan character.

The crura (*cr*) are plainly seen supporting the crown of cirri; and the liver already shows the first indications of its differentiation into the peculiar cæcal ramifications which become so numerous in the adult; and at this stage is seen the division of each lateral portion of the liver into a dorsal and a ventral lobe. The liver is divided into a series of cæca, though these are united.

The divaricators (*d*) are completely formed; and between these two muscles is seen the lengthened intestine, the blind extremity of which is held firmly to the shell by a membrane, called by Hancock the ventral mesentery.

The appearance of the shell at this stage is represented in fig. 16. Radiating ribs, to the number of fifteen, ornament the shell. It will be seen by this figure that the setæ correspond in growth and position to the radiating furrows; and this observation is also made by Hancock in his examination of the adult. A well-defined concentric line seems to indicate the earlier *Lingula*-shaped shell; and though no ribs appear in the earlier stages, they are defined upon this area afterwards; and it would appear from this that the ribs are formed on the inner surface, and that the setæ direct and induce the furrow. The lobes of the liver (*l*) and the peduncle (*p*) and peduncular capsule are shown in this figure.

In fig. 14 a stage still more advanced is given; the valves are thrown back, disclosing the stomach and intestine suspended from the calcareous loop. The crura (*cr*) are well defined; and the ventral mesentery (*v m*) is more distinctly seen in this figure. Two lateral bands are seen holding the stomach in position; and these appear to be attached to the crura, though they probably pass by them and become attached to the hæmal valve. These are the lateral gastro-parietal bands, first described by Huxley.

The walls of the blind intestine are yet light brownish in colour, as in the Phylactolæmata, and, as before remarked, are hepatic. A kidney-shaped area is faintly defined on the neural valve. A portion of this outline indicates the point of attachment of the perivisceral wall.

In fig. 14 *a* an enlarged view of the digestive sac and adjacent parts of fig. 14 is shown. The liver in this stage communicates with the stomach by large openings on each side; and fine granules were seen rapidly circulating to and fro from the liver to the stomach. The fæces, rolled into a spiral and pyriform shape, were constantly in motion by the action of the cilia lining the stomach. This mass was frequently urged toward the mouth before it was finally discharged. The passage of the fæces through the mouth was repeatedly witnessed, though, after the careful investigations of Huxley, Hancock, Lacaze-Duthiers, and Gratiolet, no further proof is needed of the absence of an anal outlet to the intestine of this and allied species.

The experiments of Mr. Hancock, such as bursting the intestines under a compressor, were performed on many living adult specimens, yet in no case was the slightest evidence of an anal outlet observed.

Fig. 15 represents a stage but slightly advanced from fig. 14. The cirri are more numerous, but still spring from a circular lophophore.

Fig. 17, Pl. XVI., represents a considerably advanced stage, in which the lophophore, before circular, has rapidly assumed its hippocrepidan character—rapidly, since forms nearly of the same size show no marked indications of change; for in one example we may have a circular lophophore, or one showing but slight indentation, while in another example, hardly differing in size, we have the lateral processes well advanced in development. It is possible that we may have here a feature observed by Fritz Müller in the young *Discina* described by him: he mentions the remarkable fact of having repeatedly captured free-swimming young which had evidently advanced further in their development than the oldest of those which had already fixed themselves. It will be noticed that in this stage (fig. 17) the cirri stand erect upon the arms (that is, pointing towards the anterior margin of the shell), and that the arms are not deflected. This stage of the lophophore vividly recalls the hippocrepidan forms among the Polyzoa, such as *Plumatella*, *Cristatella*, *Lophopus*, and others.

The liver now shows its adult characters in having its ramified cæca separated and not adhering by their walls in one mass. In this early condition it resembles the liver of *Thecidium*, as described and figured by Lacaze-Duthiers.

Fig. 18 represents a stage where the arms become deflected; as yet no central process of the lophophore is developed; the mouth is very large, and that margin of it not bearing cirri is very pliant in its movements.

In the next stage (fig. 19) the arms are more deflected and make a sharper curve in their approach together, and the central process of the lophopore is indicated by that portion forming the base of the inner curve developing into two prominences. The free lip is seen in irregular curves, and these changed with every movement of the parts.

Fig. 20 represents a slightly more advanced stage, where the central processes of the lophophore are more developed. The free lip is here seen thrown broadly back, disclosing a capacious mouth, within which are seen two blunt projections, though in another view of the mouth only one projection was observed. The free lip seemed to perform all the functions pertaining to the epistome in the higher Polyzoa; and we find it on the inner bend of the arms, as in the Polyzoa, though not occupying the same homological position with regard to the flexure of the intestine. It will be noticed that in all these stages the cirri are comparatively thick.

In the stage represented by fig. 21, the cirri become more attenuated and increase rapidly in number; the central process is more advanced, though not yet thrown into a vertical spiral, as in the adult; and the mouth has lost the broad reflected character of the lip which it possessed in the earlier stages, though the free lip has yet considerable pliancy. For the first time now appears another adult character, in the apparent decrease in the length of those cirri in the median line of the mouth.

In fig. 22 the mouth of an adult individual is shown, with the cirri. In this view the oral tubercle (*ot*), as it may be called, is strongly marked. The same projection is represented in the mouth of *Thecidium mediterraneum* as figured by Lacaze-Duthiers. A singular lunate groove, running parallel with the free lip, is indicated in the figure, which may be called the oral groove (*o g*). It seems more like a wrinkle caused by the expansion of the free lip, though its limits are well defined and the furrow is quite deep.

The independent movements of the cirri are shown in fig. 22; these are just as pliant in their movements as those of the extreme young, and at all times recall the motions of the cirri in the Polyzoa.

Structure of the Shell.—In the younger stages of the shell the peculiar scale-like structure may be studied to the best advantage. The scales are few in number, but slightly overlapping, and form a layer quite distinct from the outer layer, which appears to be homogeneous, save the concentric lines of growth appearing like rows of oblong and flattened nodules. The terminal portions of the pallial cæca within or upon this outer layer are brown in colour and distinctly granulated. I failed to make out any thing satisfactory regarding the character of these peculiar parts. In a few doubtful cases I thought I saw one or two tubules radiating from the terminal ends of the cæca; and in fig. 23 *a* one observation is represented. It will be seen by this that the tubules radiate from the largest diameter of the cæca, and not from the periphery of the granulated disk; and this is in accordance with the admirable observations made by King*. The scales do not appear to encroach upon the walls of the cæca.

Fig. 23 shows a small fragment of the shell at an early stage; portions of five scales are here seen forming the inner layer of the shell. In the earlier stages, when they are large and few in number, the scales are flat, now and then showing a raised line caused by the encroachment of two superincumbent scales, between which the under scale is closely adjusted. This may be seen in fig. 24, where the end of a scale is broken and shown in section. As the shell increases in age, the scales become more attenuated; and now the scale is diverted wherever it encounters a cæcal process, and forms a yoke or loop around it.

In the young state a few spicula at the base of the cirri mark the commencement of the calcareous loop. At a later stage the spicula increase rapidly in number, and finally anastomose, appearing as in fig. 25. The scales composing the base of the crura are acicular in shape, and run parallel with the crural axis. In adult specimens the scales of the crural supports resemble acicular crystals, and, when boiled in a solution of caustic potash, glisten and separate, resembling the fibres of asbestos.

Fig. 27 represents the crural process of one side, taken from a specimen less than an eighth of an inch in length; it exhibits the first stages of the loop. The acicular scales are shown

* Prof. W. King "On the Histology of the Test of the Class Palliobranchiata," Transactions of the Royal Irish Academy, 1869, vol. xxiv. pt. 11.

at the base, while the remaining portion is made up of scales similar to those composing the shell. From an extremely young specimen I observed these same peculiar acicular scales (fig. 26); and they probably indicate the presence of the crura.

Nothing of a satisfactory nature was made out regarding the structure of the shell in the earliest stage (fig. 2, Pl. XV.)—though, had the shell possessed the peculiar scale-like structure and cæcal perforations, they would have been visible.

Growth of the Shell.—Figs. 9, 10, and 11, Pl. XV., severally show portions of the hæmal valve, neural valve, and the valves connected, from an early Linguliform stage. In fig. 9 the hinge-plate (*h p*) and the dental socket (*d s*) are well marked; in the earlier stages of their development the crura appear as slight projections. In fig. 10 the prominence of the so-called teeth of the shell (*te*) is shown.

Fig. 11 represents the valves joined; the cæca are seen perforating the entire margin of the shell about the foramen, which is very wide and rudimentary.

On Pl. XVI. a series of stages are given to show the gradual development of the crura and parts surrounding the foramen. The upper line of figures in this series, marked N, represents the neural or ventral valve; and the lower line of figures, marked H, represents the hæmal or dorsal valve. In the youngest of these stages, figs. 28 and 29, a broad gap in the neural valve indicates the peduncular foramen. It will be seen that the shell is folded upon each side of the peduncular passage. These folds never meet in this species.

Figs. 30 and 31 show a slightly more advanced stage, the difference being mainly in the greater prominence of the crura.

In the next stage, figs. 32 and 33, the calcareous loop is well advanced, though not yet connected by a continuous shelly layer, although at all stages these portions are connected by a membrane charged with spicula. Figs. 34 and 35 represent similar portions of an adult shell for comparison. It will be seen that the neural process of the loop becomes connected, while the hæmal process does not become so connected, though in some specimens it closely approximates. The peduncular opening becomes more circular; and the cardinal process (*c p*), which does not appear in the earlier stages, is now present.

In the early stages the shell is as long as it is broad, and the hinge-margin represents the greatest transverse diameter of the animal. Later the shell elongates, with the sides nearly parallel, and the peduncular opening wide and gaping. In a stage intermediate between the Linguliform and the adult the peduncular opening is more contracted, the sides of the shell are no longer parallel, though the hinge-margin has nearly the same outline as in the first stage. In the adult shell the outline assumes entirely different proportions, being nearly oval, while the hinge-margin forms a sharp angle, and the foramen is quite circular.

Relations with the Polyzoa.—The general affinities of the Brachiopoda with the Polyzoa, as indicated by Milne-Edwards, Huxley, Hancock, Agassiz, Hyatt, and others, are admitted by most zoologists.

In the preceding examinations of the early stages of *Terebratulina* we have additional evidence of their relationship. In the evolution of the lophophore, from its circular character, surmounted by a few cirri, to that of the hippocrepidan stage, we have suggested, first, the circular lophophore in the inferior or Gymnolæmatous Polyzoa, and, finally, the bilateral lophophore of the superior or Phylactolæmatous Polyzoa. The brachial fold, a delicate membrane bordering the lophophore, immediately within which the cirri spring, as seen in *Lingula* and *Discina*, may properly be compared to the calice in the higher Polyzoa. Still later, the presence of a distinct fold bordering the mouth, very pliant and active, may be compared as to function and position to the epistome of the Polyzoa, though not occupying a homological position with regard to flexure of intestine. It would appear that the membranes suspending the stomach and intestine in the perivisceral cavity have some relation to the funiculus in the Polyzoa. In *Paludicella* there are two flexible cords connecting the stomach and the endocyst, called by Allman the anterior and posterior funiculus, to which are attached respectively the ovary and testis. In *Lingula* and *Discina* we find the reproductive organs attached to bands that connect the stomach and intestine to the perivisceral wall. In *Alcyonella* the ovary arises from the endocyst; and likewise in *Terebratulina* and allied genera we find the mantle, or endocyst, holding the reproductive organs.

The early appearance of the divaricator muscles in *Terebratulina* would justify Mr. Hyatt in his views that these muscles represent the retractors of the Polyzoa*.

The combination of the stomach and intestine in their early stages, with the presence of hepatic cells lining their inner walls, and the presence also of a cardiac valve or constriction, all recall similar parts in the higher Polyzoa.

That these relations may be carried further there is no reason to doubt. Fritz Müller has noted in an early stage of

* A. Hyatt, "Observations on Polyzoa, suborder Phylactolæmata," Proc. Essex Instit. vols. iv. & v. Salem, Mass.

some species of *Discina* (though, from observations I have made on *Lingula pyramidata*, the embryos examined by him are as likely to belong to this genus as to *Discina*) several sets of setæ which project from the body and are capable of locomotion. F. A. Smitt* has noticed in the development of *Lepralia Peachii* a cluster of six bristles, bent at their points, that from time to time were drawn in and again thrust out.

With propriety may also be suggested a certain parallelism between the leading groups of the Polyzoa and the Brachiopods. We have forms, like *Lepralia*, attached by one region of their shell, this shell being calcareous and exhibiting minute punctures, which have been compared to similar markings in certain Brachiopods. So, among the latter group, do we find forms attached, as in *Thecidium* and some species of *Productus*; and generally the articulate Brachiopods might be compared to such forms as *Lepralia*; while, on the other hand, such genera as *Pedicellina*, with its long, pliant, and muscular stalk, or *Loxosoma*, with a stalk highly retractile, may be compared to *Lingula*. The limits or intentions of this paper will not allow any considerations regarding the relations of the Brachiopods with the other groups of the animal kingdom. I have elsewhere † expressed my belief that they are true Articulates, having nearer affinities with the Vermes; and, in view of the above relations of the Brachiopods with the Polyzoa, it is interesting to remark that Leuckart has for a long time placed the Polyzoa with the Vermes; and in a new edition of the 'Outlines of Comparative Anatomy'‡, Prof. Carl Gegenbaur removes the Polyzoa from the Mollusca and associates them with the Vermes.

EXPLANATION OF THE PLATES.

In the accompanying figures *m* designates the mouth; *e*, epistome: *œ*, œsophagus; *s*, stomach; *c*, cardia; *i*, intestine; *f*, fæces; *vm*, ventral mesentery; *l*, liver; *h*, hepatic cells; *og*, oral groove; *ot*, oral tubercle; *d*, divaricator muscles; *lb*, lateral gastroparietal bands; *p*, peduncle; *pa*, point of attachment of peduncle; *se*, setæ; *cm*, pallial cæcum; *t*, cirri; *g*, granules passing to and fro from liver to intestine; *cr*, crura; *cl*, calcareous loop; *ex*, external shell-layer, of a chitinous nature; *in*, internal shell-layer, of calcareous scales; *hp*, hinge-plate; *cp*, cardinal process; *ds*, dental sockets; *fo*, foramen; *te*, teeth of shell; *cs*, calca-

* "Om Hafs-Bryozoernas utveckling och fettkroppar," Œfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar: Stockholm, 1865.

† "The Brachiopoda a Division of Annelida," American Journ. Sc. July 1870; reprinted in Ann. & Mag. Nat. Hist. ser. 4. vol. vi. no. 33.

‡ Grundzüge der vergleichenden Anatomie. Zweite umgearbeitete Auflage. Leipzig, 1870.

reous spicula; *cn*, notch for pallial cæca; H, hæmal valve; N, neural valve.

PLATE XV.

Fig. 1. A few eggs in their natural position, from the pallial membrane of an adult individual.

Fig. 2. Earliest stage noticed. This was attached to rock, resting upon the broad hinge-margin.

Fig. 3. Another stage, in which the body has rapidly lengthened, and the peduncle is equal in length to the remaining portion of the animal.

Fig. 4. Stage in which a few cirri are developed, with the œsophagus and stomach hanging below.

Fig. 5. The animal at rest and in action.

Fig. 6. The same, from above, reversed.

Fig. 7. A more advanced state, with the liver as a simple hepatic fold on each side of the stomach.

Fig. 8. Portions of two cirri, highly magnified, to show more plainly the form of the spicula.

Fig. 9. A portion of the hæmal valve.

Fig. 10. A portion of the neural valve.

Fig. 11. The same portions before separation.

Fig. 12. A slightly more advanced stage, showing the crown of cirri.

Fig. 13. A still more advanced stage, with the hæmal valve forcibly thrown open, showing the divaricator muscles with the stomach between them. The crown of cirri shows the first indications of its bilobed character.

Fig. 14. A stage more advanced; valves forcibly opened, showing all the parts plainly.

Fig. 14 *a*. A highly magnified view of the stomach, hepatic folds, lateral bands, &c. of fig. 14. This figure shows a fæcal mass rolled in a spiral form, in the act of being discharged through the mouth. The line bordering the upper portion of the figure indicates the inferior margin of the crural processes.

Fig. 15. The hæmal valve, with the crown of cirri &c.

Fig. 16. A view of fig. 13 with the valves closed.

PLATE XVI.

Fig. 17. A stage considerably more advanced than the preceding ones, showing the lophophore already bilobed, but with the cirri not deflected. Cæcal lobes of the liver few, but separated.

Fig. 18. Showing the lophophore with the cirri deflected.

Fig. 19. The arms of the lophophore more sharply bent; the central processes first indicated. The highly flexible lip is here seen in folds.

Fig. 20. A stage slightly more advanced than the preceding. The lip is seen thrown back, disclosing the capacious mouth.

Fig. 21. A stage more advanced, in which the lophophore begins to assume the characters of the adult. The cirri are now more numerous and more attenuated, and the lip is not so widely reflected.

Fig. 22. View of the mouth of an adult individual, showing the oral tubercle and oral groove.

Fig. 23. Fragment of shell, highly magnified, showing scales, tubules, and outer layer, with lines of accretion indicated by rows of flattened bead-like nodules.

Fig. 23 *a.* Exterior portion of tubule, showing radiating pores.
Fig. 24. Single scale, broken across, and showing ridge in section.
Fig. 25. Portion of crural process from early stage.
Fig. 26. Acicular scales from early stage.
Fig. 27. Right crural process from early stage.
Figs. 28, 29, 30, 31, 32, 33. Portions of hæmal and neural valves of early stages, showing development of crura.
Figs. 34, 35. Corresponding parts of adult, natural size.

LI.—*Notes on the New-Zealand Eared Seal* (Phoca ursina, *Forster*; Arctocephalus Forsteri, *Gray*). By Dr. JAMES HECTOR, F.R.S.

(In a letter to Dr. J. E. GRAY, F.R.S. &c.)

I ENCLOSE a description of the skull of a full-grown male seal taken in Milford Sound.

Palate moderately concave, narrowed in front, most expanded opposite to the last molars, and again contracted to a deep posterior notch bounded by a truncate semicircular margin, the position of which is opposite to the middle of the zygomatic arch.

	inches.
Length of skull along base	9·6
Length of palate	4·5
Width of palate at first molar	1·2
,, ,, at fifth molar	1·6
,, ,, at posterior notch	0·6
Width at auditory bullæ	5
Width of jaw at zygomatic arch	6
Length of lower jaw	6·8
Width of lower jaw at condyles	5

Lower jaw moderate, with a blunt hook-like process projecting on the inner side in front and below the condyles.

In its short palate and white base of fur it is like *Arctophoca Hookeri*.

Captain Cook shot many of this same seal; at least I never heard that there are two kinds on the west coast, except the mention made in Polach (see Dieffenbach).

Note.—On comparing Dr. Hector's description and measurements of the skull with that of *Arctophoca Hookeri*, it appears to be nearly related to and probably a species of the genus *Arctophoca*. It differs very essentially, in the measurements of its parts, from that of *Arctophoca Hookeri*; the skull is rather shorter than the length of a not full-grown skull of that species; and the palate differs most essentially from it in the width of the different parts.—J. E. GRAY.

LII.—*On a new Species of* Caprimulgus. By G. R. Gray, F.R.S.

Hitherto only one species of the genus *Caprimulgus*, and that of a sombre colour, has been known as an inhabitant of Madagascar. It is therefore interesting to be able to record another species of this singular genus that is a well-marked and showily coloured bird, viz.:—

Caprimulgus enarratus.

Top of the head and cheeks of a silky pale brownish grey, with a series of deep-black spots on the former, each spot very narrowly margined with dark rufous; hind head with a narrow band of white tinged with rufous, and then a broad band on the nape of rufous, with the end of each feather hairy and of a more obscure colour; upper part of the back black, with the feathers narrowly bordered with rufous white; the scapulars deep black, with the margins of the outer web of each feather more or less margined with rufous white or rufous; the rump dark brownish grey, with some of the feathers vermiculated with pale rufous, and with a tear-shaped spot at the apex of each feather black, surrounded with rufous white; upper tail-coverts pale chestnut-colour, with irregular transverse bars of black; tail fuscous black, with irregular transverse bars of pale chestnut; some of the bars on the middle feathers are spotted with black, the two outer feathers on each side mostly black and tipped with white; wings fuscous, narrowly banded with pale rufous, each feather marked at its apex with a diamond-shaped black spot, which is margined with rufous or white; quills fuscous black, the outer web of the first indistinctly spotted with pale chestnut; the outer webs of the rest are all prominently spotted with the same colour, with the third, fourth, and fifth quills tipped with brownish grey and banded on the inner web with spots of pale chestnut; the secondaries greyish fuscous black, and irregularly barred with pale rufous; the outer feathers greyish rufous white, irregularly spotted close to the tip with black surrounded with rufous; under wing-coverts black, and barred with pale rufous; throat pale rufous; the jugulum with a broad black band, each feather more or less surrounded on the margin with rufous or white, which in some of the feathers is vermiculated with pale rufous, and thus forms a band of similar marked feathers to those on the back; the under surface pale rufous brown barred with fuscous.

Total length 9″; wings 6″ 6‴.

Hab. Madagascar.

The specimen just described is "the beautiful new Goatsucker" of which Mr. Sharpe says he is not aware that I had published any description*. I can, however, assure him that the description of this fine bird was written more than twelve months ago; but I think it right to make him aware that I have deferred its publication until the present opportunity.

My young friend Mr. Sharpe seems equally anxious to be made acquainted with the fact whether I had published on another Madagascar bird, of which he says, I "was inclined to consider it undescribed"—an opinion which Mr. Sharpe himself once entertained; but he afterwards kindly informed me that it might be *Cossypha imerina* of Dr. Hartlaub, though he at the same time pointed out some differences that existed between it and Dr. Hartlaub's description. These differences he still refers to in his paper, and also further states that he "cannot guarantee the absolute correctness of his identification." From these remarks I am led to infer that it may *yet* be an unnamed species, as we both formerly considered it; and, should our conjecture hereafter prove to be right, then I would venture to propose that it should be designated as

Cossypha Sharpei, G. R. Gr.

Cossypha imerina, Sharpe *nec* Hartl. in Proc. Zool. Soc. 1871, p. 316,

where copious descriptions are given of several phases that the bird in question undergoes: these, therefore, need not be repeated here.

The chief reason for referring to this trivial matter is to satisfy Mr. Sharpe that I had not hitherto published or even written in reference to this bird.

LIII.—*Notice of Spiders captured by* Miss Hunter *in Montreal, Upper Canada, with Descriptions of Species supposed to be new to Arachnologists.* By John Blackwall, F.L.S.

Tribe **Octonoculina.**

Family Lycosidæ.

Genus Lycosa, Latr.

Lycosa canadensis, n. sp.

Length of an immature female $\frac{3}{20}$ of an inch; length of the cephalothorax $\frac{1}{12}$, breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{16}$;

* Proc. Zool. Soc. 1871, p. 317.

length of a posterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{1}{6}$.

The cephalothorax is long, glossy, sparingly clothed with short hairs, compressed before, truncated in front, and rounded on the sides, which are depressed and marked with furrows converging towards a narrow, slight indentation in the median line of the posterior region; it is of a brownish-yellow colour, the cephalic region, where the eyes are situated, being black; a broad, irregular, brown band, mingled with yellowish-brown, extends along each side, the lateral margins have a brownish-black hue, and two short, parallel, obscure, brown lines occur immediately behind the eyes. The falces are conical and vertical; the maxillæ increase in breadth from the base to the extremity, which is rounded, and are somewhat inclined towards the lip, which is nearly quadrate. These parts have a pale-yellowish hue, the maxillæ being the palest, and the base of the lip the darkest. The sternum is heart-shaped, convex, sparingly supplied with hairs, and of a dull-yellow colour; the lateral margins, which are jet-black, meet at its posterior extremity, where they form a somewhat bifid spot. The eyes resemble those of other species of the genus with regard to their disposition and relative size, the dimensions of the four small ones forming the anterior transverse row being equal or nearly so. The legs are long, provided with hairs and sessile spines, and are of a pale-yellowish hue, with obscure soot-coloured annuli, which are most conspicuous on their inferior surface; the fourth pair is much longer than the second, which rather surpasses the third (the anterior legs were missing); each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is very minute. The palpi are long, of a pale-yellowish hue, and have a small pectinated claw at their extremity. The abdomen is oviform, convex above, projects over the base of the cephalothorax, and is thinly clothed with short adpressed pale hairs; the colour of the upper part and sides is black; a red-brown band extends from the anterior extremity of the former more than a third of its length along the middle, and on each side of it there is a longitudinal line of the same hue; a row of red-brown spots passes from the extremity of the median band to the coccyx, diminishing in size as they approach the latter; and on each side of this row there is another of the same hue; the sides are freckled with red-brown; the under part has a dull-yellow colour, and that of the coccyx and spinners is yellowish-white.

The immature female described above was the only specimen of this *Lycosa* comprised in the collection.

Family THOMISIDÆ.

Genus PHILODROMUS, Walck.

Philodromus obscurus, n. sp.

Length of an immature female $\frac{1}{10}$ of an inch; length of the cephalothorax $\frac{1}{16}$, breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{16}$; length of a leg of the second pair $\frac{1}{4}$; length of a leg of the third pair $\frac{3}{20}$.

The eyes are disposed on the anterior part of the cephalothorax in two transverse curved rows, forming a crescent whose convexity is directed forwards; the lateral eyes, which are seated on small tubercles, are rather the largest of the eight. The cephalothorax is short, broad, convex, glossy, compressed before, truncated in front, rounded on the sides, and depressed at the base; a broad, pale, brownish-yellow band extends from its anterior margin along the middle; and the sides, which are of a dark-brown colour, have a longitudinal row of minute yellowish-white spots near their superior border, and a few spots of the same hue on their lateral margin. The falces are short, cuneiform, vertical, and of a brownish-yellow hue, with a brown spot at their base, in front. The maxillæ are pointed at the extremity and inclined towards the lip, which is triangular and pointed at the apex; and the sternum is glossy and heart-shaped. These parts are of a pale yellowish-white colour, the base of the lip having a brown hue. The legs are provided with hairs and a few fine spines; they are of a pale brownish-yellow colour, and are marked with minute black spots, particularly on the femora, and with reddish-brown annuli at the joints; the second pair is the longest, then the first, and the third and fourth pairs are nearly equal in length; each tarsus is terminated by two curved pectinated claws, below which there is a small scopula. The palpi are short, and resemble the legs in colour. The abdomen is oviform, somewhat depressed, notched at its anterior extremity, and thinly clothed with pale hairs; the colour of the upper part is yellowish-grey; a pale-brown triangular spot, whose vertex is directed forwards, occurs at its anterior extremity, and is followed by four depressed brown spots forming a quadrangle, the posterior pair being much the most conspicuous; a brown line passes from each of the posterior spots to the yellowish-white coccyx, where the two meet, and numerous transverse curved rows of minute brown spots pass to the sides, which are of a dark-brown hue, their irregular superior margin being penetrated by several oblique white streaks; the colour of the under part is yellowish-white, and that of the spinners brownish-yellow, the base of the superior pair being dark brown.

As the distribution of the colours of this small and immature specimen differs from that of all other species of the genus *Philodromus* of which I have any knowledge, I am induced to describe it as new to natural science.

Family Drassidæ.

Genus Drassus, Walck.

Drassus Hunteræ, n. sp.

Length of the female (not including the spinners) $\frac{3}{10}$ of an inch; length of the cephalothorax $\frac{1}{6}$, breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{10}$; length of a posterior leg $\frac{2}{5}$; length of a leg of the third pair $\frac{5}{16}$.

The eyes are disposed on the anterior part of the cephalothorax in two transverse, parallel, slightly curved rows, whose convexity is directed upwards; the intermediate eyes of the anterior row, which is the shorter, are the largest and darkest-coloured of the eight, and the intermediate ones of the posterior row are the smallest. The cephalothorax is long, slightly compressed before, rounded in front and on the sides, convex, glossy, with a small indentation in the median line of the posterior region; it is sparingly clothed with silky, adpressed, whitish hairs, interspersed with long, prominent, black ones, which are most abundant in the region of the eyes; its colour is black tinged with red, particularly in the median line. The falces are long, conical, vertical, prominent at the base, which is supplied with long black hairs, and are of a brownish-black hue tinged with red at the extremity. The maxillæ are curved towards the lip, enlarged and rounded at the extremity, with a large, oblique, transverse depression near the middle, and are of a red-brown hue. The lip is oval and rounded at the apex; the sternum is oval and sparingly supplied with whitish hairs. These parts are of a brownish-black hue, the extremity of the lip being tinged with red. The legs are long and provided with hairs; the third and fourth pairs have a few spines on the tibiæ and metatarsi; and the metatarsi and tarsi of all are supplied to a greater or less extent with hair-like papillæ on their inferior surface; the coxæ, genual joints, tibiæ, metatarsi, and tarsi have a reddish-yellow hue; the coxæ of the anterior legs are much the darkest, being strongly tinged with brown; and the colour of the femora is brownish-black; the fourth pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by two small, curved, pectinated claws. The palpi are long, and have a reddish-yellow hue. The abdomen is oviform, somewhat depressed, the anterior extremity, which has the appearance of having been cut in a direct line across, projects slightly over the base of the cephalothorax, and has some long, prominent black hairs in front; it is clothed with short adpressed hairs, and is of a dull-black hue; a transverse white band occurs at the anterior extremity of the upper part, from each end of which a short line of the same hue is directed backwards; in the posterior region a white band surrounds a black space, which comprises a few rather obscure, angular white lines that have their vertices directed forwards; the spinners are black, prominent, and cylindrical, the inferior pair being the longest and most robust; the under part is of a dull-greyish colour in the middle, the branchial opercula have a yellow hue, and the colour of the vulva, which is somewhat crescent-shaped, is black slightly tinged with red.

Immature males that have to undergo their final ecdysis resemble the adult female in colour, but the white bands and lines are not so distinctly marked.

In connecting with this *Drassus* the name of Miss Hunter, of Carmarthen, I avail myself of the opportunity to express the obligation I am under to that lady for placing at my disposal the specimens of *Arachnida* collected by her in Montreal.

Drassus diversus, n. sp.

Length of an immature male (not including the spinners) $\frac{5}{24}$ of an inch; length of the cephalothorax $\frac{1}{10}$, breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{12}$; length of a posterior leg $\frac{5}{12}$; length of a leg of the third pair $\frac{1}{4}$.

The cephalothorax is oval, somewhat pointed before, convex, glossy, thinly clothed with pale adpressed hairs, and has a slight, narrow indentation in the median line of the posterior region; it is of a dull-yellow colour, the sides are tinged with brown, and the lateral margins have a brownish-black hue. The eyes are disposed on the anterior part of the cephalothorax in two transverse, parallel, slightly curved rows, whose convexity is directed upwards; the intermediate eyes of the anterior row are the largest and darkest-coloured of the eight, and the intermediate ones of the posterior row are the smallest. The falces are conical and vertical; the maxillæ are curved towards the lip, enlarged and rounded at the extremity, and have a small, oblique, transverse depression near the middle; the lip is oval, and rounded at the apex; and the sternum is oval; the legs are moderately long; all are provided with hairs, and the third and fourth pairs with sessile spines, and the tarsi are sparingly supplied with hair-like papillæ on their inferior surface; the fourth pair is the longest, then the first, and the third pair is rather the shortest; each tarsus is terminated by two small, curved, pectinated claws; the imperfectly developed palpi are rather long. The colour of these parts is pale yellow, the lip having a tinge of red. The abdomen is oviform, somewhat depressed, and its anterior extremity, which has the appearance of having been cut in a right line across, projects very slightly over the base of the cephalothorax; it is thinly clothed with adpressed pale hairs, and is of a dull yellowish-white colour, the sides having a brownish-black hue, and the colour of the branchial opercula is yellow; two spots placed transversely on the upper part, near to its anterior extremity, and a transverse bar situated near the middle, are composed of coarse black hairs; the spinners are prominent and cylindrical, the inferior pair being the longest and most robust; their colour and that of the coccyx is yellowish-white.

The specimen from which the description was made was the only one of the species comprised in the collection.

Drassus vasifer.

Drassus vasifer, Walck., Hist. Nat. des Insect. Apt. t. i. p. 620.

A single adult female of this species, which appears to be little known to arachnologists, was contained in the collection. I have also received a specimen of it from Toronto; and Walckenaer remarks that it has been found in the United States of North America.

Family CINIFLONIDÆ.

Genus ERGATIS, Blackw.

Ergatis diligens, n. sp.

Length of an immature female $\frac{1}{10}$ of an inch; length of the cephalothorax $\frac{1}{20}$, breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{24}$; length of an anterior leg $\frac{1}{10}$; length of a leg of the third pair $\frac{1}{12}$.

The eyes, which are nearly equal in size, are disposed on the anterior part of the cephalothorax in two transverse rows; the intermediate ones of both rows form a square, and those of each lateral pair are placed obliquely on a tubercle and are near to each other. The cephalothorax is compressed before, convex in the cephalic region, but depressed and rounded in front; the sides and base are depressed, the former being marked with furrows, which converge towards the middle; a red-brown band extends along the middle, the colour of the sides is dark brown tinged with red, and the lateral margins have a brownish-black hue. The falces are somewhat conical, vertical, and of a pale dull-yellowish hue. The maxillæ are inclined towards the lip, rounded at the extremity, which is more abruptly curved on the inner than on the outer side, and are rather darker-coloured than the falces. The lip and the sternum are oval, glossy, and of a dark-brown colour tinged with red, the former being much the palest at the apex. The legs are rather short, and of a pale-yellowish hue, with reddish-brown annuli; the first pair is the longest, then the second, the third pair is the shortest, and the metatarsal joint of each posterior leg is provided with a calamistrum composed of a single row of fine curved bristles; the palpi resemble the legs in colour. The abdomen is oviform, convex above, projects greatly over the base of the cephalothorax, and is clothed with whitish adpressed hairs; its colour is yellow; a black band, very narrow at its anterior and broad at its posterior part, passes from the anterior extremity to the middle of the upper side, and is followed by transverse, curved, confluent, black bars, which extend to the coccyx; the sides have a brownish-black hue, the under is paler than the upper side, and has a broad, imperfectly defined, longitudinal, reddish-brown band in the middle. The spinners are eight in number, and the two inferior ones are united throughout their entire length, the proximal extremities being without any definite mark of distinction.

This species is closely allied to *Ergatis annulipes*, but differs from it in colour and in the figure of the design on the upper part of the abdomen.

Family Theridiidæ.

Genus Theridion, Walck.

Theridion tepidariorum.

Theridion tepidariorum, C. Koch, Die Arachn. Band viii. p. 75, tab. 273. fig. 646, tab. 274. figs. 647, 648; Blackw., Spiders of Great Britain and Ireland, part ii. p. 180, pl. 13. fig. 114.

This species has an extensive geographical distribution, being found in Europe, Asia, and America. It is probably a native of hot climates, as in Europe it usually inhabits conservatories, and may have been imported, as Koch conjectures, with exotic plants. A specimen of an adult female, comprised in the collection received from Miss Hunter, was discovered in winter between the sashes of one of the double windows of the house in which she resided.

Family Epeïridæ.

Genus Epeïra, Walck.

Epeïra sericata.

Epeïra sericata, C. Koch, Uebers. des Arachn. Syst. erstes Heft, p. 2: Die Arachn. Band xi. p. 110, tab. 385. figs. 914, 915; Blackw., Spiders of Great Britain and Ireland, part ii. p. 328, pl. 23. fig. 238.
—— *virgata*, Hahn, Die Arachn. Band ii. p. 26, tab. 46. fig. 113.

Epeïra sericata appears to be a common spider in Montreal. The collection contained numerous specimens, some of which were adult, and the others in various stages of growth.

Epeïra cucurbitina.

Epeïra cucurbitina, Walck., Hist. Nat. des Insect. Apt. t. ii. p. 76; Latr., Gen. Crust. et Insect. t. i. p. 107; Sund., Vet. Acad. Handl. 1832, p. 245; Blackw., Spiders of Great Britain and Ireland, part ii. p. 342, pl. 25. fig. 247.
Miranda cucurbitina, C. Koch, Die Arachn. Band v. p. 53, tab. 159. figs. 371, 372; titulus 5, Lister, Hist. Animal. Angl., De Aran. p. 34, tab. 1. fig. 5.

An immature female of this *Epeïra* was included in the collection.

LIV.—*On two undescribed Species of European Birds.* By R. B. Sharpe, F.L.S., Librarian to the Zoological Society of London, and H. E. Dresser, F.Z.S. &c.

In the course of our studies on the birds of the Western Palæarctic Region we have met with two birds which, as far as we can see, are deserving of specific separation from the species with which they have usually been classed. The first of these we designate

Picus Lilfordi, n. sp.

P. similis *P. leuconoto*, sed pileo coccineo et præcipue dorsi postici fasciis nigris conspicuis distinguendus.

This new species is closely allied to the *Picus leuconotus* of Northern Europe, but differs materially in its crimson crown and conspicuously barred rump. In the northern bird the head is vermilion and the rump pure white.

We have dedicated this species to Lord Lilford, the President of the British Ornithologists' Union, who shot the typical specimen in Epirus. Besides this example we have no less than eight Macedonian skins, collected by Dr. Krüper, as well as one sent us by Mr. Robson from Ortakeuy, in Turkey. A glance at a series of specimens is all that is needed to convince the most sceptical that *P. Lilfordi* is an excellent species.

Our second bird is from the British islands; and it is proposed to call it

Parus britannicus, n. sp.

P. similis *P. atro*, sed paullo minor et dorso semper olivaceo-fulvo distinguendus.

The Coal Titmouse of England will be found, on comparison with Continental examples, to be perfectly distinct, inasmuch as it has the back olive-buff, quite different from the species from the mainland, which has a slaty-blue back. Any one who examines the Coal Titmouse figured in English works, and compares it with the figure given in any Continental book, will see that, as each naturalist illustrates the bird found in his own country, the plates do not at all agree. We have now before us a large series of the two species, shot at all seasons of the year in England, and from nearly every part of the Continent. Both species will be figured in our work on the Birds of Europe.

MISCELLANEOUS.

On a new Species of Buceros. By G. R. Gray.

[Plate XVII.]

Having had my attention drawn by Mr. E. Bartlett to a head and bill of a species of *Buceros* which, on examination, presented in its formation very remarkable differences from any of the known species of that group of birds, I am induced to offer the following description of its singular and distinctive characters, under the name of

Buceros (*Byanistes?*) *casuarinus.* Pl. XVII.

Bill broad at base, laterally compressed to the tip; casque elevated posteriorly and extending somewhat backwards over the eyes, rather compressed along the culmen, which is flat and grooved along the middle for two thirds of its length, the sides of the casque shelving to the nasal channel, and furnished with six deep oblique grooves; the sides below the former are comparatively smooth, and with three apparent scales near the eyes; the nostrils are large and deeply imbedded in a broad channel which runs along the sides of the maxilla for about two thirds of its length, in which they are situated at its base; the mandibula has the gonys long and curved to the tip; the sides are furnished with four very obliquely placed grooves, advancing towards each other beneath the gonys; the margins of both mandibles are dentated in the middle.

The length from the upper part of the base of the casque to the tip of the maxilla is five inches and three lines.

The head which forms the subject of this description is supposed to have been brought from West Africa.

Observations on some points in the Embryology of the Lemuroidea, *and on the Zoological Affinities of those Animals.* By M. Alph. Milne-Edwards.

In all existing systems of classification the Lemuroidea form with the Monkeys a single group, called *the order Quadrumana*. Various anatomical considerations had led me to doubt the correctness of this approximation; and I had a lively desire to ascertain whether the characters drawn from the development of the embryo would support or contradict it. Therefore, when my friend M. A. Grandidier started upon his last voyage of exploration in Madagascar, I directed his attention to this point, requesting him to seek carefully for female Lemuroidea in a state of gestation. The results obtained by him surpassed my hopes; for he procured fœtuses belonging to four different genera of the group Lemuroidea; and these he has been kind enough to place at my disposal.

The dissections that I have made of these have enabled me to ascertain that, with regard to the intra-uterine development, there exist essential differences between the Lemuroidea and the Apes. It is well known that in the latter the placenta is small, discoidal, and intimately united with the uterine decidua, and that the umbilical vesicle is greatly reduced, and even disappears very early. The Lemuroidea present a very different arrangement. Thus, in *Propithecus*, which may be regarded as one of the highest representatives of the type under consideration, and consequently as nearest to the Monkeys, the chorion is almost entirely covered with thick and close villosities, constituting a sort of vascular cushion, and forming the placenta, which forms almost a complete hood over the amnios, and which I shall denominate the *bell placenta* (*placenta en cloche*) in opposition to the *discoidal placenta* of man and the monkeys, the *zonary placenta* of the Carnivora, and the *diffused placenta* of the Herbivora. The villosities, which are very much tufted towards the middle and upper portions of the ovum, gradually diminish as they approach the cephalic pole, where they disappear almost entirely over a small space. The uterine decidua is greatly developed, and presents a corresponding arrangement.

Between the chorion and the amniotic coat we find a vast membranous sac extending in the direction of the major axis of the ovum, and adhering to the umbilical cord by a short slender peduncle. This sac is elongated so as to form at each of its extremities a sort of digitiform horn, and only contracts slight adhesions to the two adjacent coats; none of the large vessels of the cord are distributed upon it. If air is injected into this sac under water, it is distended and its outlines become distinctly marked. It represents the umbilical vesicle, which is much less developed in most of the unguiculate Mammalia.

In the genera *Lepilemur, Hapalemur*, and *Chirogaleus* the placenta presents the same characters.

From this investigation it follows that the tunics of the embryo of the Lemuroidea are constructed upon a plan of which we are acquainted with no other example in the class of Mammalia. This special type departs much more from that of Man, the Monkeys, Chiroptera, Insectivora, and Rodentia than from that which is proper to the Carnivora; for if we suppose the caudal pole of the ovum in the dog to be invaded by the villosities of the placenta, we have almost a realization of the special characters of the ovum of the Lemuroidea; and I may add that the arrangement of the umbilical vesicle is very nearly the same in the two types, whereas in the Monkeys it is completely different.

These important embryological characters are in accordance with those furnished by the brain, the skull, the dental system, and the hands.

The brain of the most highly organized Lemuroidea is but little developed behind; and instead of entirely covering the cerebellum, as it does in the Monkeys, it leaves a more or less considerable portion of that organ exposed. Gratiolet, also, had previously noticed that the characters of the encephalon of the Lemuroidea separate these animals clearly from all the Primates.

The orbit, which, in the group of the Monkeys, is completely closed outwardly and isolated from the temporal fossa, communicates broadly with the latter in all the genera of Lemuroidea, which gives their skull a certain resemblance to that of the Carnivora.

The teeth which arm the lower jaw in front are formed very differently in the Monkeys and the Lemuroidea. In the former the distinction between the canines and the incisors is very clear, and the latter are nearly vertical; in the Lemuroidea they are narrow, pressed against each other like a comb, laid almost horizontally, and their forms are so similar that certain zoologists regard them as being all incisors, whereas in reality those of the third pair represent the canines of other Mammalia.

The hands, of which the thumb is always well developed, and almost constantly opposable to the other digits, do not present the characters of those of the Monkeys; they are admirably constructed for climbing, but unfitted for the prehension of articles of food. It is with the mouth that these animals usually lay hold of their nourishment, unless they employ their united hands for this purpose, as the squirrels and many rodents are in the habit of doing. The fingers, instead of tapering towards the end, like those of Monkeys, are generally enlarged in their terminal portion, forming discoidal pads which the nail does not entirely cover. Lastly, the index of the posterior hand terminates, as is well-known, in a regular claw.

If, in the classification of the Mammalia, we desire that the natural groups, denominated *orders*, should have the same zoological value, it seems to me impossible to unite in one division having this degree of importance the Monkeys and the Lemuroidea. The existence of a hand may occur in animals derived from very different types; we have long known examples of it among the Marsupials, whilst among the Monkeys we find, side by side with clearly pentadactyle species, others of which the anterior limbs are destitute of a thumb. We therefore cannot regard this organic peculiarity as constituting a dominant character; and the numerous and essential differences that I have indicated in the course of this memoir seem to me to have a far higher zoological value, and to call for a profound distinction between the Monkeys and the Lemuroidea. It is upon the support of these facts that I propose to regard each of these groups as forming a distinct order, the order of the Lemuroidea uniting the order of the Simiæ to the order of the Carnivora.—*Comptes Rendus*, August 14, 1871, tome lxxiii. pp. 422–424.

On some Fungi belonging to the Family Laboulbeniæ. By Dr. Peyritsch.

The Laboulbeniæ include *Stigmatomyces muscæ* of Karsten, the genus *Arthrorhynchus*, referred by Kolenati and Diesing to the *Rhygodeæ* in the system of parasitic worms, and the structures occurring on *Nebriæ*, which were regarded by Mayr as morbid growths of the chitinous membrane.

The author observed the development of *Laboulbenia muscæ*, which lives parasitically upon the common housefly. The *Laboulbeniæ* made their appearance epidemically upon the flies in the summer and autumn, showing themselves in the males particularly upon the limbs, in the females chiefly upon the head and trunk. The fungus developes no mycelium growing upon the surface or in the tissues of the animal. The perithecium, which is furnished with a long bicellular stalk, is produced from the bicellular spore, together with a curved branch furnished with points, which is inserted at the apex of the superior cell. When the spore has fixed itself by its pointed end, it ascends, the product of the lower cell of the spore becomes the stalk and perithecium, and that of the upper cell of the spore becomes the branch (with the exception of its basal cell, which is produced from a segment of the lower cell of the spore). The rudiment of the perithecium, which originally appeared as a lateral excrescence, grows rapidly in length. When its vertex does not yet appear to be equal in height with the terminal branch, the latter has already attained its complete development and definitive size, spherical cells make their appearance at the points, whilst at the same time the protoplasmic contents protrude from the cell at the vertex of the perithecium. The further development of the perithecium probably takes place in consequence of the fertilizing influence of the round cells of the branch upon the protruded fertilizable body; and there is produced in the cavity of the perithecium a tuft of tubes, in each of which eight spores are developed.

The fungus spreads from one fly to another during their copulation. *Laboulbenia muscæ* belongs to the *Ascomycetæ*.

Laboulbenia nycteribiæ, which has been described as an animal parasite of the *Nycteribiæ*, is distinguished from *Laboulbenia muscæ* by the branch being inserted at the base between the first and second supporting cells of the perithecium, and the long neck of the perithecium furnished with a circlet: of *Laboulbenia nebriæ*, which occurs upon *Nebria brunnea*, the author had not sufficient material for comparison, this only sufficing to establish its relationship.—*Anzeiger der kön.-kais. Akad. der Wiss. in Wien*, November 2, 1871, p. 207.

The Pepino (Philesia buxifolia).

"I had hardly entered the woods when one of the officers brought me a specimen of an exquisite rose-coloured flower, which I found in the course of the two succeeding years everywhere abundant in the damp region of the Strait of Magellan and the western channels, and with whose beauty I never ceased to be delighted. This was the elegant *Philesia buxifolia*, an endogenous plant, classed by some botanists with the *Smilaceæ*, by others with the *Liliaceæ*, and by a third party regarded as the type of a natural order named *Philesiaceæ*. It varies very much in its growth: for although in ordinary circumstances it forms a suberect under-shrub from one to two feet in height, when it occurs close to the base of trees its branches frequently elongate, and, pushing themselves through the coating of moss and lichens with which the trunks of the trees in this humid country are, with few exceptions, covered, often attain a height of from six to ten feet or more.

"The appearance presented by a cluster of these beautiful flowers hanging pendent from the branch of a tree is most attractive. The plant ranges from Valdivia in South Chili, where it is denominated Pepino, to the south of Fuegia. In the Strait of Magellan I did not meet with it to the east of Port Gallant, nor did I encounter it in the island of Chiloe, though I found it in the Chonos archipelago."—CUNNINGHAM's *Magellan*, p. 178, t. 16 at p. 321.

The Copigue (Lapageria rosea).

"We had not gone far before I had the delight of seeing for the first time that exquisite twiner, *Lapageria rosea*, the "Copigue" of the Chilians, with the appearance of which, as seen in hothouses, some of my readers are doubtless familiar. The plant winds over shrubs and low trees in a very elegant manner; and the flowers, shaped somewhat like those of a lily, are often as much as three inches long, of a thick waxy consistence, and of a most splendid deep rose-colour, minutely spotted with white in the interior, and marked at the base of each segment with a small blotch of dark purple. A white variety of the flower is also to be met with, but is of much rarer occurrence. The plant is a near ally of the beautiful *Philesia buxifolia* of the Strait, but is much handsomer, and possesses a greatly more limited range, apparently only extending from the north of Valdivia to the north of Concepcion, a space of between three and four degrees, while *Philesia* ranges over nearly fifteen. One interesting fact with regard to the Copigue is its extreme hardiness, being almost the only plant that can exist in the area covered by the sulphurous smoke of the smelting-furnaces. This was remarked to me by the manager of the Lota Company's works, to whom, as well as the various officials of the company, we were indebted for much attention; and I verified the observation for myself subsequently, finding specimens in a flourishing condition winding around the skeletons of shrubs killed by the smoke. The Chilians sometimes make use of the flowers for poultices."—CUNNINGHAM'S *Magellan*, p. 364.

On the Generation of Helix aspersa. By M. S. JOURDAIN.

The follicles of the genital gland of *Helix aspersa* produce ovules and spermatozoids. The former are developed in the thickness of the simple walls of the follicle, the latter in cells of its inner surface. The excretory canal of the hermaphrodite gland (ovo-deferent duct) always contains spermatozoids; it affords a passage to the ovules, which seem to traverse it rapidly, and only at the moment of deposition. The ova and spermatozoids appear to travel in the ovo-deferent canal by the action of the vibratile cilia which line its inner wall.

In the ovo-deferent canal the greater part of the spermatozoids already possess the characters which we find in them later on, when they are ready to act upon the female element. Their movements, which have been denied, are very lively. The less advanced state of the ovule and its immaturity seem to explain the want of action of the spermatozoids, notwithstanding the direct contact which takes place between the male and female elements.

At their issue from the ovo-deferent canal the ovule and the spermatozoid pass separately into two half-canals of very unequal calibre, joined in such a manner that their margins are common. These we may call the *ovigerous* and *deferent channels*.

On quitting the ovo-deferent canal the ovule receives a very thick layer of albuminoid substance from a peculiar gland which pours its product of secretion into the most distant part of the ovigerous channel; and lower down the actual walls of this channel furnish the double tunic of the egg and the calcareous granules which are disseminated through the outer of these envelopes.

The semen descends by the deferent channel, in which the spermatozoids are already agglutinated by the secretion of the glands which open into it in great numbers. They then pass into the deferent canal, and finally penetrate into the flagelliform appendage, the glands of which, by a reflex action due to the presence of the semen, secrete a mucus, which becomes solidified and moulded upon the walls of this appendage, enclosing the male element in a sort of elongated and flexible sheath—a true spermatophore, called by malacologists *capreolus*.

At the moment of sexual approach, the penis, the extremity of which is in relation with the entrance of the copulatory branch, causes the spermatophore to penetrate into this appendage of the female apparatus. The spermatophore breaks up and becomes disaggregated; the spermatozoids are then set at liberty, and spread in the copulatory branch, the copulatory vesicle, and especially the ovigerous channel, where at this moment, and at this moment only, we find them in great quantities and full of life. By the action of the vibratile cilia which line the inner wall of the ovigerous channel, the spermatozoids go to meet the ova; and it is in the commencement of this channel that fecundation appears to be effected.

During the preludes of copulation the two individuals project their dart, which usually traverses through and through the walls of the visceral cavity, where it may be found long afterwards among the viscera, slightly altered. The dart, contrary to the opinion expressed by a malacologist, when once detached, is speedily reproduced. Within a few hours of the copulation its rudiments may be perceived; and a few days suffice for its complete reproduction. We may therefore, in some cases, from the degree of development of this calcareous style, judge approximately of the time that has elapsed since the last sexual intercourse.—*Comptes Rendus*, Oct. 30, 1871, p. 1059.

On the Persistence of Caryophyllia cylindracea, *Reuss, a Cretaceous Coral, in the Coral-fauna of the Deep Sea.* By P. Martin Duncan, M.B. Lond., F.R.S., F.G.S., Prof. of Geology in King's Coll. Lond.

The author first referred to the synonyms and geological distribution of *Caryophyllia cylindracea*, Reuss, which has hitherto been regarded as peculiar to the White Chalk, and as necessarily an extinct form, inasmuch as it belonged to a group possessing only four cycles of septa in six systems, one of the systems being generally incomplete. The distribution of the *Caryophylliæ* of this group in the Gault and the Upper Chalk, the Miocene, and the Pliocene was noticed, and also that of the species with the incomplete cycle. The falsity of this generalization was shown to be proved by the results of deep-sea dredging off the Havannah, under Count Pourtales, and off the Iberian peninsula under Dr. Carpenter and Mr. Gwyn Jeffreys. The former dredged up *Caryophyllia formosa* with four complete cycles; and the latter obtained, from depths between 690 and 1090 fathoms, a group of forms with four complete and incomplete cycles. This group had a Cretaceous facies; one of the forms could not be differentiated from *Caryophyllia cylindracea*, Reuss; and as a species of the genus *Bathycyathus* was found at the same time, this facies was rendered more striking. The representation of the extinct genera *Trochosmilia*, *Parasmilia*, *Synhelia*, and *Diblasus* by the recent *Amphiheliæ*, *Paracyathi*, and *Caryophylliæ* was noticed; and it was considered that as the Cretaceous forms throve under the same external conditions, some of them only being persistent, there must be some law which determines the life-duration of species like that which restricts the years of the individual. It was shown that deep-sea conditions must have prevailed within the limits of the diffusion of the ova of coral polyps somewhere on the Atlantic area ever since the Cretaceous period.—*Proc. Geol. Soc.* June 7, 1871.

INDEX TO VOL. VIII.

END OF THE EIGHTH VOLUME.

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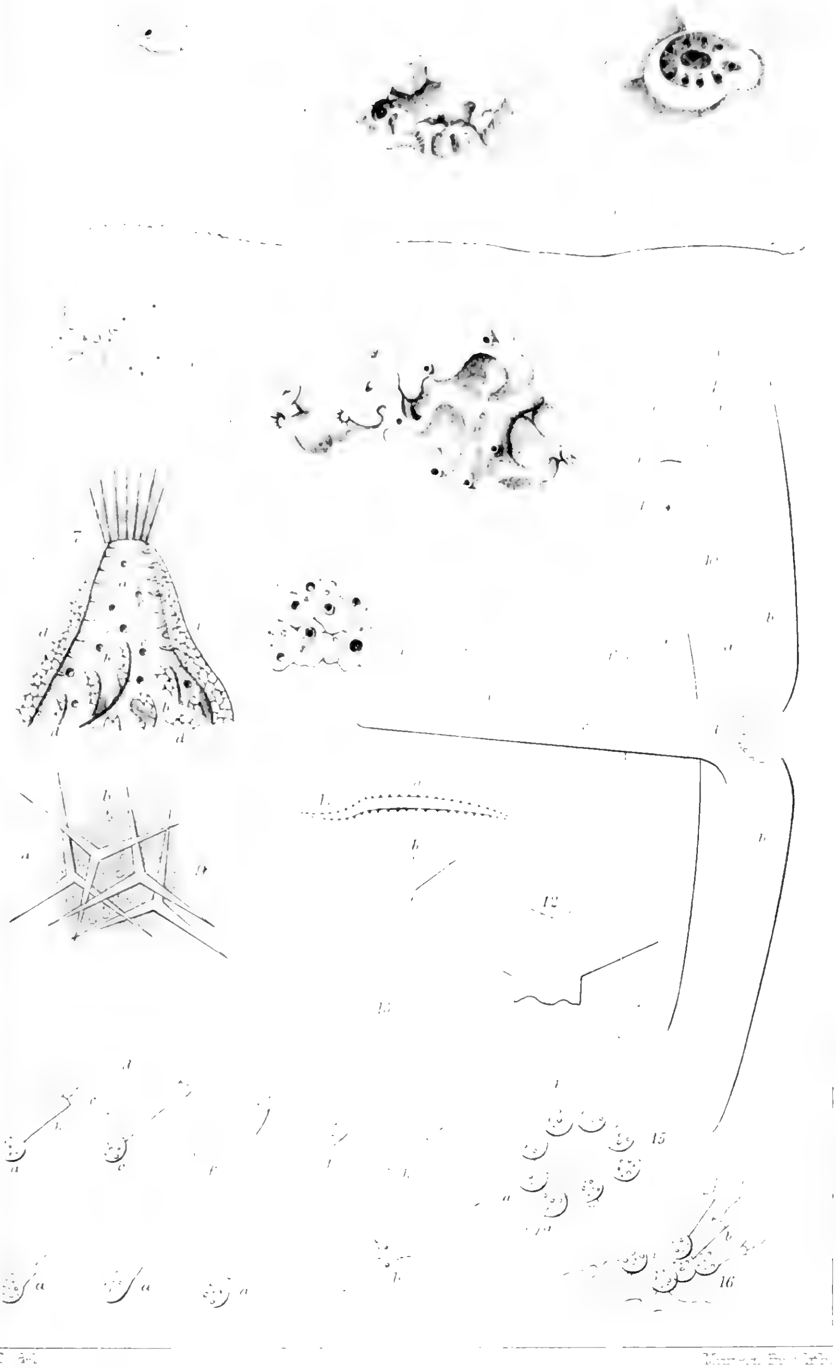

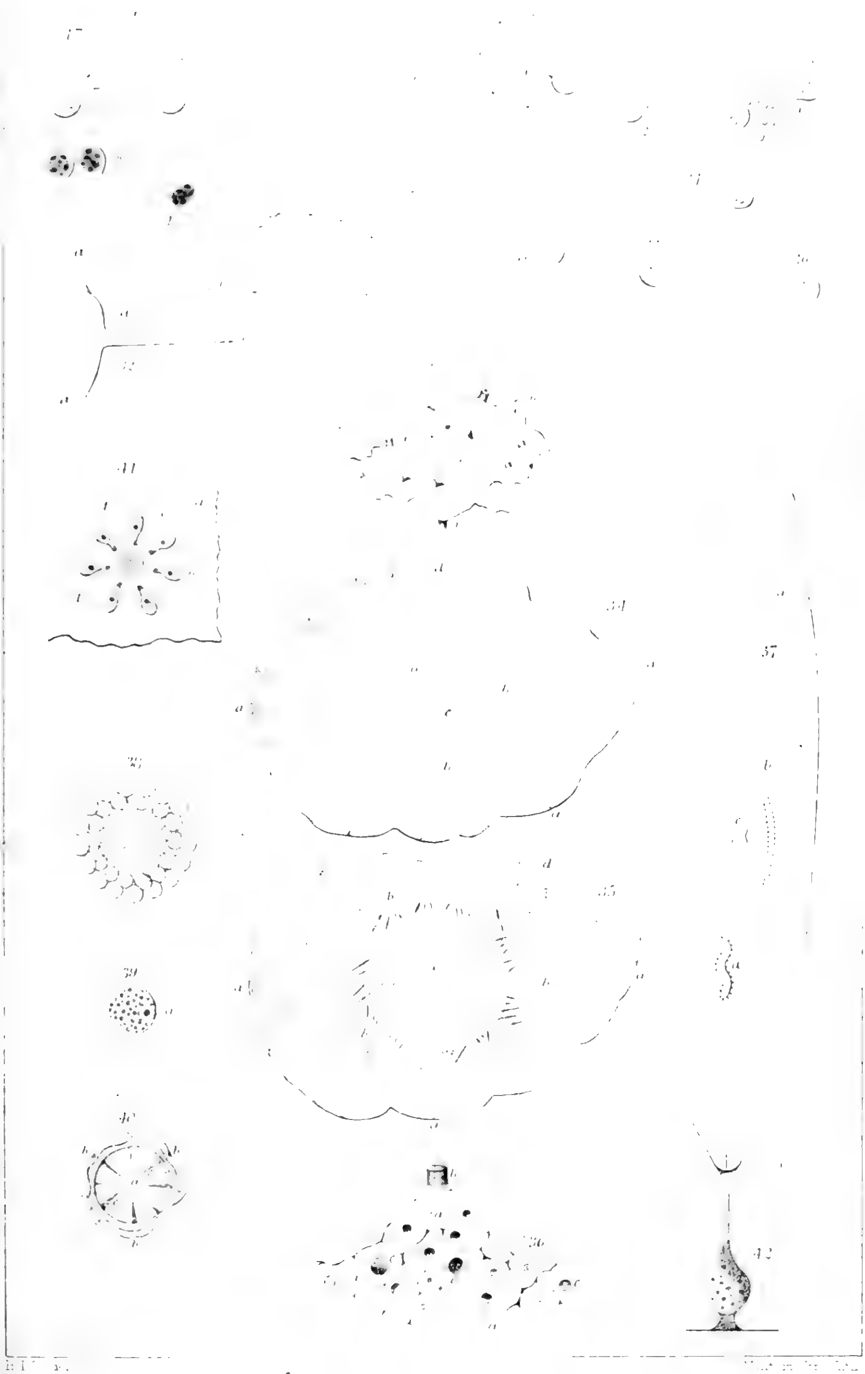

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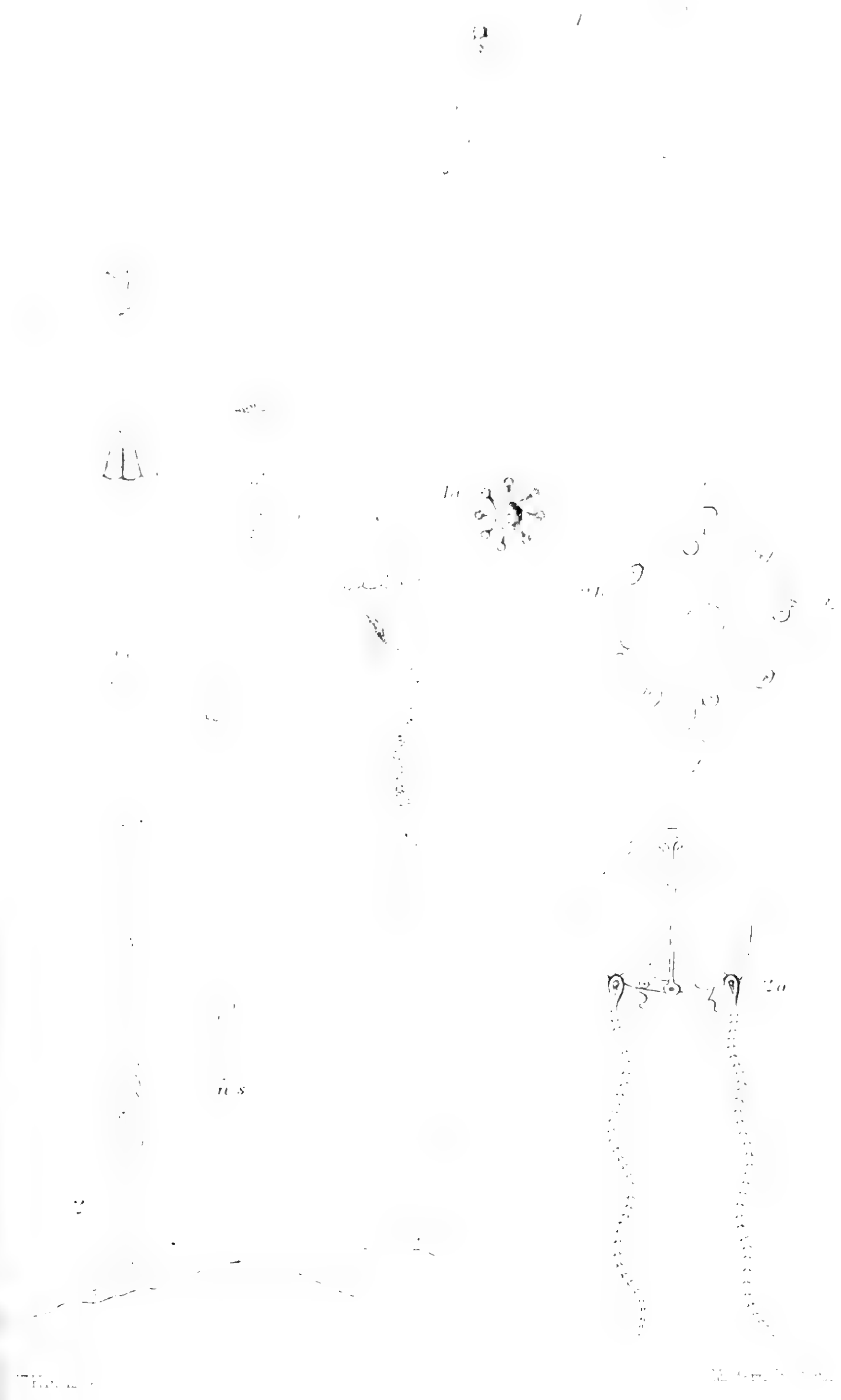

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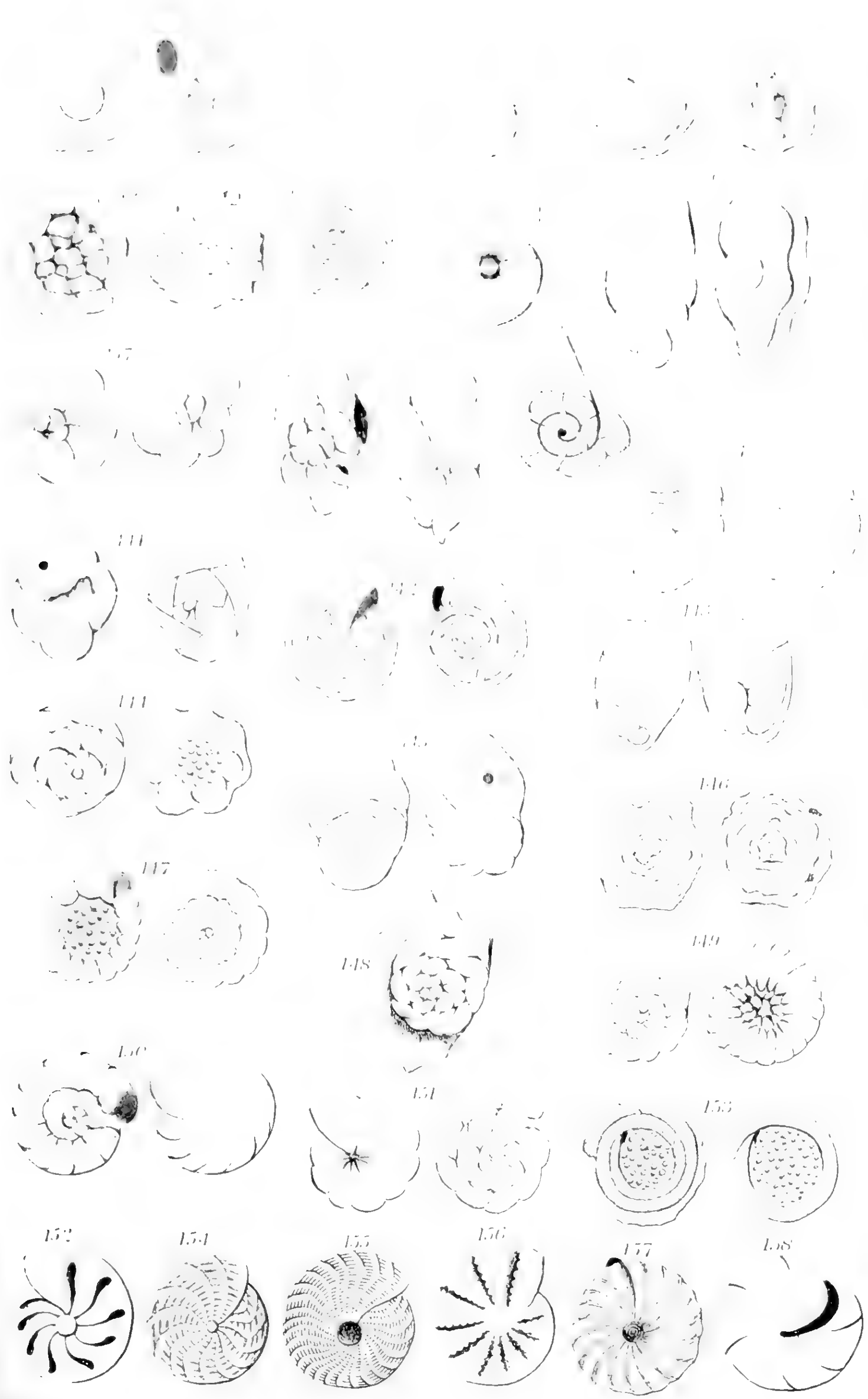

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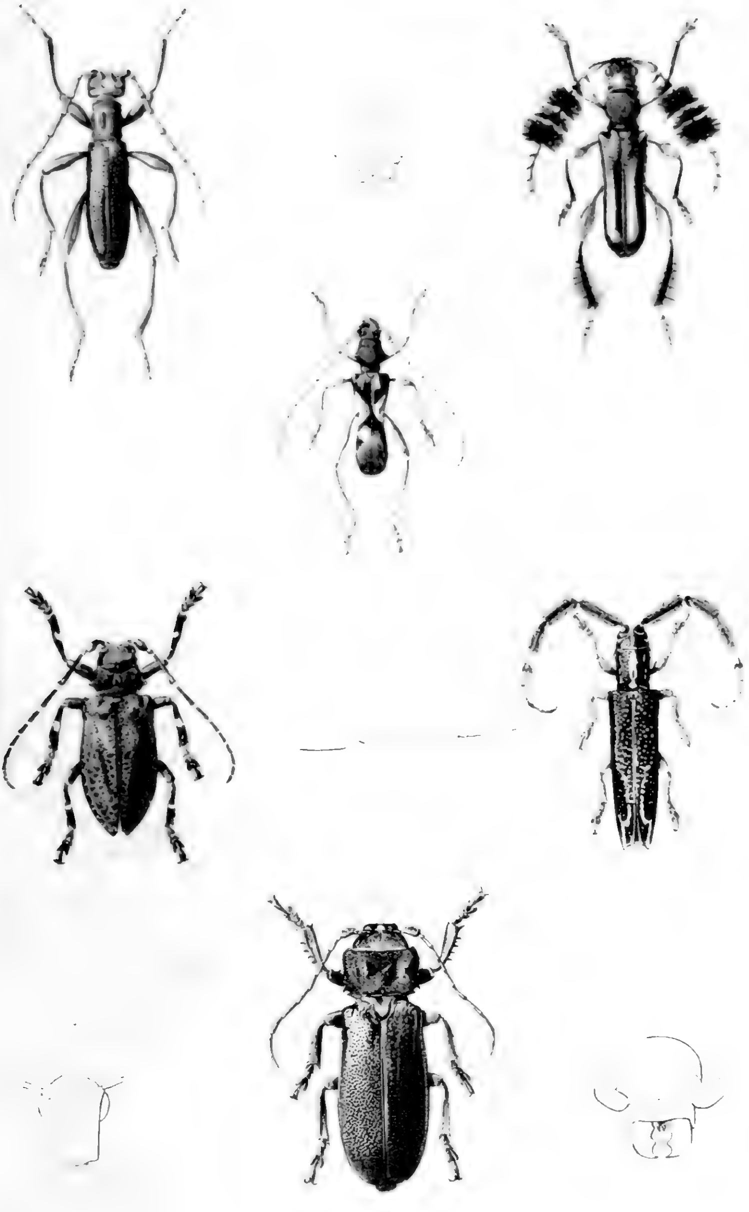

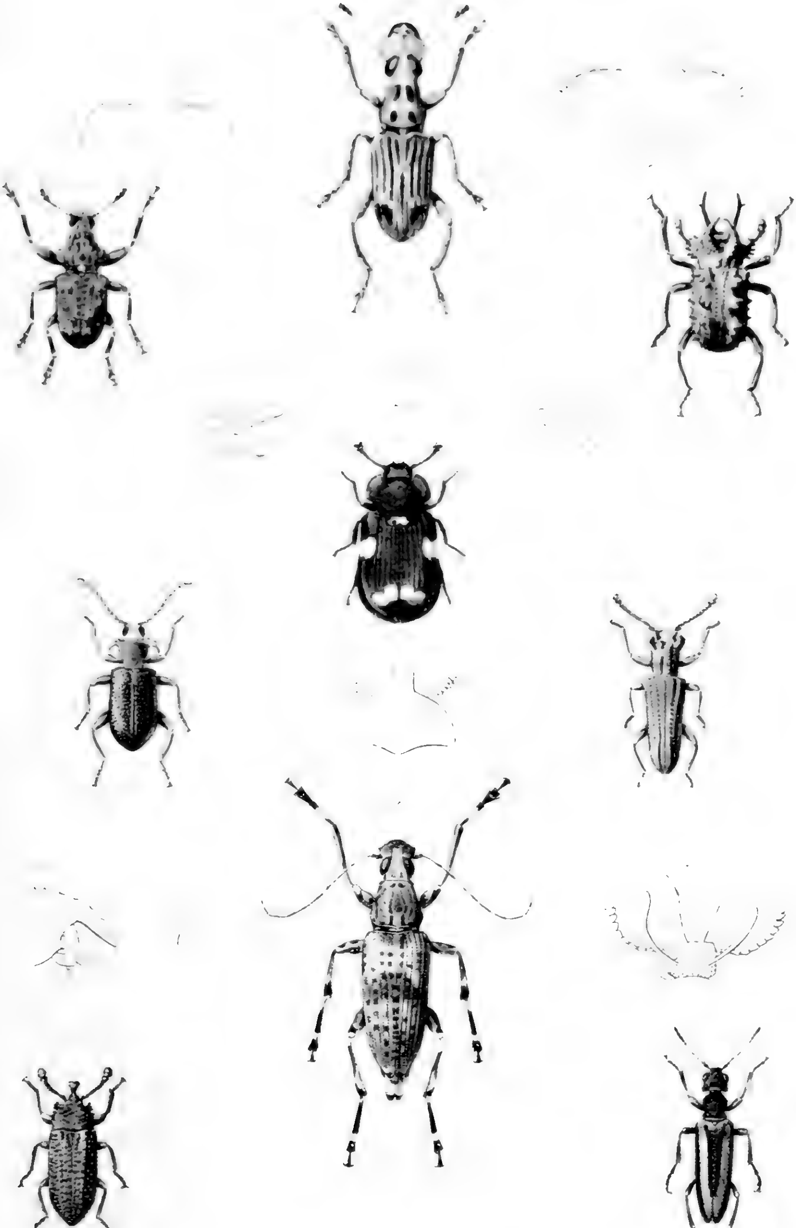

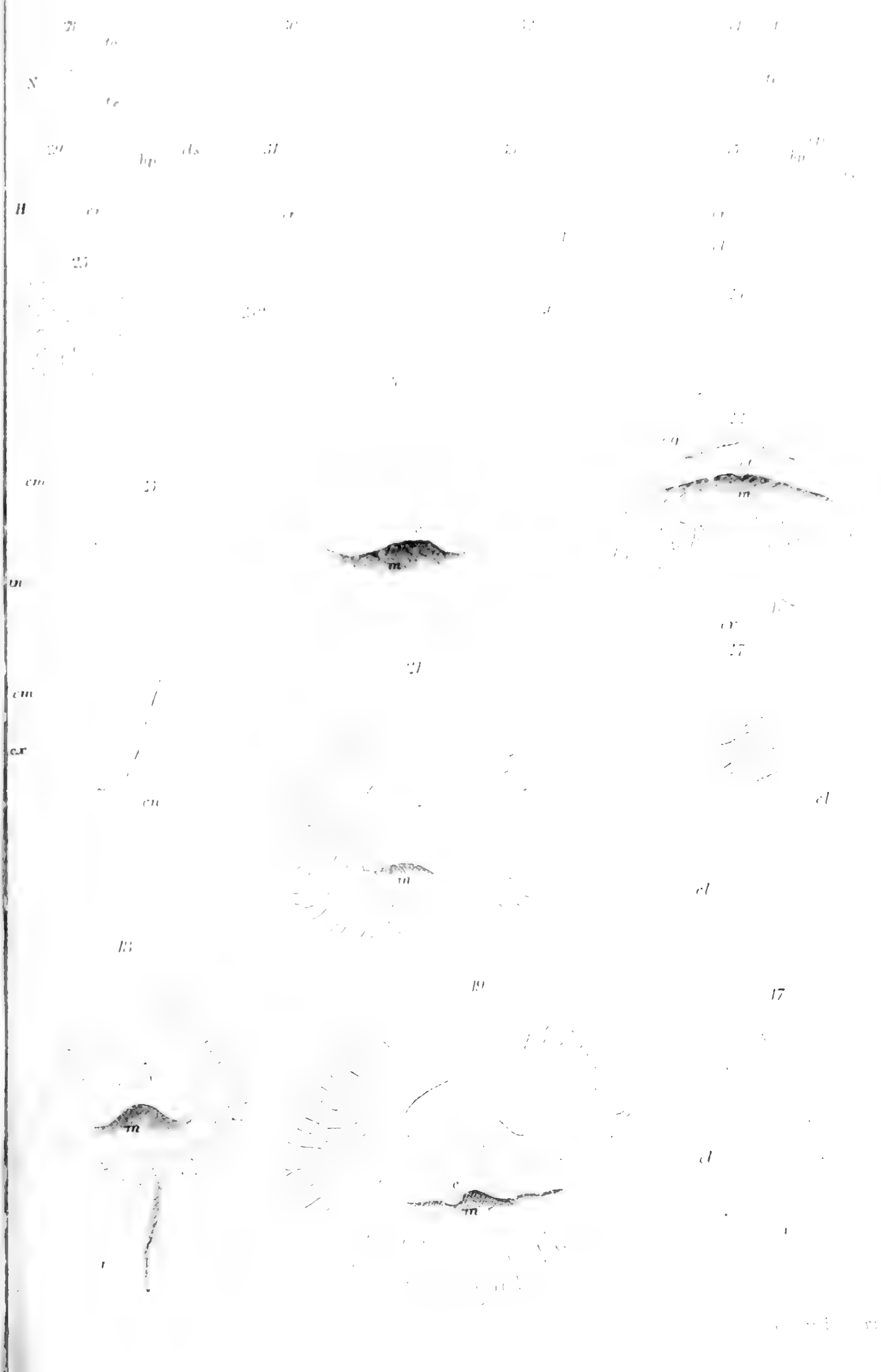

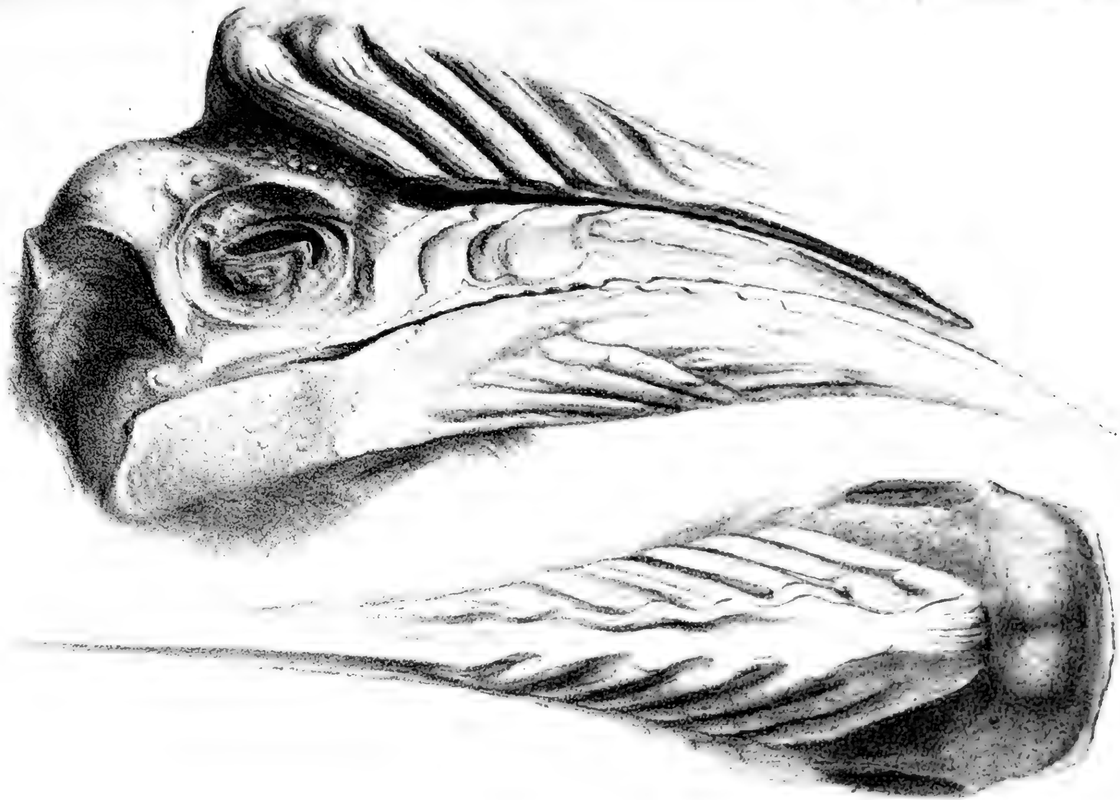

G. Willis lith.

Buceros casuarinus. G. R. Gray

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