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57

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

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

CONDUCTED BY

CHARLES C. BABINGTON, Esq., M.A., F.R.S., F.L.S., F.G.S.,
JOHN EDWARD GRAY, Ph.D., F.R.S., F.L.S., F.Z.S. &c.,
WILLIAM S. DALLAS, F.L.S.,
AND
WILLIAM FRANCIS, Ph.D., F.L.S.

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

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

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

J. Taylor, *Norwich,* 1818.

ALERE FLAMMAM.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

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

No. 79. JULY 1874.

I.—*Observations on a few Graptolites from the Lower Silurian Rocks of Victoria, Australia; with a Further Note on the Structure of* Ceratiocaris. By R. Etheridge, Jun., F.G.S.

[Plate III.]

The Silurian fauna of certain portions of the Palæozoic districts of South-eastern Australia, especially that of the colony of Victoria, is of peculiar interest, on account of the close relationship existing between it and that of a corresponding age in Great Britain. This was originally pointed out by Prof. M'Coy in a small pamphlet published for the Intercolonial Exhibition of 1861*, where he states that he had recognized numerous species of Graptolites in the rocks of the colony characteristic of beds of Lower Silurian age elsewhere. Amongst these were *Diplograptus pristis*, His., identical with specimens from the south of Scotland, *D. mucronatus*, Hall, and *D. ramosus*, Hall, similar to those of the Utica slate of New York, together with many double or twin Graptolites

* Intercolonial Exhibition Essays, 1861, "On the Ancient and Recent Natural History of Victoria;" also this Journal, 3rd series, 1862, vol. ix. p. 137.

from similar horizons. In addition to these Prof. M'Coy was also able to recognize characteristic Bala and May-Hill Sandstone (Upper Llandovery) fossils from several localities, extending over a considerable area. Furthermore, from the occurrence of the Trilobite *Phacops longicaudatus*, Murchison, the presence of the Wenlock-shale series was surmised, besides *Orthoceras bullatum*, a well-known Ludlow form, from beds on which a part of Melbourne itself stands.

The few forms of Graptolites here noticed were collected, some by my friend and former colleague, Mr. Norman Taylor, others by the latter gentleman and myself; whilst a few have since been received from Mr. G. H. F. Ulrich, through Mr. R. Daintree, to both of whom I am much indebted for them. The majority of the specimens are not in a good state of preservation.

Genus TETRAGRAPTUS, Salter.

Tetragraptus bryonoides, Hall. Pl. III. figs. 1–4*.

Graptolithus bryonoides, Hall, Grapt. Quebec Group, p. 84, t. 4. figs. 1–11.
?*Didymograptus caduceus*, Salter, Quart. Journ. Geol. Soc. 1855, ix. p. 87; *ibid.* 1863, xix. p. 137, fig. 13, *a*, *b*.
Didymograptus caduceus, M'Coy, Exhibition Essay, 1861, p. 161.
Tetragraptus bryonoides, Nicholson, Quart. Journ. Geol. Soc. 1868, xxiv. p. 131.

Frond consisting of four simple stipes, united in pairs at their bases, and connected by a short funicle of variable length, from the centre of which proceeds a short pointed radicle, &c. (*Hall*).

Of the Victorian forms of this species four figures are given. Fig. 1, the impression of a frond showing the four stipes flattened out, two broken off near the funicle, whilst on the other two the cast of the solid axis is well defined. Fig. 2 is a similar specimen, in which the whole of the four stipes are displayed, but here, again, two more perfect than the others. These two specimens have the stipes somewhat wider than in the figures of this species given by Hall; they present a certain resemblance to *G. Bigsbyi*, Hall, which I find Prof. Nicholson considers hardly separable from *D. caduceus*, Salter, or *T. bryonoides*, Hall ('Annals,' 1870, v. p. 348). Figs. 3 & 4 are the more common forms under which this species is found in Victorian rocks, and exactly coincide with that described and figured by Salter as *Didymograptus caduceus*. I have placed this above as a synonym of *T. bryo-*

* In drawing these figures, one of the specimens was unfortunately placed the wrong way up; the stipes should be represented looking downwards.

noides, more in deference to the opinion of others better versed in this difficult group than myself; but nevertheless the examination of many Australian specimens has shown the position of the two stipes and "apparent radicle" to be so constant, that I am led to the conclusion that we should pause before finally considering the two species synonymous. At any rate, if they are one and the same, I think Salter's name might with advantage be retained as a varietal designation for such forms as those represented by figs. 3 & 4.

T. bryonoides is characteristic of the Quebec group in America and the Skiddaw group of the north of England.

Localities. Watchbox Ranges, near Baynton's, county of Dalhousie, in blue shale; collected by Mr. N. Taylor. Castlemaine, county of Talbot, in chocolate shale; collected by Mr. G. H. F. Ulrich. Mainroad Gully, Mia-Mia, Spring Plains, Redesdale, county of Dalhousie, in red and white sandy shale; collected by Mr. N. Taylor and the writer.

Tetragraptus quadribrachiatus, Hall. Pl. III. figs. 5–8.

Graptolithus quadribrachiatus, Hall, Grapt. Quebec Gr. p. 91, t. 5. figs. 1–5, t. 6. figs. 5, 6.
Tetragraptus crucialis, Salter, Quart. Journ. Geol. Soc. 1863, xix. p. 137, fig. 8 *b*.
—— *quadribrachiatus*, Nicholson, Quart. Journ. Geol. Soc. 1868, xxiv. p. 131; M'Coy, Exhibition Essay, 1861, p. 161.

Frond composed of four simple undivided stipes arranged bilaterally, or two proceeding from each extremity of the funicle &c. (*Hall.*)

The specimens represented by figs. 5, 6, 7, & 8 I have referred to this species. The stipes appear to be somewhat wider than in those figured by Hall (but this may perhaps be due to pressure), and the funicle slighter.

This species is characteristic of the Quebec and the Skiddaw series.

Localities. Watchbox Ranges, near Baynton's, county of Dalhousie, in blue shale; Newham, near Lancefield, county of Bourke. Collected by Mr. N. Taylor.

Genus Phyllograptus, Hall.

Phyllograptus typus, Hall. Pl. III. figs. 9, 10.

Phyllograptus typus, Hall, Grapt. Quebec Group, p. 119, pl. 15. figs. 1–12; M'Coy, Exhibition Essay, 1861, p. 161; Nicholson, Quart. Journ. Geol. Soc. 1868, xxiv. p. 133, pl. 5. fig. 16.

Stipes robust, composed of four semielliptical parts joined by their straight sides. In some specimens of this species the linear central axis is often crenulate from the bases or impressions of cellules of the other division, which is rectangular to that part of the frond preserved. (*Hall.*)

Numerous specimens of this handsome Graptolite are in my possession from the under-mentioned locality. These show elongato-ovate to obovate form; but in none is the radicle well preserved, and the crenulate axis or midrib only faintly so—except in one specimen, where the latter is sufficiently exposed to demonstrate the specific affinities of the specimens. Hall mentions that the cellules are obscure at the margins; but in the Australian specimens before me these are moderately well marked and almost denticulate. The largest specimen measures 1 inch in length by about $3\frac{1}{2}$ lines in width.

P. typus is a typical Quebec and Skiddaw species.

Locality. Newham, near Lancefield, county of Bourke, in blue shale; collected by Mr. N. Taylor.

Genus LOGANOGRAPTUS, Hall.

Loganograptus Logani, Hall. Pl. III. figs. 11 & 12.

Graptolithus Logani, Hall, Grapt. Quebec Group, p. 100, t. 9. figs. 1–9, and t. 11. fig. 7; M'Coy, Exhibition Essay, 1861, p. 161.
Dichograptus Logani, Nicholson, Quart. Journ. Geol. Soc. 1868, xxiv. p. 128.
Loganograptus Logani, Hall, Twentieth Annual Report, State Cab. New York, 1867, p. 226; Nicholson, Monograph Brit. Grapt. 1872, pt. i. p. 110.

The imperfect specimens represented by figs. 11 & 12 are the only ones in my possession, although far finer have been obtained from various localities in the colony, and are, I believe, in the geological collection of the National Museum, Melbourne. Only a little more than half the specimen (fig. 11) is preserved. There is no evidence of a disk; and the state of preservation is not sufficiently good to show the true characters of the cellules. Fig. 12 is also an imperfect specimen, and, so far as I can judge, is an individual of the present species, although there are only eleven stipes preserved. No disk is apparent; but for some little distance around the funicle the matrix is discoloured, or rather has assumed a lighter colour, approaching that of those parts of the organism preserved.

L. Logani is recorded from both the Quebec and Skiddaw series.

Localities. Newham, near Lancefield, county of Bourke, in blue shale; collected by Mr. N. Taylor. Mainroad Gully, Mia-Mia, Spring Plains, Redesdale, county of Dalhousie, in red sandy shale; collected by Mr. N. Taylor and the writer.

Genus Climacograptus, Hall. Pl. III. fig. 13*.

On a few pieces of shale accompanying *Tetragraptus quadribrachiatus*, and a few other forms, are fragments probably referable to this genus. In one of these (fig. 13) the cellules appear as transverse openings down the right-hand side of the scalariform impression. There is likewise a faint indication of the extension of the axis at the proximal end.

Locality. Newham, near Lancefield, county of Bourke; collected by Mr. N. Taylor.

Genus Diplograptus, M'Coy.

Diplograptus mucronatus, Hall. Pl. III. figs. 14–17.

Graptolithus mucronatus, Hall, Pal. New York, 1847, i. p. 268, t. 73. fig. 1, *a–d*.

Diplograptus mucronatus, Salter, Mem. Geol. Surv. 1866, iii. p. 330, t. 11 A. fig. 6, t. 12. fig. 1; M'Coy, Exhibition Essay, 1861, p. 161; Nicholson, Quart. Journ. Geol. Soc. 1868, xxiv. p. 139.

Prof. Nicholson recorded this characteristic Upper Llandeilo Graptolite as occurring in the Skiddaw series as far back as 1868; it therefore becomes a very interesting point to find it in company, in Victorian rocks, with other genera and species indicative of the same beds, such, for instance, as *T. quadribrachiatus*, *P. typus*, *T. bryonoides*, &c. Figs. 14 & 15 represent a specimen showing the distal extension of the central axis and the long slender processes from the cells. In figs. 16 and 17 may be noticed the peculiar marginal fibres, considered by Hall as giving attachment to the reproductive sacs. Furthermore these fibres are more or less anastomosing, forming a network similar to instances mentioned by Mr. Carruthers in specimens from Moffat, and by Mr. Baily from Meath †. The former remarks, "It is not easy to determine how far the processes from the mouths of the hydrothecæ are to be depended upon for specific characters," but would propose for such forms as the present, should the anastomosing nature of the fibres be of sufficient importance, the specific name of *D. Bailyi*.

D. mucronatus is recorded from the Upper Llandeilo beds of Moffat (*Carruthers*), Lower Llandeilo beds of Wales (*Salter*), Skiddaw series of the north of England (*Nicholson*), Hudson-River group of Albany, U.S. (*Hall*), and has been recorded by Prof. M'Coy from Victoria.

Localities. Watchbox Ranges, near Baynton's, county of Dalhousie, and Newham, near Lancefield, county of Bourke, both in blue micaceous shale; collected by Mr. N. Taylor.

* The figure of this specimen should also be reversed.

† Geol. Mag. v. p. 131.

Diplograptus pristis, Hisinger. Pl. III. fig. 18.

I have referred fig. 18 to this species with some hesitation. There are a series of notch-like projections down each side the stipe, evidently the denticles of the cellules; and the distal extremity is prolonged and expanded into the small globular body or vesicle often met with in some species of this genus. *D. pristis* has previously been recorded from Victorian rocks by Prof. M'Coy*.

Locality. Newham, near Lancefield, county of Bourke, in blue micaceous shale; collected by Mr. N. Taylor.

Genus Didymograptus, M'Coy.

Didymograptus? fruticosus, Hall. Pl. III. fig. 19.

Graptolithus fruticosus, Hall, Grapt. Quebec Group, p. 90, t. 5. figs. 6–8, t. 6. figs. 1–3.

Frond consisting of two pairs of ascending and slightly curved stipes, arising from the two sides of a long slender radicle. The stipes are celluliferous on the inner or adjacent margin, little divergent at the bifurcation, and continuing for half or two thirds their length nearly straight; above this they curve gently outwards . . . . . Radicle half an inch in length. Cellules short and broad . . . . Aperture wide, apex pointed, scarcely mucronate, and sometimes acutely rounded. (*Hall.*)

I was for some time in great doubt to what species to refer this form; but its chief characters appear to approach those of *D.*? (*Grapt.*) *fruticosus*, Hall, nearer than any other, although three only of the four stipes are preserved. A definite attachment is to be seen between the two remaining right-hand stipes, the second of the opposite side having probably been removed through injury. The cellules are broad, with a wide aperture and pointed apex, which projects without becoming mucronate. The radicle is not as long as it should be in this species, according to Hall's description.

Quebec group.

Locality. Castlemaine, county of Talbot, in hard black shale; collected by Mr. G. H. F. Ulrich.

Didymograptus nitidus, Hall. Pl. III. fig. 20.

Graptolithus nitidus, Hall, Grapt. Quebec Group, p. 69, t. 1. figs. 1–9.
Didymograptus nitidus, Salter, Quart. Journ. Geol. Soc. 1863, xix. p. 137, fig. 13, *d*; Nicholson, *ibid.* 1868, xxiv. p. 135.

Frond composed of two simple stipes proceeding from a

* Exhibition Essay, 1861, p. 161.

small radicle, and diverging at an angle of about 170°. Stipes narrower at the base, and gradually widening towards the extremities. Radicle short, abruptly tapering to a point. (*Hall.*)

The specimen I have figured as this species appears to correspond in form and number of cellules with Hall's species. It likewise has some resemblance to Hall's *D.* (*Grapt.*) *patulus*; but the angle of divergence is less than in that species. It is both a Quebec and Skiddaw form.

Locality. Castlemaine, county of Talbot, in chocolate-coloured shale; collected by Mr. G. H. F. Ulrich.

Didymograptus Pantoni ?, M'Coy. Pl. III. figs. 21 & 22.

Graptolithus Pantoni (M'Coy), Salter, Quart. Journ. Geol. Soc. 1863, xix. p. 138 (without description).

To the specimens from which figs. 21 & 22 were drawn, I have provisionally given the name of *Didymograptus Pantoni*, M'Coy. I am not acquainted with any description or figure of this Graptolite; but, from a certain resemblance the specimens bear to Mr. Salter's *D. v-fractus*, which he considered like Professor M'Coy's *G. Pantoni*, I have, as before stated, provisionally given that name to them. Fig. 21 shows two stipes placed in juxtaposition, with the union of the two with the radicle wanting. Fig. 22 represents one stipe and a small portion of the other, and enables us to judge of their angle of divergence from the radicle, which appears to be much less than that of Salter's figure of *D. v-fractus*, and still less than Nicholson's representation of the same species*. That *D. v-fractus*, Salter, and *D. Pantoni*, M'Coy, are identical, I am not at all prepared to say; the great difference in the angle of divergence of the stipes would appear to separate them, of course presuming the specimens here figured to be the latter species. Should they be proved to be identical, Prof. M'Coy's name would have priority. The number of cellules in a given space in *D. v-fractus* and our present species does not correspond, being greater in the former, so far as an opinion can be formed from figures only.

Locality. Mainroad Gully, Mia-Mia, Spring Plains, Redesdale, in red shale; collected by Mr. N. Taylor and the writer.

Genus Graptolithus, Linnæus.

Graptolithus latus, M'Coy†. Pl. III. fig. 23.

The fragmentary Graptolites referred to under this name

* Mon. Brit. Grapt. 1872, pt. i. p. 104, fig. 48.

† Quart. Journ. Geol. Soc. iv. p. 223; also Brit. Pal. Foss. p. 4, t. 1 B. fig. 7 *a*, *b*, *c*.

are now generally regarded as portions of other more complex species, such as *Dichograptus octobrachiatus*, *Didymograptus patulus*, Hall, and others. Prof. Nicholson remarks that, "while not representing a true species, the name may be usefully retained as a convenient designation for the numerous specimens which are too fragmentary to admit of specific or generic determination" *. Such a fragment appears to be the stipe (fig. 23) provided with the triangular submucronate denticles of this so-called species. *G. latus* is recorded as a Victorian species by Prof. M'Coy †.

Localities. Watchbox Ranges, near Baynton's, county of Dalhousie, and Newham, near Lancefield, county of Bourke, in blue micaceous shale; collected by Mr. N. Taylor.

Graptolithus, sp. Pl. III. fig. 24.

In this specimen the cellules do not all retain their normal outline. It is probably only a portion of a stipe of a more complex form. Professor M'Coy ‡ has recognized *G. tenuis*, Portlock, as accompanying other simple Graptolites in Victorian beds; it may be a variety of this.

Locality. Newham, in blue shale; collected by Mr. N. Taylor.

Discarding for the moment the form I have here introduced as *Didymograptus Pantoni* (?), M'Coy, we find that the majority of the foregoing species are particularly characteristic of the Quebec and Skiddaw groups.

Diplograptus mucronatus is considered in this country to be chiefly an Upper Llandeilo species, but at the same time has been placed as a member of the Skiddaw fauna by Prof. Nicholson §. Its occurrence in Victoria with such truly Quebec and Skiddaw species as here shown will, in some degree, tend to confirm this.

Grouping the species recorded in this communication under their respective localities, we find that they range themselves thus:—

Watchbox Ranges, Baynton's: *Tetragraptus bryonoides*, Hall (*D. caduceus*); *T. quadribrachiatus*, Hall; *Diplograptus mucronatus*, Hall; *Graptolithus latus*, M'Coy.

Newham, near Lancefield: *Tetragraptus quadribrachiatus*, Hall; *Phyllograptus typus*, Hall; *Loganograptus Logani*, Hall; *Climacograptus ?*, sp.; *Diplograptus mucronatus*, Hall; *D.*

* Quart. Journ. Geol. Soc. xxiv. p. 141.

† Exhibition Essay, 1861, p. 161.

‡ *Loc. cit.*

§ Quart. Journ. Geol. Soc. 1868, xxiv. p. 139.

pristis ?, Hisinger; *Graptolithus latus*, M'Coy; *Graptolithus*, sp. (? *G. tenuis*, Portlock).

Castlemaine: *Tetragraptus bryonoides*, Hall; *Didymograptus* (?) *fruticosus*, Hall; *D. nitidus*, Hall.

Redesdale (Spring Plains): *Tetragraptus bryonoides*, Hall; *Loganograptus Logani*, Hall; *Didymograptus Pantoni* ?, M'Coy.

Further Note on the Structure of Ceratiocaris.

At the Brighton Meeting of the British Association* Mr. H. Woodward, F.R.S., noticed the discovery of the "swimming-gills" of *Ceratiocaris*, to which I had previously drawn his attention. On a slab of thin flaggy shale from the Upper Silurian series of Lesmahagow are exposed the caudal segments, telson, and caudal appendages of a *Ceratiocaris*. From the ventral margin of the terminal segment proceeds a broad paddle-shaped membranous (?) expansion, presenting a strong marginal outline, with a transversely striated surface. This is followed by another similar appendage, proceeding in the same manner from the penultimate segment. The dorsal edge of the specimen shows that one of the corresponding "foot-gills" of the opposite side has been bent back upon itself, and thus thrust out of place. The free ends of these paddle-shaped appendages are attenuated to more or less rounded points. They do not show any evidence of a marginal fringe. These gill-feet are no doubt analogous to the same supplementary abdominal organs in *Nebalia*.

Locality. Linn Burn, about two miles north of Muirkirk, Lanarkshire, in thin flaggy shale. Collection of the Geological Survey of Scotland. Collected by Mr. A. Macconochie.

EXPLANATION OF PLATE III.

Figs. 1 & 2. *Tetragraptus bryonoides*, Hall. Spring Plains, Redesdale, Victoria.

Figs. 3 & 4. *Tetragraptus bryonoides*, Hall (*D. caduceus*, Salter). Watchbox Ranges, near Baynton's, county of Dalhousie, Victoria.

Fig. 5. *Tetragraptus quadribrachiatus*, Hall. Watchbox Ranges, near Baynton's.

Figs. 6–8. *Tetragraptus quadribrachiatus*, Hall. Newham, near Lancefield, county of Bourke, Victoria.

Figs. 9 & 10. *Phyllograptus typus*, Hall. Newham, near Lancefield.

Fig. 11. *Loganograptus Logani*, Hall. Spring Plains, Redesdale, Victoria.

Fig. 12. *Loganograptus Logani* ?, Hall. Newham, near Lancefield.

Fig. 13. *Climacograptus* ?, sp. Newham, near Lancefield.

Figs. 14 & 15. *Diplograptus mucronatus*, Hall. Watchbox Ranges, near Baynton's, county of Dalhousie.

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* Brit. Assoc. Report, 1872, p. 323; also Mem. Geol. Survey, Explanation 23. Scotland, p. 93.

Fig. 16. *Diplograptus mucronatus*, Hall, with marginal fibres. Newham, near Lancefield.
Fig. 17. *Diplograptus mucronatus*, Hall, with marginal fibres. Watchbox Ranges, near Baynton's.
Fig. 18. *Diplograptus pristis*?, Hisinger. Newham, near Lancefield. The cellules are somewhat too distinctly represented in this figure.
Fig. 19. *Didymograptus? fruticosus*, Hall. Castlemaine, county of Talbot. Three only of the four stipes are here seen.
Fig. 20. *Didymograptus nitidus*, Hall. Castlemaine.
Fig. 21. *Didymograptus Pantoni*?, M'Coy. Spring Plains, Redesdale. Showing the upper portion of two stipes.
Fig. 22. *Didymograptus Pantoni*?, M'Coy. Spring Plains, Redesdale. Showing one stipe, and portion of the other, with radicle.
Fig. 23. *Graptolithus latus*, M'Coy. Watchbox Ranges, near Baynton's.
Fig. 24. *Graptolithus tenuis*?, Portlock. Newham, near Lancefield.

Note.—The figures are all drawn as near as possible to the natural size. I am much indebted to my friend Mr. B. N. Peach for his careful delineation of the specimens.

II.—*Amphipodous Crustacea. A new Species, and some Items of Description and Nomenclature.* By the Rev. T. R. R. Stebbing, M.A.

[Plates I. & II.]

Liljeborgia Normanni, n. sp. Pl. I. figs. 1, 1 *a*, 1 *b*, 1 *c*.

This species comes very near to *Liljeborgia shetlandica*, discovered by the Rev. A. M. Norman; and I have taken the liberty of naming it in honour of that very distinguished carcinologist. Both pairs of gnathopoda agree very closely with the figures and descriptions given by Bate and Westwood of those members in *L. shetlandica*. In the first pair, however, the finger of the new species is longer, and has a serrated edge; in the second pair the hand, instead of being only fringed with hair, is very prettily covered with it. The coxæ of the fifth and sixth pairs of legs are deeper than those figured for *L. shetlandica*; and the thighs of the fifth pair, instead of being equal to those of the sixth and seventh, are considerably smaller.

The lenses of the eyes are not numerous, though the eyes are large—which accords with the description given of the genus, though the eyes of *L. shetlandica* are stated to be small. The magnitude of the eyes is in many species of sessile-eyed Crustacea a very variable character.

The head has a rather deep slit below the lobe on which the eye is situated; and the effect produced is that of a mouth with a curiously protruding chin below it.

The principal specific distinction consists in the ornamentation of the fourth and fifth segments of the pleon: the fourth has its hinder margin produced centrally into three sharp subequal teeth; the fifth has a pair of teeth at each side of its hinder margin. From each interval between two teeth, from the centre of the sixth segment, and from the two ends of the deeply cleft terminal tail-piece there is to be seen a conspicuously projecting seta or spine, those of the tail-piece in the same line with it, the others being directed upwards and outwards.

The specimen here described and figured was taken under a stone in Salcombe Harbour. Its colour was orange, mottled with rose-red; its length, not including the antennæ, three tenths of an inch; the inferior antennæ about half the length of the animal. Another specimen, taken subsequently with the dredge in the same locality, is evidently the female of this species, the only observable differences between the two specimens being that the latter has a pouch containing eggs, and the second pair of gnathopoda agreeing in shape with the first pair.

Iphimedia Eblanæ, variety. Pl. II. fig. 4.

The variety of this species now to be described was dredged in Torbay. My friend Mr. Arthur Hunt sent me, a few weeks back, a small pan of sea-water containing crabs and other marine animals. Among these, two minute crustaceans had been accidentally included, one of them being unmistakably *Iphimedia obesa*, the other apparently *Iphimedia Eblanæ*. The two differed in colour—the former being a speckled brown, much set off by the bright red eyes, while the latter was bright salmon-red of two shades mixed all over. This latter agrees with *I. Eblanæ* in the length of the first and last segments of the body, in having the thighs of the last two pairs of walking-legs produced posteriorly into two sharp points or teeth, in the strongly hooked character of the latero-dorsal teeth of the third segment of the pleon, and in the shape of the coxæ of the last three pairs of walking-legs. It differs, however, in the entire absence of the remarkable peculiarity assigned to *I. Eblanæ*, of having "the first three segments of the tail armed with a central dorsal tooth, directed posteriorly." The thigh of the fifth pair of legs, moreover, is produced posteriorly into one point only, instead of into two.

The circumstances above mentioned under which the two Torbay specimens were obtained suggested the idea that they might be sexes of one species. On the other hand, it should be mentioned that dredging in Salcombe Harbour yielded several specimens of *Iphimedia obesa* without one of *Iphimedia Eblanæ*. *I. obesa* appears to be very variable, but always admirable, in colouring. Among the Salcombe specimens one was whitish, striped with rosy pink, another lemon-coloured, and several purplish grey, most charmingly relieved by scarlet eyes. Very minute hairs stand erect on the hard brittle skin of these portly and beautifully dressed little creatures. The colour of the eyes unfortunately fades rapidly.

Microdeuteropus versiculatus ♂. Pl. I. figs. 2, 2 *a*–2 *f*.

This hitherto unfigured form of *Microdeuteropus* (*Microdeutopus*, Bate and Westwood) was dredged in Salcombe Harbour; and I was at first tempted to make a new species of it, under the name of *Microdeuteropus crinitipes*, in allusion to the great beauty of the hairy gnathopoda. But, upon minute comparison, it appears to differ from the previously described *M. versiculatus*, along with which it was taken, only in the form of the first pair of legs, and is no doubt the male of that species. The Rev. Mr. Norman has, I find, already decided this in his report to the British Association in 1868 on the Shetland Crustacea. In that report he describes the first gnathopods, and states that the hand is at least as wide at the extremity as at the base, his specimens in this one particular appearing to differ from mine. The chief difference between the male and female forms is that in the former the wrist of the first pair of legs is more bulky, and armed at the infero-distal extremity with a strong tooth-like process curving slightly outwards. The hand is not nearly so large compared with the wrist as in the female; but in both the wrist is considerably larger than the hand. The palm is ill-defined; the finger is serrated on the inner edge, and is smaller than the finger in the female. The inner side of the wrist in both sexes is profusely adorned with hairs, the fringe consisting of several fine bundles or closely set brushes.

The second pair of legs are very peculiar; they appear to be exactly alike in both sexes, and have the meros, wrist, and hand all embellished with copious hairs of great length. Under the microscope these hairs are seen to be beautifully feathered. It is, of course, only when the creature is in liquid that these elegant appendages can be seen to full advantage. The wrist and hand are both of them long and slender, the wrist being the longer of the two and rather curiously curved; the meros is also long, closely adpressed to the wrist for about two thirds of the length of the latter, where it terminates in a fine point. The hand, at least in dead specimens, is very much inclined to take a twist, so as not to lie in the same plane with the rest of the limb. This is also the case with the hand of the first pair in the male; and the peculiarity complicates the task of examination as well as that of drawing an exact profile.

As the specimen described in the 'British Sessile-eyed Crustacea' was imperfect, it may be well to add that the last pair of legs are (as is surmised in that valuable work, and in agreement with the description of the genus) much longer than the rest; while the inferior antennæ are the same as those of Messrs. Bate and Westwood's *Microdeutopus anomalus* (on the precise specific position of which as a female form Mr. Norman's very important paper above mentioned should be consulted), with a peduncle as long as that of the superior antennæ and a flagellum much shorter than the peduncle.

Microprotopus maculatus, Norman. Pl. II. figs. 5, 5 *a*, 5 *b*.

This small Amphipod is described by the Rev. A. M. Norman in the 'Annals and Magazine' for December 1868. Mr. Norman, who established the genus in which it is placed, reports it as found among *Laminariæ* at Tobermory, in the Island of Mull, July 1866. I have obtained it plentifully, and of both sexes, this year as the result of dredging in Torbay. As only portions of the animal have been hitherto figured, it seems worth while to give a full-length portrait of it. It should also be noticed that the wrist in the second pair of gnathopods is much broader than would appear from the figure appended to Mr. Norman's description. It receives the hand into a sort of cup or segment of a cup. When the hand is viewed on the inner side, the cup-shape of the wrist is not apparent, while the huge finger also obscures the tooth-like processes of the hand, with the exception of a portion of the largest process. The thigh seems to be deeply grooved lengthwise in a line with the back of the hand. The wrist of the female has been already fully described by Mr. Norman as "very short, broader than long, and somewhat cup-shaped, the infero-posteal angle being projected into a rounded lobe."

Gammarella brevicaudata and *Gammarella* (*brevicaudata* ♀) *Normanni*. Pl. II. figs. 3, 3 *a*–3 *g*.

There can be no doubt that the above-mentioned names have been assigned to the male and female of a single species. Messrs. Bate and Westwood express their suspicion that this would prove to be the case. I first took the female at Anstis Cove, Torquay, on the 21st of March last, under a stone at extreme low-water mark, in company with *Janira maculosa*. Since then I have taken both forms in companionship, and again, along with *Janira maculosa*, under similar circumstances in Salcombe Harbour. They have probably often been seen before, but mistaken for the young of the everywhere abundant *Gammarus locusta*. The shortness of the tail is an obvious distinction; but, as the creature when alive keeps it for the most part curled under its body, it is not such a telltale as it might otherwise be.

The difference in the length of the flagellum of the superior antennæ, noted by Bate and Westwood as one of the chief distinctions, was merely an accidental variation in their specimens. The length of this appendage undoubtedly varies in both forms, as it does in many other species of sessile-eyed crustaceans—so as to make it a very unsafe character on which to ground a specific difference, unless a large number of individuals have been examined and found constant in this feature*.

The only difference of importance between the two forms is in the second pair of gnathopoda. In the male the hand is very large, long, and oval, with a short cup-shaped wrist, and having the palm fringed with ten or a dozen thorn-like bristles, along the inner side of which lies the strong and long finger, tapering almost to the extremity of the palm. The length of the finger, however, is somewhat variable. The corresponding pair of legs in the female have the wrist and hand long and narrow, slightly pubescent, of nearly the same length and breadth, and terminating in an inconspicuous finger. The first pair of legs are very similar to the second, but have the hand shorter than the wrist; they do not seem to differ at all from the first pair of legs of the male.

The coxæ of the first three pairs of legs have a small tooth at the postero-inferior margin, not particularly easy to observe. The thighs of the last three pairs, and especially of the last pair, are serrated in a very conspicuous manner: those of the last pair differ slightly in the male and female—the male having the posterior margin almost in a single curve, with a

* Thus in *Ampelisca carinata*, Bruzelius (*Ampelisca Gaimardii* of Bate and Westwood), the inferior antennæ are stated by the latter authors to be two thirds the length of the animal: and so they sometimes are; but Mr. Norman speaks of the Scotch specimens as having the inferior antennæ "extremely long, equalling the whole length of the animal," and I have two fine specimens from Salcombe in which they are longer than the animal.

scarcely perceptible indentation; while in the female the large bulge of the thigh is contracted rather suddenly by a forward curve.

It remains only to notice that the sixth pair of legs are rather longer than the fifth and seventh pairs, and that the lobe of the head on which the eyes are situated is not curvilinear, but angular, and has a slight incision below it. These details, as well as the elevation of the fourth segment of the pleon, are common to both sexes. For other points the reader may be referred to the standard authorities.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Liljeborgia Normanni.* 1 *a.* First gnathopod. 1 *b.* Second gnathopod. 1 *c.* Terminal segments of pleon, seen from above.

Fig. 2. *Microdeuteropus versiculatus,* male. 2 *a.* First gnathopod, with the hand twisted and foreshortened, more enlarged than the following figure. 2 *b.* First and second gnathopods of another specimen. 2 *c.* Second gnathopod of the same, seen from the opposite side. 2 *d.* First gnathopod of female. 2 *e.* Second gnathopod of female. 2 *f.* Hairs of second gnathopods.

PLATE II.

Fig. 3. *Gammarella brevicaudata* (*G. Normanni*) female. 3 *a.* First gnathopod. 3 *b.* Second gnathopod. 3 *c.* First and second gnathopods of male. 3 *d.* Second gnathopod of another specimen, with a shorter finger. 3 *e.* Maxilliped. 3 *f.* Length of male. 3 *g.* Length of female.

Fig. 4. *Iphimedia Eblanæ,* variety.

Fig. 5. *Microprotopus maculatus,* male. 5 *a.* First gnathopod. 5 *b.* Second gnathopod.

III.—*On* Callisoma Branickii, *a new Species from Nice.* By AUGUSTUS WRZEŚNIOWSKI, Professor of Zoology in the Warsaw University.

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

GENTLEMEN,

You would greatly oblige me by publishing in your valuable Journal, as soon as possible, a brief description of a new species of the Amphipodous genus *Callisoma,* Costa.

I am, Gentlemen, Yours truly,

Warsaw, May 28, 1874. A. WRZEŚNIOWSKI.

Callisoma Branickii, n. sp.

The head small; the eyes compound, elliptic. Inferior antennæ about half the length of the animal in the female and more than three fourths in the male. Mandibulæ with a molar tubercle. The first and second gnathopoda resembling those of *Callisoma Hopei* and *C. crenata.* The coxæ of the five anterior pairs of appendages the same as in the above-named species; but those of the fourth pair of pereiopoda considerably deeper than the ones appertaining to the fifth pair. The meros in the first two pairs of pereiopoda is produced anteriorly, and those of the three succeeding appendages, as well as the carpus of the third pereiopos, are produced posteriorly into a squamose plate. The basis in the last three pairs of pereiopoda nearly the same as in *Callisoma crenata*, but the basis in the fourth pair considerably broader and higher than in the fifth pair. The fourth segment of the pleon, very much smaller than the preceding, has a notch on its dorsal surface and close to its junction with this segment; the fifth segment, still smaller, is also remarkable by a like but much less deep notch. The pleopoda of the sixth pair biramous, the rami being subequal, subfoliaceous; the inner one shorter and fringed on its inner margin with plumous hairs; the outer margins of both branches bear three to four spinules. Telson deeply cut, but single.

The whole animal is covered with brownish-yellow, minute, subovate spots, very regularly disposed, particularly on the segments of the pleon. The dead specimens preserved in spirit are yellowish grey, the others preserved in glycerine tending to a lemon-colour.

Length of the male 7·54 millims., of the female 8·22 millims.

The specimens were taken by Count Constantine Branicki at Nice in a dead *Clypeaster*, and presented to the Zoological Museum at Warsaw.

Being desirous of associating with the discovery one who has done so much for the advancement of natural history in his own country, and contributes so profusely to the enriching of our country museum, I have attached to the species the name of Count Constantine Branicki.

IV.—*On the Longicorn Coleoptera of New Zealand.* By H. W. Bates, F.L.S.

The number of new genera and species of Longicorn Coleoptera described in the following pages, chiefly obtained, without their devoting especial attention to the family, by two gentlemen (Mr. Lawson and Mr. Fereday) in the immediate neighbourhoods of the settlements where they are located, shows how much yet remains to be done before we can be said to have a satisfactory knowledge of the insect-fauna of New Zealand. The representatives of this almost exclusively wood-eating coleopterous family are evidently much more numerous in species there than in the British Isles, 57 being already known; whereas in Britain we have only 56, a number not likely to be increased by future researches. It would be proper, doubtless, to withdraw from the New-Zealand list four of the species as being evidently introduced (three from Australia and one from Europe), thus leaving 53 only; but, on the other hand, several undescribed species exist in private collections.

The remarks I had occasion to make in a former paper on the family Geodephaga, as to the strong endemicity of the New-Zealand Coleopterous fauna, are more than justified by the subsequent study of the family Longicornia. A close and repeated examination of all parts of the external structure which afford characters for judging on the affinity of forms in this difficult group, has resulted in showing that very few indeed of the New-Zealand genera are found in other parts of the world. Out of the total number of 35, no fewer than 26, as far as at present known, are peculiar to the islands; and about a dozen of these have no near relationship to forms occurring elsewhere, the rest being more or less related to genera found in Lord Howe's Island, New Caledonia, and Australia. It is in these two latter countries that seven of the other nine genera occur, one only of them (*Demonax*) extending its range through the Moluccas to South-eastern Asia. As to species, all, except one (*Hylotrupes bajulus*) introduced from Europe and three introduced from Australia, are peculiar to the islands.

Coleoptera Longicornia.

Family **Prionidæ**.

Prionoplus reticularis.

Prionoplus reticularis, White, Dieffenbach's 'New Zealand,' ii. p. 276; Westwood, Arcana Entomologica, ii. p. 25, t. 56. f. 1.

Northern and Southern islands.

Family **Cerambycidæ**.

Division I. *Eyes coarsely faceted.*

Phoracantha dorsalis, Newm.

I have not seen any specimen from New Zealand of this well-known Australian insect. White gives it on the authority of Dr. Sinclair.

LIOGRAMMA, nov. gen.

Ad. gen. *Phacodes* et *Elaphidion* affine, sed antennis articulo tertio apice intus acute producto, articulis reliquis simplicibus. *Corpus* lineare, paulo convexum, nitidum sed passim pubescens. *Caput* retractum; oculi prominuli, grossissime granulati; frons brevis; palpi breves, articulis terminalibus triangularibus. *Antennæ* ♂ corpore paulo longiores, pilosæ, haud sulcatæ, scapo curvato-clavato, articulo tertio apice intus acute dentato, quarto quam tertio paulo breviore, quinto usque undecimum æqualibus, precedente longioribus, gradatim attenuatis. *Thorax* oblongus, postice vix angustatus, lateribus paulo rotundatis inermibus, supra rugosis, lineis elevatis politis. *Elytra* thorace vix latiora apice late rotundata. *Pedes* modice elongati, femora gradatim clavata; tibiæ haud sulcatæ; tarsi breves, articulo primo modice elongato. *Acetabula* antica postice aperta, extus vix angulata, prosterno angusto, marginato; intermedia extus clausa.

This new genus is founded on *Callidium zealandicum* (Blanch.), an insect having no near affinity to *Callidium*, but which Lacordaire was inclined to place in *Callidiopsis*, and White included in *Œmona*. It differs in essential characters from all those groups, and seems most nearly allied to the American genus *Elaphidion*.

Liogramma zealandicum.

Callidium zealandicum, Blanch. Voyage au Pôle Sud, Zool. iv. p. 272, pl. 17. f. 4.
Callidiopsis zealandicus, Lacordaire, Gen. ix. p. 357, note.

Rusty brown in colour, with paler pubescence; the smooth streaks on the thorax consist of a dorsal line and two discoidal ones on each side, the inner of which is connected with a rounded tubercle, and the outer short and sometimes obsolete; the elytra are rugose-punctate throughout.

Sent in some numbers by Mr. Wakefield, with a note attached—" Under bark, Akaroa."

Didymocantha sublineata.

Eburida sublineata, White, Voy. Ereb. & Terr. p. 19.
Didymocantha sublineata, Lacord. Gen. ix. p. 344.

Auckland and Port Nicholson.

Didymocantha picta, n. sp.

D. modice convexa, breviter erecte pubescens, castaneo-fusca; elytris nitidis, apice conjunctim rotundatis, rugoso-punctatis, utrinque maculis quatuor fulvis; thorace spina laterali et tuberculis quinque dorsalibus, interstitiis grosse punctatis; scutello albo; antennis pedibusque castaneo-rufis. Long. 6 lin.

New Zealand. Received from Dr. Baden of Altona.

This species has some points, such as the distinctly clavate femora and tuberculate thorax, in common with the genus *Ambeodontus*; but the form of the muzzle (very short, not tapering, and with produced acute anterior angles), the antennæ, and the palpi are different and show a nearer affinity with *Didymocantha*.

The head is slightly exserted, coarsely punctured, with prominent eyes and short palpi. The antennæ are pubescent throughout, with the fourth joint distinctly shorter than the third, and much shorter than the fifth. The thorax is much narrower than the elytra, with the lateral spine placed much behind the middle, and five tubercles on the disk, three only of which are much elevated; the depressed parts are covered with round punctures. The fulvous spots on the elytra are:—one, rounded, basal; a second, elongated, behind the shoulder; a third, irregular, meeting the corresponding one on the suture in the middle; and a fourth, small, discoidal, before the apex.

Didymocantha diversicornis.

Callidium diversicornis, White, Voy. Ereb. & Terr. p. 20.

The type (a damaged specimen) in the British Museum resembles much *D. picta*, and is congeneric with it. It has, however, more numerous yellow spots on the elytra.

Œmona hirta.

Saperda hirta, Fab. Syst. Entom. p. 184.
Saperda villosa, Fab. Syst. Eleuth. ii. p. 320.
Œmona humilis, Newm. Entom. p. 8 (1840).
Isodera villosa, White, Voy. Ereb. & Terr. p. 21, t. 4. f. 1 (1846).

Auckland, apparently not uncommon.

Leptachrous, nov. gen.

Genus *Phlyctænodi* affine, a quo differt capite ante oculos magis elongato, quadrato, palpis gracilibus filiformibus etc. *Corpus* elongatum, gracile. *Caput* exsertum, antice paulo elongatum, lateribus parallelis; tubera antennifera fortiter oblique elevata. *Palpi* articulis terminalibus haud dilatatis. *Antennæ* subtiliter ciliatæ, scapo gracili, clavato, quam articulo tertio vel quarto longiore; articulus quintus precedente et sequente longior. *Thorax* antice constrictus, supra inæqualis, haud distincte tuberculatus, spina laterali validissima. *Elytra* costata, apice acute rotundata.

Pedes modice elongati; femora vix incrassata. *Prosternum* inter coxas exsertas angustum; acetabula intermedia extus aperta.

Founded on *Cerambyx strigipennis*, Westwood, which White referred with doubt to *Phlyctænodes*, but which differs in all essential points from that genus. The much shorter maxillary palpi, long square muzzle, and elongated scape are the most obvious structural peculiarities.

Leptachrous strigipennis.

Cerambyx strigipennis, Westw. Arc. Ent. ii. p. 27, pl. 56. f. 6.

Port Nicholson. Christchurch.

Ambeodontus tristis.

Saperda tristis, Fab. Syst. Entom. p. 186.
Phlyctænodes trituberculatus, Redtenb. Reise Novara, Col. p. 188.

Three examples received from Mr. Fereday, of Christchurch, belong undoubtedly to the same species as the type specimen of *Saperda tristis* still preserved in the Banksian collection at the British Museum. They agree also well with Redtenbacher's description cited above.

Ambeodontus retiferus, Lacord. Gen. ix. p. 374 (note).

Agapanthida pulchella, White, Voy. Ereb. & Terr. p. 22, pl. 4. f. 10.

Placed by Lacordaire near *Phlyctænodes*.

Ophryops pallidus, White, Voy. Ereb. & Terr. p. 19, pl. 4. f. 8.

Port Nicholson. I have not been able to examine the type of this and the preceding species.

ASTETHOLEA, nov. gen.

Corpus lineare, depressum, fere glabrum. *Caput* breve, rotundatum, exsertum, inter antennas latum, planum, post oculos gradatim angustatum, genis brevibus haud angulatis. *Antennæ* breviter pubescentes, scapo gradatim clavato, articulo tertio quam scapo vel articulo quarto breviore. *Oculi* magni, reniformes, grosse granulati, supra longe distantes. *Thorax* rhomboideus, planatus. *Elytra* linearia, apice obtuse rotundata. *Pedes* modice elongati; femora gradatim incrassata. *Coxæ* anticæ conicæ, contiguæ, exsertæ, prosterno ante coxas truncato; coxæ intermediæ contiguæ, mesosterno antice triangulari, inter coxas haud continuato. *Abdomen* (♀) normale.

This is another of the anomalous forms of Longicornia, of which there are so many in Australia and New Zealand. Its nearest ally seems to be *Tricheops*; but the head is nearly plane between the antennæ, and the antenniferous tubers are almost horizontal, with a continuous impressed dorsal line.

Astetholea pauper, n. sp.

A. fulvo-testacea, glabra, pedibus pallidioribus; capite thoraceque lævibus subsericeis, hoc medio utrinque angulari haud spinoso; elytris punctulatis, utrinque bicostulatis, apud latera et apicem lævibus. Long. $3\frac{1}{4}$–4 lin. ♂ ♀.

Linear and depressed, nearly glabrous, but moderately shining. The head and thorax in their wider parts are as broad as the elytra; the latter are smooth on the sides (which are vertical) and near the apex, but punctulate and with two raised discoidal lines from the base to beyond the middle.

Auckland (*Mr. Lawson*); three examples.

Blosyropus spinosus, Redtenb. Reise Novara, Col. p. 192, t. v. f. 10.

The author does not specify the structure of the eyes, so that it remains uncertain whether this large and remarkable Longicorn belongs to this or the following division. The form of the head, according to the figure, much resembles that of *Astetholea*.

Psilomorpha tenuipes, Saunders, Trans. Ent. Soc. 2nd ser. i. p. 80, t. 4. f. 1.

Found in New Zealand, according to Redtenbacher (Col. Novara, p. 188).

Division 2. *Eyes finely faceted.*

Stenoderus suturalis, Oliv.

Recorded by Redtenbacher as taken in New Zealand.

Callíprason Sinclairi.

Callíprason Sinclairi, White, Dieffenb. New Zeal. ii. p. 277; Westw. Arc. Ent. ii. p. 27, t. 56. f. 3.

Callíprason marginatum, White, Voy. Ereb. & Terr., Ins. p. 23, t. 4. f. 6.

The exact locality of neither of these two species is recorded, and I have not yet seen examples of them.

Zorion minutum.

Callidium minutum, Fab. Syst. Ent. p. 192.
Obrium Fabricianum, Westw. Arc. Ent. ii. p. 28.

I have seen a large number of specimens from Auckland. Amongst them are several varieties, in one of which the white elytral fascia is reduced to a round spot margined with violet, and the pale bases of the femora are terminated by a dusky ring.

Zorion guttigerum, Westw. Arc. Ent. ii. p. 28, t. 56. f. 4.

Port Nicholson.

A specimen from Mr. Lawson, taken near Auckland, differs from Westwood's description by having the head and greater part of the thorax testaceous yellow, nearly as in *Z. minutum*; the tibiæ and tarsi are also violet-brown, like the clubs of the femora. It remains with New-Zealand coleopterists to decide by observation on the spot whether these diversities of coloration really indicate specific differences, and whether there are really more than one variable species in the islands.

GASTROSARUS, nov. gen.

Corpus lineare, nitidum, sparsim erecte pubescens. *Caput* exsertum, post oculos paulo angustatum sed haud elongatum; frons brevis, verticalis. *Oculi* magni, modice convexi et granulati, laterales, supra distantes. *Palpi* paulo elongati, articulis terminalibus vix dilatatis oblique truncatis. *Antennæ* basi distantes, haud ciliatæ; scapo et articulis tertio et quarto æqualibus, brevibus, quinto usque undecimum paulo longioribus. *Thorax* rhomboideus, lævis. *Elytra* linearia, utrinque postice leviter attenuata, apice acute truncata, supra fere lævia. *Prosternum* inter coxas angustum; mesosternum oblongum; metasterni episterna fere parallela, apicem versus tantum angustata; acetabula antica et intermedia extus paulo aperta. *Abdomen* (♀) lineare, elongatum; segmentis primo usque quartum normalibus, quinto ventrali late excavato et dense atque longe piloso; pygidio valde convexo et arcuato. *Pedes* robusti; femora gradatim incrassata; tarsi breves, posticorum articulo primo vix secundo tertioque conjunctim longiore.

Another anomalous genus, having no near affinity with any other known form; it seems, however, to come nearest such genera as *Callimus*, and especially the Australian *Earinis*. I know only the female, which differs from the same sex in *Earinis* in the concentration of the hairiness of the abdomen on the fifth ventral segment and on the arched borders of the pygidium. The form of the metathoracic episterna is very similar to that of *Earinis*, as is also the thorax—oblong, with an angular dilatation in the middle of each side. The head and thorax together are small relatively to the rest of the body. The antennæ (♀) are not much more than three fourths the length of the body.

Gastrosarus nigricollis, n. sp.

G. violaceo-nigra, nitida; ore, pedibus, abdomine et elytris fulvo-testaceis, his apice violaceis. Long. $5\frac{1}{2}$ lin. ♀.

The head is sparingly but strongly punctured, except the middle of the crown, which is convex and glossy. The thorax is small, very faintly punctured, and with a transverse depression near the anterior and posterior margins. Each elytron tapers gradually from base to apex, the latter being broadly and sharply truncated, and not reaching the tip of the abdomen; the surface is glossy, and bears only a few punctures, strongest near the base.

One example. Christchurch (*Mr. Fereday*).

Eburida sericea, White, Cat. Long. Col. Brit. Mus. p. 299.

Waypa River.

The type specimen of this insect in the British Museum has no resemblance whatever to *E. sublineata*, with which White associated it, and which has been found to belong to *Didymocantha*. *E. sericea* has finely faceted eyes and broadly angulated anterior acetabula, and will therefore find its proper place in the *Callidiinæ*; it will probably remain a distinct genus, but I am doubtful whether White's name can properly be applied to it.

Hylotrupes bajulus, L.

Two specimens taken by Mr. Lawson at Auckland, differing in no respect from the European insect. Evidently introduced.

Demonax spinicornis.

Clytus spinicornis, Newm. Zoologist, 1850, Suppl. p. cxix; White, Cat. Long. Col. Brit. Mus. p. 286.

New Zealand. I have not seen this species.

Coptomma variegatum.

Callidium variegatum, Fab. Syst. Ent. p. 189.
Coptomma virgatum, Newm. Ann. & Mag. Nat. Hist. v. 1840, p. 18.

Northern and Southern islands.

Navomorpha lineatum.

Callidium lineatum, Fab. Syst. Ent. i. p. 189.
Coptomma lineatum, White, Voy. Ereb. & Terr., Ins. p. 20, t. 4. f. 5.

Navomorpha sulcatum.

Callidium sulcatum, Fab. Syst. Ent. i. p. 189.
Coptomma acutipenne, White, *l. c.* t. 4. f. 2.

I have examined Fabricius's type in the Banksian collection, and fail to detect any differences between it and the *acutipenne*, White.

Auckland; Christchurch.

[To be continued.]

V.—*On the Skulls of Sea-bears and Sea-lions* (Otariadæ), *and on the Seals of the Auckland Islands.* By Dr. J. E. Gray, F.R.S. &c.

The British Museum contains a large series of the skulls of Sea-lions and Sea-bears, I believe more numerous than those of all other museums in Europe or North America put together; but the British-Museum collection, though large, does not afford a complete series of the different ages of any one species. Thus there are adult skulls of three species of Sea-lions, and also a number of skulls of the young, but not of the intermediate ages. It is the same with the different species of Sea-bears; there are skulls of adult and of very young of several species. The most interesting series is that of the Antarctic Hairy Sea-bear (*Phocarctos Hookeri*).

The examination of the Museum series leads one, I think, to the following conclusions:—

The milk-teeth, like those of the Seals, are very small, and are changed soon after birth, and are immediately followed by the permanent series, in the following order:—

The cutting-teeth are changed first, and after them the grinders, which are followed by the canines, which do not appear above the gums until after all the grinders are developed, and they continue to develop during the growth of the young animal. The crowns of the second series of teeth are, when they are first formed, of the size and form which they retain during the life of the animal, and are only altered in the adult age by the wearing away of the edge of the lobes of the crown which are developed during youth. The roots are being gradually developed during growth; they are at first hollow, but become solid, and some rather thickened in old age. The grinders of the second series, when they are first developed in the very young animal, are rather crowded; but they soon become regularly placed, and they occupy the same length in the margin of the jaw and the same situation relative to the front edge of the zygoma and other parts of the jaw in the young and the perfect animal; so that the position of the grinders in these parts affords a very good character for the distinction of the species, and the dividing them into generic groups.

Zoologists who have not had the opportunity of examining the skulls of the Sea-lions and Sea-bears seem to believe that the teeth of these animals vary greatly in the form of their crowns and their position relative to other parts of the jaw during the age of the animal, and find a difficulty in making out the characters of the species.

The skulls, during their growth from youth to adult age, chiefly lengthen between the back of the face and the brain-case; and the palate of the young is generally broad behind, with a broad opening and a broad front margin to the internal nostrils; but as the skull ages, the back of the palate and the opening to the internal nostrils gradually become narrower, and the lobes on the hinder part of the side fold together over the internal nostril.

The lower edge of the lower jaws of the large skulls of old Sea-lions, probably all males, is much spread out and expanded.

Judging by the very few specimens of the skulls of the very young Sea-bears in the British Museum, and by the figures of the skulls of the young that have been published, they offer two variations in respect of the shape of the internal nostrils:—

In the first the opening of the internal nostril at the end of the palate of the young, as of the adult animal, is short, broad, truncated in front, with sometimes a central notch; and the edge of the internal nostril, in the very young animals, as in *Otaria*, is near to the line between the condyles, but not so near as in that genus; and as the animal grows, and the bones of the face lengthen, the opening of the internal nostril extends further forward, and becomes gradually oblong, narrower, and arched in front, as in *Gypsophoca tropicalis*, *Phocarctos elongatus*, and *Euotaria nigrescens*.

In the second, the hinder opening of the nostril of the very young skull in *Callorhinus*, as figured by Mr. Allen, in *Eumetopias Stelleri*, as shown by the specimens in the Museum, and (judging by the half-grown specimens) in *Arctocephalus* *antarcticus* and *Zalophus Gilliespii* is elongate, coming far forward, and acute in front, and becomes shorter, narrower, and rounded in front in the full-grown animals.

It is to be observed that the two forms of the opening to the palate have been observed in the two species of the genus *Euotaria.*

All these variations have been considered characteristic of species when only one skull has been examined; but the accession of a larger series of skulls shows how these parts vary during growth, and perhaps from accidental circumstances, and shows the necessity of examining a series of specimens of each species.

The British Museum contains some skulls that exhibit the differences that exist in the skulls of the two sexes of these animals. The skulls of the males, in common with the males of the Seals, are known by the larger size of the canines; and their large size renders a broader muzzle necessary to contain them. Probably other characters would be observed if we had a larger series, and knew the sexes to which they belonged. For example, the British Museum possesses several skulls of the *Phocarctos Hookeri* from the Southern seas. The one figured in the 'Zoology of the Erebus and Terror' appears, on account of the small size of the canines, to be that of a full-grown female; and there are two skulls from the same expedition which appear from the size of their canines, which are being gradually developed, to be skulls of full-sized but young males. The two males, 336 *b* and 336 *e*, have larger crowns to the grinders, and the lower jaw of each is strong and broad; whereas the skull of the older female, 336 *a*, which has the canine teeth and outer upper cutting-teeth perfectly developed, has these teeth much slenderer than in the skulls of what I consider to be males; the grinders have smaller crowns, which are placed rather further apart from one another than in the males, but occupy the same length of the margin of the jaw. These skulls also present a difference in the size of the occipital condyles. The occipital condyles of the two young males are large, $2\frac{7}{12}$ in. wide, while the occipital condyle of the adult female is much smaller, only $2\frac{1}{6}$ in. wide in the widest part; and they are of rather a different shape in the skulls of the two sexes.

Since this paper was written, I have received the third part of the 'Proceedings of the Zoological Society' for 1873, which contains a paper by Mr. J. W. Clark, the keeper of the Anatomical Museum of the University of Cambridge, "On the Eared Seals of the Auckland Islands," from which it appears that

Mr. Clark has bought two skulls and the fragments of a third, now in the Museum of Cambridge, obtained from the Auckland Islands during the French expedition of the 'Astrolabe' in the years 1837–1840. He has determined, with the assistance of Mr. E. Gerrard, and by comparison of them with the named skulls in the British Museum, that they belong to *Otaria Hookeri*; and he concludes, from the size of the canine teeth, that the larger is the skull of a male of this species (of which a side and a palatine view are figured P. Z. S. 1873, pp. 754, 755), and the two smaller ones those of females.

Mr. J. W. Clark observes, p. 757:—"It follows that *Otaria Hookeri* has been determined and hitherto known only from female skulls;" and at p. 760 he further observes:—"It is curious that no male specimen" (skull) "should have been brought back, except the one that M. Dumoutier reserved for himself" (which is now in the Museum of Cambridge, and figured by Mr. Clark).

There were in the British-Museum collection, at the time Mr. Clark consulted it to identify the skulls he bought in Paris, the skulls of an adult and a younger male and three skulls of females of this species. The skulls belonged to stuffed specimens of a male and two females, and the skeletons with their skulls belonged to two males and a female.

All except one skeleton of these were brought home by the Antarctic Expedition under the command of Captain Sir. J. Ross; and the skull of the female specimen was chosen to be figured in the 'Zoology of the Erebus and Terror' as being in the most perfect state. The other skeleton was brought from New Zealand.

Mr. Clark observes, "It will be most interesting to discover whether *Otaria Hookeri* is restricted to the Auckland Islands, or whether it extends to any part of New Zealand or Australia." There is in the British Museum the skeleton of a young male from New Zealand, presented to the Museum in 1851 by Sir George Grey.

Mr. Clark goes on to say, "If I am right in my opinion that *Otaria Hookeri* is not found at Cape Horn, the identification of it with the Eared Seal of Pennant, the *Phoca flavescens* of Shaw, and the *Otaria flavescens* of Desmarest, falls to the ground. Pennant's specimen came from the Straits of Magellan."

It is very true that all the specimens of *O. Hookeri* in the Museum, like all the other specimens received from the Antarctic Expedition, were without special habitats. Dr. Burmeister, in the 'Annals and Magazine of Natural History,' 1866, xviii. p. 99, describes and figures the skull of a specimen of *Arctocephalus falklandicus*, "about 3 feet long, taken at the mouth of the Rio de la Plata, where they were formerly common, on the Islas de los lobos"—that is, "the islands of the Sea-wolves."

On comparing Dr. Burmeister's figure of the teeth with those of the skulls of the different Sea-bears, I can only come to the conclusion, from the size of the lobes of the crowns of the teeth, that this figure represented the young *O. Hookeri*; and therefore if this animal is found at the mouth of the Rio de la Plata and at New Zealand, there is no reason why it should not be found at the Straits of Magellan, especially when we consider the enormous number of the southern seals that are collected both for their skins and oil, and that several are recorded as having been found in localities where they are no longer to be found, or at least not in sufficient abundance to be "fished for;" and as I know no other *Otaria* of a pale yellowish colour, I am still inclined to regard the Eared Seal of Pennant as a synonym of *O. Hookeri*.

Mr. J. W. Clark gives an abstract of the history of the Auckland Islands from Mr. Shillinglaw's introduction to, and extracts from, his publication of Captain Musgrave's Journal of the wreck of the 'Grafton' and 20 months' stay on the island: an edition of this book was published first at Melbourne in 1865; and it was reprinted in London in 1866, with the introduction last. Mr. Clark concludes that there are two species of Seals in the Aucklands:—(1) a large Black Seal; and (2) the Sea-lion, called the Tiger Seal because some of the females are spotted (P. Z. S. 1873, p. 753). Mr. Clark identifies the Sea-lion of Musgrave with *O. Hookeri*. It is to be observed that the males and females of *Otaria Hookeri* in the British Museum are plain-coloured and yellowish, and that, of the two specimens in the museum at Paris examined by Mr. Clark, brought from the Auckland Islands, the female is of a uniform yellow colour; so that I have a suspicion that Captain Musgrave, who has only a sealing captain's notion about the species of seals, confounded another seal with Hooker's Sea-bear, more especially as we have authority for believing that the Spotted Sea-leopard (*Stenorhynchus leptonyx*) is found in the Aucklands, and we have in the British Museum the skull of this seal from New-Zealand, presented by Dr. Knox, and it is a seal which has a most extensive distribution in the Antarctic and Southern seas. I know no species of Sea-lion or Sea-bear that has a spotted fur; whereas the Earless or True Seals are very often more or less spotted or eyed, and the Sea-leopard is particular among them for being distinctly spotted.

Mr. Clark observes, "I may mention that I was shown a skeleton of *Otaria jubata* marked as from the Aucklands,"—I suspect, from the Paris Museum, though it is not stated. There is no doubt that this is the Black Seal mentioned by Captain Musgrave; and it would be curious to examine the skeleton to see if it is a separate species of the Sea-lion (*Otaria jubata*) from that found on the coast of South America. Mr. Clark proceeds, "If this should be the case, which I do not believe on the evidence presented to me, it would greatly extend the range of that species; but it is very unlikely that there should be two Hair-Seals as well as a Fur-Seal on the islands."

I do not quite understand what Mr. Clark means by the latter sentence. According to his opinion, the Sea-lion of Musgrave is *Otaria Hookeri*, and the skull figured by Dr. Hector as the young of *A. cinereus* is "very probably the young of *O. Hookeri*;" and we are at the same time told that "*O. Hookeri* is a hair-seal." If the Black Seal of Musgrave, of which we have no account, is *Otaria jubata* or an allied species, it is undoubtedly a hair-seal. Then the *fur-seal* on the Auckland Islands is not accounted for, but *two hair-seals* are! It is to be observed that Captain Musgrave, with a true sealer's view of seals, believes that the Sea-lions which he is about to describe are "common to the higher north and southern latitudes;" so that he has not a very clear idea of zoological species.

I may mention that I have authority for believing the following seals are found on the Auckland Islands:—

1. *Stenorhynchus leptonyx*, most probably the Tiger Seal of Musgrave. This is a regular earless seal, without under-fur. Skull in the British Museum from New Zealand.

2. *Otaria* (*jubata?*). Also without under-fur, always of a dark brown colour. Preserved in the Paris Museum? Most likely the Black Seal of Musgrave.

3. The pale Sea-bear (*Phocarctos Hookeri*). "The Sea-lion," Musgrave; *Otaria Hookeri*, J. W. Clark. A hair-seal without under-fur. Specimens of males and females with skulls in the British Museum.

4. The smaller fur-seal of the Aucklands, *Gypsophoca*, sp.?; *Arctocephalus cinereus* jun., Hector. A true fur-seal. This may be the fur-seal of the sealers; but most probably what they went to collect is another, larger species, perhaps the same as the fur-seal of New-Zealand, *Euotaria cinerea* (*Arctocephalus cinereus* of Hector).

We are informed by Captain Morell, as quoted by Mr. Clark, that "in 1823 Captain Johnson took from this and the surrounding islets 13,000 as good fur-seal-skins as ever were brought into the New-York market." But as yet no small or large fur-seal from the Aucklands has reached Europe, unless it is the fur-seal of commerce (*Otaria falklandica*, Hamilton, Ann. & Mag. Nat. Hist. 1838, ii. p. 81, t. xli., and Jardine, Naturalist's Library, vi. p. 271, t. xxv.), of which we have specimens in the Museum without any reliable habitats and without skulls, which have been compared with the original specimens in the Museum of Edinburgh, said to have been brought from South Georgia or South Shetland by Captain Weddell; but the skins of these seals are very rare in the country now, which agrees with the account of their being no longer to be found in the Aucklands in 1830.

Mr. Clark finishes his paper by some remarks on my genus *Gypsophoca*. He doubts whether the skull received from the Auckland Islands and regarded by Dr. Hector as the young of *Arctocephalus cinereus* is a *Gypsophoca*, but thinks it "may very probably be a young *O. Hookeri*;" and he at the same time observes, "The skull in the British Museum from North Australia is that of so young a specimen that it would be difficult, unless one had a very large series of skulls of different sexes and ages to compare it with, to determine its species with certainty, though I suspect it will turn out to be *Arctocephalus cinereus*" (p. 759).

These observations of Mr. Clark's are exactly such as it is the object of this paper to prevent; and the fact of Mr. Clark having fallen into such a mistake shows the necessity of the subject being studied, even by the keepers of anatomical museums. The skull received by Dr. Hector from the Auckland Islands and the skull in the British Museum from North Australia, though neither of them is the skull of a full-grown or aged animal, are both fully developed and of animals which have their permanent teeth in a complete state, with even their canines developed; and they both have, besides the peculiarity in the form of the base of the skull, the last two upper grinders placed behind the back edge of the front of the zygomatic arch, in a way that is only found in the genus *Gypsophoca*, and is not found in either *Phocarctos Hookeri* or *Euotaria cinerea*—or, as Mr. Clark chooses to call one, *Arctocephalus cinereus*, and, the other, *Otaria Hookeri*, although the latter has no relation to the restricted genus *Otaria*.

VI.—*Descriptions of new Reptilia and Amphibia from Persia and Baluchistán.* By W. T. Blanford, F.R.S.*

Lacertilia.

Family **Lacertidæ.**

9. *Lacerta princeps.*

L. magna, fere sesquipedalis, dentibus palatalibus prædita; scutis postnasalibus utrinque binis, præfrontali unico, verticalis marginibus lateralibus parallelis, anteriore posterioreque in medio prominentibus; squamis temporalibus polygonalibus, antice majoribus; collari libero, denticulato; squamis dorsalibus rhomboideis, carinatis, in series transversas ordinatis, ventralibus in series 10 longitudinales, extremas valde angustiores, dispositis; poris femoralibus utrinque 14: supra griseo-olivacea, subtus albida, maculis 4–5 cæruleis, nigro marginatis, longitudinaliter ordinatis, utrinque post axillam ornata.

Hab. in Persia meridionali.

Only a single specimen obtained. The form of the back-scales resembles that in the small species *Lacerta Fitzingeri* and its allies (*Notopholis*, Gray, *nec* Wagler).

10. *Eremias persica.*

E. major, cauda elongata, corporis longitudinem dimidio vel plus quam dimidio excedente, membris longioribus quam in peraffini *E. arguta* Pall., pede anteriore ad rostrum attingente, posteriore ultra humerum; scuto infraoculari ad labrum pertinente; supralabialibus cæteris 5–7 antice, 3–4 postice; squamis caudalibus caudæ basin versus haud carinatis: supra grisescenti-castanea, nigro sparsim maculata, fascia lata nigra vel nigrescente, interdum albo maculata vel interrupta utrinque ad latus ornata; dorso in ætate juniore albo nigroque longitudinaliter fasciato, lateribus membrisque superne nigris, albo maculatis: cæterum *E. argutæ E. veloci*que Pall. similis.

Hab. frequens in omnibus fere planitiebus Persicis, quæ altitudinem pedum 3000 supra mare superant.

A fine species, distinguished from *E. arguta*, Pall. (=*E. variabilis*), by its longer tail and limbs, and by the infraocular shield extending to the lip. From *E. velox*, Pall., it may be recognized by the caudal scales not being keeled. It is a larger form than either, growing to a length of between 9 and 10 inches, and somewhat differently coloured.

* Continued from vol. xiii. p. 455.

11. *Eremias fasciata.*

E. sexpollicaris, gracilis, elongata, cauda corporis longitudinem duplam æquante vel superante; collari libero, recto; squamis dorsalibus parvis, rotundatis, convexis; caudalibus superioribus carinatis, ventralibus in series transversas 32–35, singulas in medio abdomine e 14–16 scutis oblique nec longitudinaliter ordinatis compositas; præanali uno, sæpe (haud semper) majore; poris femoralibus utrinque 16–19; scuto præfrontali unico, a rostrali supranasalibus, et a verticali postfrontalibus longe discreto; supraciliaribus duobus æqualibus granulis fere vel omnino circumdatis; interoccipitali posteriore nullo; infraorbitali ad labrum pertinente; dentibus palatalibus nullis: supra albida vel fulvescenti-grisea, fusco longitudinaliter fasciata, membris superne fuscis, albo maculatis.

Hab. in Persia meridionali, haud procul ab urbe Karman et in Gedrosia haud frequens.

Distinguished from young examples of *E. persica* by its more elongate form, duller colours, by the superciliary shields as a rule being surrounded by granules, and by the entire absence of palatal teeth.

Mesalina, Gray.

The principal character given by Gray for the distinction of this genus from *Eremias*, the presence of a large præanal shield, is variable in individuals. A better distinction is the form of the ventral shields: they are more numerous and arranged in oblique rows in *Eremias*, less numerous and arranged in longitudinal series in *Mesalina*.

12. *Mesalina brevirostris.*

M. ab *M. pardali* scutis ventralibus in 12 series longitudinales nec 10 ordinatis, capite breviore minusque depresso distinguenda.

Hab. in insula Tumb dicta sinus Persici, et ad Kalabagh in regione Punjab Indiæ.

13. *Mesalina pardaloides.*

M. peraffinis *M. pardali*, sed scutis ventralibus in series longitudinales duntaxat 8 (nec 10) ordinatis, serie extrema utrinque e scutis multo angustioribus composita.

Hab. in insula Henjam seu Angam dicta in sinu Persico.

Both the above are small lizards, closely allied to *Mesalina pardalis*.

14. *Acanthodactylus micropholis.*

A. squamis dorsalibus carinatis, parvis, antice et ad latera minimis; scutis ventralibus in series longitudinales 10, extremis angustioribus ordinatis; poris femoralibus utrinque circiter 25; digitis breviter fimbriatis; scuto infraorbitali plerumque ad labrum pertinente: superne griseus vel fuscus, longitudinaliter albo striatus, membris albo maculatis: cæterum *A. Cantoris* similis.

Hab. in Gedrosia (Baluchistán).

This is distinguished from *A. Cantoris* and, *à fortiori*, from *A. Boskianus* by its much smaller scales on the back, by the granular scales, resembling those of an *Eremias*, on the back of the neck, by the infraorbital shield resting on two supralabials instead of three or four and generally reaching the lip, by being always striped even in old specimens, &c. Several specimens were procured.

Family **Scincidæ.**

15. *Ablepharus pusillus.*

A. parvus gracilis, cauda corporis longitudinem fere duplam æquante; scuto rostrali mediocri, nasalibus postfrontalibusque discretis, supraciliaribus tribus anteriore maximo, præoccipitali (seu frontoparietali) unico, interoccipitali mediocri; palpebris omnino absentibus, annulo circumorbitali e squamis parvulis composito; meatu auditorio parvo, haud denticulato; squamis 20 circum medium corpus, circiter 26 inter axillam et inguinem.

Hab. ad Basrah, ad ripas fluminis Shat el Arab (Tigridis cum Euphrate juncti).

Two specimens obtained. It differs from *Ablepharus Brandti*, Strauch (? *A. agilis*, Stoliczka), in the smaller number of scales between the axils, which are fifty in that species.

Zygnopsis, gen. nov.

Genus affine *Ophiomori*, naribus inter duo scuta, alium supra, alium infra, supranasalibus contiguis, sed membris quatuor debilibus præditum.

16. *Zygnopsis brevipes.*

Z. corpore elongato, pedibus brevibus, anticis digitis 4, posticis 3 instructis, capite conico, rostro rotundato; scuto verticali magno, postice latiore, ad latera emarginato; occipitali magno, margine anteriore concava, postica valde convexa; præoccipitalibus nullis; postoccipitalibus minoribus, oblique elongatis; oculis parvis, palpebris inferioribus transparentibus, meatu auditorio externo nullo; squamis corporis lævibus, in series longitudinales 22 ad medium corpus dispositis: grisea, longitudinaliter fusco fasciata.

Hab. haud procul a Karman in Persia meridionali.

A single specimen only was procured of this remarkable new form.

OPHIDIA.

17. *Typhlops persicus.*

T. purpurascenti-brunneus, fere unicolor, subtus vix pallidior, antice parum attenuatus; scuto rostrali mediocri, subtus parum angustiore, fronto-nasale latitudine haud æquante, nasali cum fronto-nasali supra narem juncto, præoculari antice valde convexo, oculare longitudine subæquante, fronto-nasalibus post nasale approximatis, præfrontali, frontali, interparietali, supraocularibus parietalibusque subæqualibus squamas dorsales latitudine paullo excedentibus; squamis corporis in 22–24 series longitudinales atque 376–390 transversas dispositis; cauda brevi, mucronata, 9 seriebus squamarum circumdata.

Hab. in Persia meridionali.

Distinguished from *T. vermicularis*, Merrem, and *T. syriacus*, Jan, by its uniformly coloured scales, and from the former by the division between the nasal and fronto-nasal shields not extending above the nostril, by the head being longer in proportion to its breadth, and by the rostral shield being broader in proportion both above and below. In *T. vermicularis* the fronto-nasal is narrower than the rostral; in *T. persicus* the reverse is the case.

18. *Dipsas rhinopoma.*

D. capite brevi, depresso; squamis corporis imbricatis in 23 (24) seriebus longitudinalibus, serie media vix majore; naribus valvulis instructis; scutis supralabialibus 8–10, quarto quintoque oculum tangentibus; verticali brevi, vix longiore quam lato, subtriangulari; præocularibus duobus, superiore ad verticale, inferiore ad nasale attingente; loreali distincto nullo; scutis ventralibus 268–274, anali haud bifido; subcaudalibus 76–77: pallide griseo-fusca, transversim albido fasciata, squamis nigro puncticulatis.

Hab. in Carmania.

Two specimens obtained: the largest measures 47·5 inches, of which the tail is 6·75. In one of the specimens the anal shield is cleft, evidently by accident, the integument beneath being also divided.

Amphibia.

19. *Bufo olivaceus.*

B. affinis *B. viridi B. vulgari*que, ab ambobus glandulis parotoideis majoribus, valde latioribus, ovalibus, distinguendus; dorso subglabro; supra pallide olivaceus, subtus albescens.

Hab. in Gedrosia.

Four specimens taken.

Fuller descriptions and figures will be given in a forthcoming work on the natural history of Persia.

VII.—*Description of a new Species of Skink.* By A. W. E. O'Shaughnessy, Assistant in the Natural History Department of the British Museum.

Cophoscincus obscurus, sp. n.

Body tetragonal; tail thick, round. Internasal very large, covering the upper surface of the snout, concave posteriorly. Frontal narrow, triangular, rounded anteriorly; fronto-parietals separated; supraorbitals five, the fifth very small; frenal rather large, almost quadrangular, with the front upper angle pointed. Supralabials six; infralabials four, narrow and long. Ear-opening none. Lower eyelid not transparent. Fifty-two scales in a longitudinal dorsal series, fifty in a ventral one; twenty-two scales in a series round the body; those on the back larger. Number of scales between fore and hind limbs about thirty-four. Preanal scales larger. Limbs small, toes short.

Colour brown, with rows of black dots along the dorsal series of scales, and a dark streak from the eye along the upper lateral margin of the body to the tail.

This species evidently resembles closely the *Lygosoma scutirostrum*, Peters (Monatsber. Akad. Berl. 1873, p. 743), but differs in the number of scales between the fore and hind limbs, and in having no external ear.

Queensland. One specimen in the British Museum.

VIII.—*A Contribution to the Fauna of the River Tigris.* By Dr. Albert Günther, F.R.S., Assistant Keeper of the Zoological Department, British Museum.

[Plates VIII. & IX.]

Dr. Sharpey, F.R.S., has presented to the Trustees of the British Museum a collection of fishes made by his nephew, William Henry Colvill, Esq., at Bagdad. This collection was the more welcome as we have hitherto experienced considerable difficulty in obtaining zoological specimens from Mesopotamia, and as the examples sent were in an excellent state of preservation and of a fair size. On a close examination of its contents it proved to add considerably to our knowledge of the fishes of the Trigris, as will be seen from the following notes.

Perhaps the most interesting specimen of the collection is a beautiful example, 2½ feet long, of *Carcharias gangeticus* (M. & H.). It was previously known that this species enters freely the large rivers of India, and that it inhabits the fresh waters of Viti Levu. But it is a matter of surprise to find a shark in a river at such a distance from the sea, Bagdad being about 350 miles from the Persian Gulf in a straight line, and many more if all the windings of the river are taken into consideration. It would be a point of great interest to ascertain whether this fish spawns in the river (as it actually does in Viti Levu, where it inhabits a lake shut out from the sea by a cataract), or whether it descends to the sea for that purpose.

Of Acanthopterygians, there is only one adult example of the eel-shaped *Mastacembelus aleppensis* in the collection: it has thirty spines; and its coloration agrees with the figure given by Heckel.

Of Siluroids there are two species, both of which appear to be common in the Tigris. The first is the *Silurus triostegus* described and figured by Heckel; the second is an undescribed species of *Macrones*, with which I associate with great pleasure the name of its discoverer :—

Macrones Colvillii. Plate VIII.

Much more slender than *M. aleppensis*, to which it is closely allied.

D. 1/7. A. 12.

The height of the body is contained six and a half times in the total length (without caudal), the length of the head five times. Snout rather depressed, not very broad, its length being two fifths of that of the head; the upper jaw is the longer. The nasal barbels extend to the hind margin of the eye, those of the maxillaries to the origin of the adipose fin. Dorsal spine rather strong, serrated behind, *and nearly as long as the head.* The adipose fin is about twice as long as the dorsal, and *commences at a distance from it which is about equal to the length of the dorsal.* Caudal fin forked, with the lobes rounded, the upper being the longer. Pectoral spine nearly as long and strong as that of the dorsal fin, very strongly serrated interiorly. The ventral fin is inserted immediately behind the last dorsal ray, and terminates at a considerable distance from the anal fin. Olivaceous, with three narrow, white, parallel, longitudinal stripes, one along, one above, and one below the lateral line.

This species does not appear to be scarce. The specimens sent are 9 inches long. Vernacular name "Abu Zumare."

The remaining specimens belong to the family of *Cyprinidæ*, and to the following species:—

1. *Aspius vorax*, Heck.
2. *Capoëta trutta*, Heck.
3. *Barynotus luteus.* Of this species there was only one example in the collection; it seems to occur in the Orontes, throughout Mesopotamia and Persia. Since I have had the opportunity of examining specimens collected by the Marquis Doria at Shiraz, I have convinced myself that it should be removed from the genus *Barbus* (or *Systomus*), to which Heckel had referred it, and placed in *Barynotus.*
4. *Barbus subquincunciatus*, Gthr. When I described this species in 1868 from a single skin in the British Museum without known locality, I suggested that it might have come from Mesopotamia. That this supposition is correct is proved by a single very fine example in Mr. Colvill's collection. It is readily recognized by the large black spots.
5. *Barbus scheich*, Heck. Appears to be common. The examples are the first I have seen; they vary considerably in the comparative length of the dorsal spine; and I have no longer any doubt that *Luciobarbus xanthopterus* of Heckel and *Luciobarbus mystaceus* of the same author are founded on individual variations of the same species.
6. *Barbus Kotschyi*, Heck., with which most probably *Barbus grypus* (Heck.) is identical.
7. The last species is undescribed; it likewise belongs to the genus *Barbus*, and can be readily distinguished from the

preceding by the absence of barbels and its large scales. Its characteristics are as follows:—

Barbus Sharpeyi. Plate IX.

D. 11–12. A. 8. L. lat. 30–31. L. transv. 4/5.

Barbels none. The osseous dorsal ray is rather strong, not serrated behind, and nearly as long as the head (without snout). There are two and a half longitudinal series of scales between the lateral line and the root of the ventral fin. Snout rather short and obtuse. The height of the body is rather more than one fourth of the total length (without caudal), the length of the head two ninths. Origin of the dorsal fin opposite to that of the ventrals. Caudal fin deeply forked. Pharyngeal teeth 5 | 3 | 2, stout, with rather obtuse crowns. Coloration uniform.

To judge from the number of specimens sent, this species appears to be common. The largest specimen is 13 inches long. Vernacular name "Aradah."

IX.—*On the Skull and some other Bones of* Loxomma Allmanni. By D. Embleton, M.D., and Thomas Atthey. With four Plates by William Dinning.

[Plates IV.–VII.]

In the 'Annals,' 1870, v. p. 374, appeared a paper by our late lamented friend Mr. Albany Hancock and Mr. Atthey, "On the Occurrence of *Loxomma Allmanni* in the Northumberland Coal-field." In the same periodical, 1871, vii. p. 73, and in the 'Nat. Hist. Trans. of Northumb. & Durh.' vol. iv. pp. 201 (1871) and 390 (1872), they noticed and partially described another skull of *Loxomma* which had been met with in the same part of that coal-field by Mr. Atthey.

This specimen, being the most complete that has yet been found here or perhaps elsewhere, and wanting but little to make it perfect, demands a detailed description.

The skull has suffered strong compression almost directly downward, with an inclination from right to left.

The upper surface and right border are perfect; but the border of the left maxilla is deficient. The two halves of a lower jaw, right and left, and of the same size, were found near the skull, to which, as they fitted it, they most probably belonged. In addition to the skull and mandible, there were discovered, at about the same time and place, vertebræ, ribs, and bones of the extremities, presumably belonging to the same animal; these were not very numerous, but were by far the most common bones of Labyrinthodonts of any size that were met with; and they differed thus considerably from those of *Anthracosaurus* and of *Pteroplax*, the only other large Labyrinthodonts that have as yet been found in the Northumberland coal-field.

The present paper contains a description of the cranium, mandible, and teeth, and a notice of the vertebræ, ribs, and other bones, in the following order—viz. the upper surface of the cranium, the under surface, the occipital surface, the mandible and teeth, and, lastly, the vertebræ, ribs, and bones of the extremities.

I. *The upper surface of the skull* is represented in Pl. IV. Viewed thus the skull of *Loxomma* resembles generally that of *Archegosaurus* and the Crocodilia, and of the latter the alligator rather than the crocodile; the snout, however, is broader than that of the alligator, as is the whole skull, and the posterior lateral expansions of the cranium for the articulation of the mandible project a good deal further backward beyond the occiput than in the above-named animals.

The length of the skull along the median line, from the end of the snout to the posterior edge of the occiput, is $12\frac{1}{2}$ inches, from the same point to the end of the lateral expansion above the articular condyle $14\frac{1}{2}$ inches.

The breadth from side to side at the widest part, which is a little in front of the posterior edge of the occiput, is 8 inches, over the posterior ends of the orbital vacuities 7 inches, over the anterior ends of the same 5 inches, and over the broadest part of the snout $3\frac{1}{2}$ inches. The snout is broadly rounded off and rather flattened in front.

This upper surface of the skull is all but perfect; the sculpturing, the mucous grooves, the nostrils, the orbital vacuities, the parietal foramen, the temporal fossæ leading to the external ears, are all distinct.

Each bone can (more or less clearly) be seen surrounded by suture; the sculptured pattern on the surface is the same as that described in the notice of *Loxomma* in the 'Nat. Hist. Trans. of Northumb. & Durh.' vol. iv. pp. 201 (1871) and 390 (1872), namely "the peculiar honeycombed or reticular structure;" but it is distinguishable from that of the other Labyrinthodonts.

On examining closely the hollows or pits of this surface, both of the cranium and mandible, one, two, or three minute but well-defined openings are seen passing into the bone, but only penetrating its outer table; when three of these exist in the same pit they are placed in a straight line: their use is enigmatical; perhaps they lodged minute glands for lubrication of the skin of the head. The skin we infer to have been naked.

The mucous grooves on the bones, of which there are two pairs, run obliquely backward from the margins of the premaxillaries and maxillaries: the premaxillary pair commence at a point midway between the median suture and the opening of the nostrils, and are $2\frac{1}{2}$ inches apart; thence they run backward and inward for a quarter of an inch, and are united by a groove running across the median line; beyond this transverse communication they pass almost directly backward for $1\frac{1}{2}$ inch, and then abruptly cease, having been impressed for the last half inch upon the nasal bones: the maxillary pair, arising on the margins of the maxillary bones, a short way behind the widest part of the snout and about a quarter of an inch behind the openings of the nostrils, run obliquely backward and slightly outward on the maxillæ, and are discontinued on the edges of the lachrymal bones.

The nostrils lie, therefore, between the premaxillary and the maxillary mucous groove of each side, but nearer to the latter than to the former. They are openings of about $\frac{1}{2}$ inch diameter, nearly circular, and bounded in front by the premaxillaries, behind by the maxillaries, and internally by the nasal bones; their central points are 3 inches apart; and a line drawn across the nasal region between these points is nearly 2 inches behind the mid point of the snout. They are only about a quarter of an inch removed from the margin of the jaw.

The orbital vacuities are large, irregularly elliptical in outline, and diverge slightly from each other in front; each measures $4\frac{1}{2}$ inches in length, and $1\frac{1}{2}$ inch across the broadest part. The true orbits occupied only a portion of the vacuities at the posterior and inner part, as indicated by two nearly opposite and slightly prominent points on each margin, which are best seen on the left side of the figure on Pl. IV.; to these points ligaments and membranes, defining in front the proper spaces for the eyes, had been attached; on the right side the malar bone has been partially dislocated, and its inner edge driven a short way into the vacuity.

The parietal foramen, rather over $\frac{1}{8}$ inch in diameter, is formed equally by the parietal bones at the union of the posterior third with the anterior two thirds of the interparietal suture. It is circular, perforates the top of the cranium, and opens below as a smooth, inverted funnel-shaped cavity, The broad channels or fossæ leading to the external auditory openings (*the temporal fossæ*) are bounded on the inner side by the squamous and mastoid bones, and, notwithstanding that the skull has been subjected to immense pressure, are still seen to be at a somewhat lower level than those bones. They pass forward for about an inch from the external posterior angle of the mastoid, are rounded off outwardly in front, their floor becoming gradually more superficial on the supratemporal bones; these constitute nearly the whole of their floor, the narrow parts of which left on the inner sides are supplied by the ossa quadrata.

External to these fossæ, extend broadly outward and backward, for nearly 2 inches behind the posterior border of the occiput, the posterior expansions of the sides of the cranium, or extensions of the maxillæ.

Individual bones.—These can be distinguished, with a little trouble, by observing the lines of suture along which they are united.

The premaxillaries form the whole of the front of the snout, and are firmly united on the median line; they are bounded behind, on each side of the mouth, by a small portion of the maxillaries, which in part they overlap; further in, by the nasal orifices, and next by the nasal bones.

The maxillaries occupy the edge of the upper jaw, from the outer ends of the premaxillaries and the nasal orifices to the suture uniting the malar and quadrate jugals, a distance of $9\frac{1}{2}$ inches; they are seen from above as far as a point nearly opposite to the middle of the length of the orbital vacuities. These bones nowhere measure more than $\frac{3}{4}$ inch in breadth; behind the broadest part they rapidly become narrower, and form a mere bordering to the jaw, and are only here and there visible from above. Their inner borders unite in front for an inch with the nasals, then for $2\frac{3}{4}$ inches with the lacrymals, and further back with the malars.

They belong mainly to the under surface of the cranium, and will be noticed again in the description of that part.

The nasals lie immediately behind the middle of the premaxillaries and before the frontals; they are more expanded in front than behind, contributing to keep up the breadth of the muzzle, and occupying the whole space between the nasal orifices; they are bounded on their outer sides by the maxillaries, lacrymals, and prefrontals.

The lacrymals are wedge-shaped and pointed in front, occupying the angles left by the maxillaries and nasals, and are cleft behind, the outer division being larger than the inner, to enclose the anterior angles of the orbital openings. They are bounded by the nasals and prefrontals at their inner, and by the maxillaries and malars at their outer border.

The frontals are narrow and elongated, slightly broader behind than before, united in front to the nasals, behind to the parietals,and on their outsides to the prefrontals for three fourths of their length, and to the postfrontals for the remaining one fourth. The median suture unites them to each other.

The prefrontals, elongated and about half as wide as the frontals, become gradually wider from back to front; they rest upon the postfrontals behind, upon three fourths of the frontals at their inner sides, and form three fourths of the inner edges of the orbital openings at their outer side. Just in front of the suture uniting the pre- and postfrontals, at the outer margins of the bones is a small but distinct prominence, marking the boundary, on that side, of the true orbit. In front, the sharply wedge-shaped ends of the prefrontals are received into retreating angles formed by the diverging sides of the nasals and lacrymals.

The postfrontals are rather more than half the length of the prefrontals, somewhat hatchet-shaped, the handle forwards, and joining the prefrontals; their inner edges are bounded almost equally by the frontals and parietals; posteriorly they abut upon the squamous bones, and externally, besides joining with the postorbitals, form smooth rounded concave edges, which look outwards and forwards, and constitute a considerable part of the inner border of the true orbit.

The parietals are a good deal shorter, but on the whole broader, than the frontals, with the posterior borders of which they articulate. They are much broader behind than in front, and are joined outside by the postfrontals and squamous bones, and behind with the pair of bones to be next mentioned.

The parietal foramen has been already noticed.

The pair of bones next behind and articulating with the parietals, and which, united on the median line, overhang the occipital segment of the skull, as the parietals themselves in most Vertebrata do, correspond to the pair called "supraoccipitals" by Von Meyer in his description of *Archegosaurus*, in his work entitled 'Reptilien aus der Steinkohlen-Formation in Deutschland.' They are irregular squares of about $\frac{3}{4}$ inch on a side; their outer borders are bounded for a short space anteriorly by the squamous, and further back by the mastoids; behind they articulate on each side of the median line with the upper border of what appears to be the true supraoccipital, and, further out, slightly with the exoccipitals. They form with the mastoids the posterior border of the top of the cranium.

These bones do not exist in the Crocodilia or in the great majority of fishes, though they are present not only in *Loxomma* and *Archegosaurus* but also in *Pteroplax*; they do not appear either to form a part of the skull in any other of the Labyrinthodonts. Occasion will be taken to notice these bones more at length under Section III. *Occipital Surface.*

The mastoids, which are squares of $\frac{3}{4}$ inch, and form the posterior external angles of the upper middle cranial surface, lie external to, and join with, the last noticed bones; in front they abut upon the squamous bones; externally they are free, and bound the posterior part of the inner margins of the fossæ leading to the ears.

At the back part of the mastoids, and close under their external angle, is a somewhat obtusely pointed tooth-like process, directed backwards from the under surface of the bone, and marked by muscular impressions.

The squamous bones, of an irregular shape, lie external to the parietal, and form the anterior curved margins of the temporal fossæ, having the postorbital and the supratemporal (Huxley), the tympanic (Von Meyer), on their outer side. They are connected in front with the postfrontal and postorbital, and behind with the mastoids. By a small posterior part of their inner margins they are sutured to the so-called "supraoccipitals."

The postorbitals are of a somewhat rhomboidal outline; their anterior internal borders, concave, form the posterior and external margins of the true orbits; their inner angles, which are truncated, abut upon the postfrontals, which bound the orbits posteriorly and internally. These two bones (the postorbital and postfrontal), with a small portion of the posterior end of the prefrontal, form the whole of the bony margin of the true orbit. The anterior angles of the postorbitals project into the orbital vacuities, marking on their outer margins the boundary of the true orbit, as noticed already under the heading "*orbital vacuities*." The postorbitals articulate by their inner and posterior sides with the squamous, and by their outer and posterior with the supratemporal of Huxley, the tympanic of Von Meyer. Their remaining sides, the anterior and the external, join with the jugal bones.

The malars or *jugals*, much elongated, form the middle two thirds of the external borders of the orbital vacuities (on the right side the bone, as already noticed, has been partially dislocated), and overlap by their external borders nearly 6 inches of the borders of the maxillaries: they grow narrower as they extend forward, and have a pointed end received into the angle formed by the diverging posterior edges of the maxillaries and lacrymals; extending backwards they become rapidly broader, and cease posteriorly in an obliquely running zigzag line of suture, which unites them, from within outwards, to the postorbitals, the supratemporals, and the quadrate jugals. The external borders of this upper surface of the maxillary part of the cranium are formed largely by these bones, and are completed in front by the maxillaries and premaxillaries, and behind by the bones next to be noticed.

The quadrate jugals, oblong in shape, complete the posterior three inches of the external, somewhat convex border of the maxillary part of the cranium; they articulate by their anterior ends with the malar, and by their internal edges, also convex, with the supratemporal, a small portion of this line of suture being reserved at the back part for connexion with the quadrates, together with which they form the great posterior external angle of the skull.

The supratemporals are much larger than the quadrate jugals, and are of an irregular oblong shape; they are bounded in front by the postorbitals and malars, externally by the malars and quadrate jugals; and posteriorly they overlap the quadrates. On their inner side they are opposed, first and in front, to the postorbitals, then to the squamous bones, and form, as before said, the greater part of the floor of the temporal fossæ, where they overlap considerably the quadrates.

The quadrate bones form only a narrow slip of the inner side of the floor of the temporal fossæ, and stretch as a rather narrow and irregular border outwards and backwards to join the quadrate jugals; these form the extreme external angle of the skull.

The quadrates enter more largely into the formation of the under surface of the skull, and there, at the external angle, form the condyles for articulation with the mandible, and will be further described with the rest of the under surface.

II. *Under surface of Skull* (Plate V.).—The dimensions are here the same as those of the upper surface. The whole of the alveolar border of the left maxilla is wanting, except about two inches of the posterior end; and there are therefore on this side no maxillary teeth remaining. The right maxilla is very nearly perfect. The whole of the middle and posterior part of the palate is much depressed, except along the median line, where, for four inches from the posterior edge of the palate, exists a narrow ridge, formed apparently of the basal part of the presphenoid and perhaps of the vomer; from this ridge the palate-bones on each side have been broken off and pressed down to a lower level. At the beginning of the posterior third of this ridge there is an oblique fracture through the presphenoidal part; in front of the fracture the ridge tapers gradually to a point, which is probably the anterior end of the median part of the vomer, and where it is joined by the vomerine palate-plates.

The teeth are all broken off at about the level of the alveoli, except four on the right side. The whole surface of the palate between the palate-plates of the maxillaries, (namely, the palate-plates of the palate-bones and of the vomers) are covered all over with small, somewhat pointed, and thickly set granulations; the vomerine and premaxillary divisions of the palate are the strongest parts of the upper jaw. There is no anterior palatine foramen.

The malar or *zygomatic arches* are open and wide, being about 4 inches long by 2 inches at the widest part, and of an elongated ovoid shape, their apices pointing forwards.

The posterior nares are placed far back, at the posterior part of the pterygoids, and close together, but distinct from each other.

Behind the nares are two bony projections, apparently from the basisphenoid; this bone is difficult to define, but is attached to the apex of the basioccipital behind. This is of a triangular form; and its forward-pointing apex is wedged in between the converging posterior lateral projections of the cranium, bordered by the ossa quadrata. At its base is seen the cup-shaped cavity for articulation with the body of the atlas.

Individual bones.—The premaxillaries are well preserved, and are firmly united by the median suture; their alveolar border or arch is somewhat elevated above their palate-plates, and contains four teeth on each side of the symphysis; all are broken off on a level with the alveoli.

In another specimen of *Loxomma* in Mr. Atthey's possession there are five teeth on the right and six on the left side.

The last two teeth at the extremities of the premaxillary arch are only half the size of the others, and are placed nearer to each other than the rest are.

Each dental interspace is fully occupied by a wide and deep depression, which varies in size with the distance at which the teeth are apart. These depressions, it has been said, are destined for the reception of the points of the mandibular teeth when the mouth is closed; as, however, we doubted the correctness of the assertion, Mr. Atthey made transverse sections through these depressed spaces and the adjacent parts of the jaw, taking in some of the teeth; and then, under a low magnifying-power, we discovered in each case, a little below the surface of the depression, the remains of the root of a former tooth. Depressions of the same character existing along the alveolar border of the maxillæ were next, in several instances, similarly examined in section, and with the same result; the remains of a tooth existed in each. These depressions, therefore, instead of lodging the teeth of the other jaw during closure of the mouth, are the vestiges of former alveoli from which old teeth have been shed. Besides, it can be shown that the teeth of the mandible are not received into these depressions when the mouth is closed; for the upper jaw, forming the larger arch, must, when the mouth is shut, enclose the corresponding part of the mandible; moreover the teeth of the mandible, when the mouth is closed, do not otherwise correspond to the depressions of the maxilla.

The median suture between the premaxillaries is distinct, and is thence continued backward, first between the vomerine palate-plates and then between those of the palate-bones and the pterygoids as far as the posterior border of these last.

At the posterior border of the premaxillaries this suture is crossed by a transverse one, uniting these bones with the vomerine plates. The latter suture is projected forwards on the median line by a rounded prominence of the vomers; from this on each side it curves forward and outward and then backward, thus surrounding a considerable part of the base of the vomerine tusk, from which it is distant only about an eighth of an inch. It terminates at the borders of the jaw, uniting at that part the contiguous ends of the premaxillaries and of the alveolar borders of the maxillaries.

The vomers, immediately behind the premaxillaries, stretch almost entirely across the palate, and are separated from the border of the jaw only by a narrow strip of the maxillary alveolar border; their external anterior angles have the large tusks, hence called vomerine, implanted in them: behind each of these is a large depression, each a little larger than the base of the tusk, and resembling those of the premaxillary interdental spaces; and further back there is an aperture on each side in the jaw, presently to be noticed.

The outer borders of the vomers are next directed backwards and inwards for about $1\frac{1}{2}$ inch; thence they run abruptly inwards and forwards, converging to the median line of the palate. The angles they thus form together are inserted between the palate-bones on the inner and the maxillaries on the outer sides.

The vomerine tusks present a clean fracture of circular outline, with a diameter of $\frac{7}{10}$ by $\frac{5}{10}$ inch.

The apertures above noticed in the jaw are obscure; they do not pass through the jaw to its upper surface, but merely pierce the nasal cavity. They are not in connexion with the anterior nares. In *Lepidosteus*, a short way behind the snout, there is, on each side of the median line, a complete perforation of the maxilla for the reception of a mandibular tooth during closure of the mouth. Perhaps the apertures in *Loxomma* have the same use; they are of about the same size as the depressions in front of them, and are bounded internally and in front by the vomers, externally by the alveolar borders of the maxillæ, and posteriorly by the anterior ends of the palate-plates of the same bones.

The maxillaries are the longest bones of the skull, and consist of alveolar borders and palate-plates. On the right side the alveolar border of the bone is very nearly perfect, whilst that on the left side is nearly all wanting. The palate-plates are perfect on both sides.

The alveolar border is a narrow tract of bone, $8\frac{1}{2}$ inches long, extending from the premaxillary to the quadrate jugal, with which latter it articulates at about $3\frac{1}{2}$ inches in front of the posterior end of the lateral part of the cranium. The border which remains bears thirteen small teeth irregularly disposed, and has four gaps from which both bone and teeth have disappeared. It is highly probable that the teeth had originally been more numerous; for in another specimen, in Mr. Atthey's collection, of the skull of *Loxomma*, in which the maxilla measured in length very nearly the same as that of the specimen before us, there were twenty-four teeth easily counted.

The inner edge of the alveolar border towards the front is depressed for the space of $1\frac{3}{4}$ inch below the level of the outer.

The palate-plates of the maxillaries are about $6\frac{1}{2}$ inches in length, with an average width of 1 inch, and extend from the aperture in the jaw and the vomerine plates backwards to articulate with the malars and ectopterygoids. Each is transversely divided into two, if not three, pieces, there being an undoubted suture at the distance of 2 inches from the anterior end of the bone, and a doubtful one at nearly the same distance further back; the supposed third piece bears no tooth.

The first piece of the palate-plate, a little broader than the others, lies between the alveolar border externally and the vomers and palate-bones internally; in front it forms the posterior margin of the aperture in the jaw; and immediately behind this edge occurs a large round depression, behind which again is a tusk, but one of smaller diameter than the depression; the tusk is only $\frac{3}{4}$ inch in diameter, and its outline is more circular than that of the vomerine tusk.

The second piece is bounded laterally by the alveolar border and by the palate-bones, and bears, at a distance of $1\frac{1}{4}$ inch behind the last-named tusk, another, which has a diameter of only ½ inch; and behind this is a depression much larger than the tusk itself.

The third piece, indistinctly divided from the second, is bounded laterally by the alveolar border and the malar externally and the palate and ectopterygoid internally; and its posterior extremity forms a small portion of the anterior boundary of the zygomatic arch.

The palate-bones are long and rather broad, occupying a large space on each side of the median line; together they have an ovate-lanceolate form, pointed in front and inclosed on each side for about an inch by the vomers, behind this by the palate-plates of the maxillaries, and next by the ectopterygoids. Their posterior ends abut upon the pterygoids; but no connecting suture can be made out.

Had the skull not been so much crushed, these bones would have been found united by suture along the whole of their inner edges; as it is, they have, as before mentioned, been dislocated from the lower edge of the vomer and presphenoid for a considerable distance along the median line, and can be observed lying apart with their serrated edges well preserved, whilst the presphenoid and vomer form the ridge already named as projecting between them.

At the posterior termination of this ridge two pits, one on each side of the median line, mark the position of the posterior nares. Behind these are two projections opposite to each other and about ½ inch apart, probably belonging to the basisphenoid; they are sharply defined posteriorly and internally, and slope downwards on their anterior and external sides. A well-defined smooth groove or channel runs along their bases on the inner and posterior sides from before backwards and is soon lost. A distinct suture follows this groove, lying on its outer edge. The grooves seem adapted for vessels or nerves; or it may be that they are vestiges of the lateral Eustachian tubes.

A transverse suture connects the posterior end of the median ridge before noticed to that part of the base of the skull immediately behind, which appears to be the basisphenoid, as it articulates or is continuous posteriorly with the apex of the basioccipital. The basisphenoid is difficult of definition, owing to the crushed state of the skull.

The basioccipital. This is the somewhat triangular piece, which, by its forwardly placed apex, articulates with the basisphenoid: its sides articulate with the quadrates; and its base is occupied by a deep cup-shaped cavity (in place of the convex condyles found in the other Reptilia) for articulation with the body of the first cervical vertebra. The surface of the bone in front of the articular cavity is smooth and slightly convex; its sides, somewhat rough, are overlapped a little by the quadrate bones.

The articular cavity, much compressed, has an oval contour; its transverse diameter is $1\frac{4}{10}$ inch, and its depth considerable. In several other specimens of the basioccipital in Mr. Atthey's collection its outline is more regularly circular; these specimens are of various sizes, having belonged to examples of different ages.

Behind and below the cotyloid cavity are partially seen the facets of the exoccipitals for articulation with the neural arch of the atlas. The foramen magnum is not visible in this view.

The quadrate bones can be distinguished as bounding by their inner borders the basioccipital triangle and the cotyloid cavity, and then running outward and backward to the posterior external angle of the cranium, joining there with the quadrate jugals and constituting the condyles for the mandibular joints. The condyles are almost transversely placed, but have a slight inclination forwards at their inner ends, about $1\frac{1}{4}$ inch long, rounded from before backwards, and their ends somewhat raised above the middle, which is slightly depressed.

The quadrates at their internal ends are broad, and become gradually narrower as they are traced outwards to the condyles, where they are again enlarged. Their outer borders form a considerable part of the inner margin of the zygomatic arch; in front they appear to articulate with the basisphenoid and ectopterygoids and perhaps also with the pterygoids; but it is impossible clearly to make out these parts. On the left side the anterior terminations of the quadrate are hidden by the ectopterygoid, which has been dislocated and thrown over them.

The ectopterygoids complete the sides and back part of the bony palate by uniting with the palate-bones and the pterygoid; but the lines of connexion are not visible.

They are rather broad and strong and articulate behind with the quadrates; directed thence outwards and forwards they are sutured to the posterior internal extremity of the palate-plates of the maxillaries.

The malar or zygomatic arches, as seen from below, are thus circumscribed by the ectopterygoids, the posterior ends of the palate-plates of the maxillaries, and a portion of the alveolar border of the same bones, by the malars, quadrate jugals, and quadrate bones.

The inferior surface of another skull in Mr. Atthey's collection is shown, of natural size, in Plate VI. fig. 1. The posterior part only is given.

III. *The Occipital Surface.*—It is impossible to estimate the height of the occiput, owing to the crushing it has undergone; it is much flattened, concave on the whole from side to side (that is, from the posterior external angle of one mastoid to that of the other); external to the occiput project backwards and outwards on each side the posterior lateral angles of the maxillary part of the cranium.

The upper border of the occipital surface is also the posterior border of the middle part of the skull, and overhangs slightly the parts beneath it. It is formed externally by the mastoids and between them by the pair of bones corresponding to those which, in *Archegosaurus*, are called by Von Meyer, in his work before quoted, "supraoccipitals." Immediately below this border runs a transverse line of suture connecting the bones forming the border with those beneath it—namely, next the median line with the single and, as we deem it, the true supraoccipital, and laterally with the exoccipitals.

The supraoccipital is of a subtriangular form, wider from side to side than from above downwards, and situated on the median line. It is doubtful whether or not the median suture passes through it. Below it articulates with the exoccipitals.

The exoccipitals are a pair united by suture on the median line below the supraoccipital; they form the upper portion and sides of the foramen magnum; their upper borders articulate next the median line with the supraoccipital and then with the supraoccipitals of Von Meyer, and further out with the mastoids; their lower borders, external to the foramen magnum, rest upon the basioccipital, and have on each a projection posteriorly, terminated at its inner side by a flat rounded articular facet looking backwards, for articulation, doubtless, with the neural arch of the atlas. Between these facets is a notch, the uppermost part of the foramen magnum; the lowest part of the foramen is the upper edge of the cotyloid cavity of the basioccipital. Owing to the compression of the skull, the foramen, however, is not easily made out.

External to the facets there is on each side a rather pointed process, apparently for muscular attachment; and beyond these again, at a short distance, are the tooth-like processes of the underside of the mastoids, mentioned in the description of the upper surface of the skull.

Below these parts is the inferior surface of the skull, described in section II.

IV. *The Mandible* (Plate VI. figs. 2 & 3).—Two half-mandibles, right and left, occurred, as is stated at the commencement of this description, 2 or 3 feet apart and not far from the skull; they are of the proper size to fit it, and most probably belonged to it.

The right half (fig. 2, half the natural size) is almost perfect; its alveolar border is quite so; it exhibits the teeth in a beautiful state of preservation; and its exterior is covered with the peculiar reticular sculpture. It measures nearly $14\frac{1}{2}$ inches in length, and at the widest part, which is about 4 inches from the posterior end, $2\frac{3}{4}$ inches in width; from this point it tapers gradually to the anterior end, where it is perfect and little more than an inch in width.

A narrow groove can be observed to run nearly the whole way along the inferior border of the specimen, beginning below the articular projection; whether this is a mucous groove, or what its signification is, is not easily determined.

The inferior margin is slightly convex; the upper or alveolar somewhat concave, with a slight eminence in front supporting the first large tooth. The anterior end terminates in a symphysis which is rather deep, and, as seen in another specimen, extended downwards and backwards, its depth being $1\frac{3}{4}$ inch, its breadth at top $\frac{5}{8}$ inch, below which it lessens to $\frac{1}{4}$ inch.

Near the posterior end the outer layer of the bone in our specimen is for a short space altogether wanting; but beyond this the articular end is well preserved, at least at the outer side. From this specimen, and from another in Mr. Atthey's possession, it can be discerned that the articular surface was a rather deep, transversely elongated, and smooth groove, rather more elevated in the middle than at the ends, for the reception of the condyle of the upper jaw, which was similarly elongated, and whose ends were gently raised above the level of the middle.

In another specimen in Mr. Atthey's collection, larger than the subject of this paper, the length of the articular groove on the mandible is $1\frac{3}{4}$ inch, the breadth $\frac{1}{2}$ inch, and the greatest depth $\frac{1}{4}$ inch. The posterior border of the articular surface curves upwards and forwards, so that the joint, though it was not interlocked, must have been pretty secure. The articular part of the jaw projects outwards from the plane of the ramus half an inch. The inner surface is not visible in this, but can be well seen in the other half-mandible.

It will be observed that the teeth in the right half are all entire, whilst those of both sides of the maxilla and, as will be seen in the sequel, those in the left half-mandible are all broken off short. The difference is thus accounted for: in the matrix they were all entire; but on this being broken up, the teeth, being firmly anchylosed to their sockets, could not come out; but the parts above the alveoli, being firmly imbedded and entangled in the matrix, have been broken away with it and lost; moreover the weakest part of the teeth is immediately above the alveolar border. In the case of the right half-mandible, which was obtained with the shale around it, this matrix has been carefully worked and cautiously chipped away, leaving the teeth *in situ*, exposed on their outer surface, but left supported by the shale on the other side.

There are upwards of twenty teeth in this half-jaw: seventeen or eighteen are well preserved; a dozen are entire. They vary much in size, and are irregularly arranged, in some parts being nearly in contact with each other, in others considerably apart. Three are much larger than the rest, and seem to correspond to the vomerine and palatal tusks of the upper jaw. These large teeth are $1\frac{1}{2}$ inch long, and upwards of $\frac{1}{2}$ inch across at their bases. The first is placed an inch from the anterior end, upon the eminence already noticed as existing on the alveolar border; a single small tooth exists in front of this. The second large tooth is 2 inches further back, and the third $1\frac{1}{8}$ inch behind the second; the third is therefore $3\frac{3}{8}$ inches behind the first; but the apices of these two are $4\frac{1}{4}$ inches apart—a distance very nearly corresponding to that between the depressions behind the vomerine and last palatal teeth of the maxilla. No interdental depressions are visible on this exterior surface. The smaller teeth vary from $\frac{3}{8}$ to about $\frac{3}{4}$ inch in length.

The *left half-mandible*, Plate VI. fig. 3 (represented half the natural size of the fragment), has been crushed, and the posterior part broken off and lost. The greater part, however, 9 inches in length (the anterior end), remains in a good state (see vol. iv. 'Nat. Hist. Trans. of Northumberland and Durham,' 1872, p. 392).

This fragment shows both inner and outer surfaces, and contains twelve teeth, of which three only are large; several gaps exist in the row, the teeth being irregularly placed.

The teeth as seen from the outer surface are, with one exception, broken off on a level with the outer alveolar border; but if we look at the inner surface, the alveolar border there is found to lie at a much lower level than the outer, forming a concave irregular line 7 inches long along the jaw, extending from the front of the third tooth backwards to the fractured end; it descends gradually towards the middle of the jaw, and then similarly rises, approximating to the level of the outer border. This deficiency of the inner border, which at first looks like a fracture, exposes the inner surface of the teeth as far as to near their roots, and the depressions between the teeth appear as if in section.

The exposed surfaces of the teeth are closely invested, however, by a thin layer of osseous tissue continuous with that covering the surfaces of the depressions, and the inner alveolar border has not in reality been broken off. The teeth of this half-mandible are differently arranged as to size and position from those of the right half.

The row of teeth begins in front, as in the other half-mandible, with a small one; next to this comes the largest tusk, behind and internal to which is the largest depression, of a nearly circular outline; next come two small teeth with a very narrow depressed interval between them; and below the former of these it is that the alveolar border begins slightly to be deficient; then we have the second depression, followed by two teeth separated by a depression broader than the last: immediately behind the latter of these two teeth is a large and, as it were, double and deep depression $1\frac{1}{4}$ inch broad; this is succeeded by three tusks separated from each other by two large depressions; after the last of these three tusks is a broad depression followed by a rather small tooth; lastly, behind this are two other teeth still smaller, with very short intervals between them; and the fractured end of the bone occurs directly after the latter of these teeth.

The teeth (Plate VII. figs. 2, 3, 4, 5, 6). With the exception of four on the right side of the cranium, three of which belong to the maxillary and one to the premaxillary, nearly half of the teeth of the right ramus, and one of the left half are broken off, as before stated. Their fracture is transverse, giving a circular outline, within which can be roughly seen their beautiful labyrinthodont structure. Several other specimens, however, of *Loxomma* have been found, of which the teeth are entire.

The size of the teeth varies both in the upper and the lower jaw, those of the vomerine plates and of the palate-plates of the maxillaries being much larger than those of the alveolar borders of the maxillaries and premaxillaries; the second tooth of the left half of the lower jaw is much larger than any of the others of that part; the ninth, the seventh, and the eighth come next in order of size, and occupy a middle position in the ramus. In the right half, the second, eighth, and twelfth are the largest, differing but little in size from each other, and the sixth is next; the twelfth is in advance of the middle of the jaw. The teeth of the mandible are more deeply socketed than those of the maxilla; all are expanded at the bottom of the alveoli, and gradually become continuous with, and anchylosed to, the bone at that part.

Each tooth, for about one fourth of its length above the border of the alveolus, is circular and of uniform diameter; in the upper three fourths it is compressed on its inner and outer sides, so that its anterior and posterior edges become sharp and cutting, maintaining at the same time the width of the lower part of the tooth. It is longitudinally grooved all round on its outer surface for about one third of its length from the alveolar border, and is abruptly pointed at the apex.

Some of the teeth are very slightly curved inwards towards the point. From the apex to within the border of the alveolus the tooth is clothed with a very thin layer of enamel, which appears structureless.

The internal structure of the teeth has been carefully drawn by Mr. Dinning in Plate VII., in which fig. 2 shows a perpendicular or longitudinal section, in a line with the jaw, of one of the posterior mandibular teeth, at the inner side of its centre, and carried through the contiguous parts of the thin band of bone mentioned as enclosing the lower part of the tooth. The longitudinal and slightly converging pillars or lines lying on each side of the pulp-cavity are the converging plates of dentine, the plicæ, seen in the transverse section, fig. 5. These plates or lines represent the labyrinthodont arrangement of the constituents of the tooth; and their upper terminations show the distance to which that peculiar structure extends—namely, somewhat less than two thirds of the whole length of the tooth.

The anchylosis of the tooth to the jaw is also seen in fig. 2; the tooth-structures at the base are, every here and there, interlocked or dovetailed more or less deeply and curiously into the bone, in which they are gradually lost; but above the base the sides of the tooth keep distinct from the alveolus and are smooth.

Fig. 3, Plate VII., is a transverse section a little way below the apex; its outline is fusiform; and its extremities, one of which is rather more pointed than the other, are parts of the cutting-edges of the tooth; the dentine is enclosed by a thin plate of enamel, and encloses the small prolongation of the pulp-cavity.

Fig. 4 of the same Plate is a transverse section near the top of the wider part of the pulp-cavity, and above the cessation of the radiating branches of the pulp-cavity; the arrangement of the dentine is still peculiar.

In Plate VII., fig. 5 represents a transverse section of a maxillary tooth (marked in Plate V., left side of figure, "*section*"), made a little below the borders of its alveolus, which are of equal height. In the centre is the somewhat oval pulp-cavity, which is pretty large as compared with that of *Labyrinthodon Jægeri*, figured in Prof. Owen's 'Palæontology;' from it pass off, radiating towards the periphery, numerous channels, separated from each other by the inwardly projecting plicæ or "infoldings" of the external layers of the tooth. The pulp-cavity and its radiations, being clear and colourless spaces, contrast well with the plicæ, which are brownish yellow, the osseous tissue around the tooth being of a lighter yellow.

The solid part of the tooth appears in the section to be arranged as a nearly circular series of toothlets or denticles, whose external margins or crowns, rounded but somewhat flattened, constitute the ridges seen on the outside of the tooth; they vary a good deal in size, and in one specimen number forty-one, in another forty-three. The concave internal margins, facing the centre of the tooth, correspond to and embrace the rounded, somewhat expanded ends of the radiations of the central pulp-cavity, each of which serves as the pulp-cavity of a toothlet, whose fangs are on each side of the space: each side of every toothlet is incorporated with that of its next neighbour; and these united are inflected towards the central pulp-cavity forming the plicæ, which divide the radiations of the pulp-cavity from each other; these plicæ are, of course, sections of the vertical plates shown at fig. 2 in Plate VII.

They vary much in length, the longest forming, by their inner ends, a series of over twenty blunt projections, like radii of a circle, pointing to the centre of the pulp-cavity; the shortest are mere mammillary processes, enclosed between the bases of the longer ones; and there are others of intermediate but different lengths. They pass in from the periphery at first, for a short distance, straight, but soon form undulating and then zigzag curves, which continue to the end, where, in places, two or more may be seen united.

Each concavity on the undulating sides of the plicæ answers to a secondary offset of the pulp-cavity; and the dentine partially surrounding these little bays is disposed as a secondary toothlet, of which the bay is its particular pulp-cavity.

If now with the aid of a $\frac{1}{4}$-inch object-glass (Powell and Lealand's) we look at the dilated end of one of the primary prolongations of the central pulp-cavity, which serves as a pulp-cavity to a toothlet, we see the tubules of the dentine radiating from its margin through a series of finely arched lines towards the crown and sides of the toothlet; before, however, reaching the outer borders of these, they pass into a dark granular-looking layer, which is parallel to the crown and sides, and in some toothlets double. This layer consists of black lines forming a close network, the meshes of which are minute and look like cells, giving this layer its black and granular aspect. It is usually well defined on its external side; but towards the pulp-cavity it is in many parts gradually thinned away, and continued, here and there, a good way into the tubular dentine; in such situations the lines often lose their dark colour, and resemble the tubes of dentine, with which it is not difficult to observe that they are continuous. The dentinal tubules can here and there be seen as black lines approaching the dark network; some can be observed to divide into two, as is common in human dentine. Many (perhaps all) of the dentinal tubes are thus, as it were, arrested in their straight course by the black layer.

Beyond this is a narrower and lighter-coloured tract, which forms the external boundary of the crown and sides of the toothlet; in it numerous closely set straight lines or tubules, mostly pale, but some black, and of the same size as those of the black layer, are visible, passing out of that layer to the exterior surface of the tooth. Thus the whole thickness of the crown of the toothlet is composed of tubular and granular dentine. The granular or nodular layer corresponds to that seen and often figured as commonly existing in the fang and other parts of the human tooth, and which is commonly black, but at times light-coloured.

In the tooth of *Loxomma* nothing like an external layer of cement is anywhere visible.

If we examine in any of our sections one of the grooves on the exterior of the tooth, we find it filled with a wedge-shaped portion of osseous tissue; but this does not pass beyond the bottom of the groove: the sides of the groove are formed by the adjacent borders of two toothlets; these approach each other at an acute angle, coalesce, and the resultant band passes inwards to the interior of a plica, being somewhat narrower than its constituents together before coalescence. The straight and short dentinal tubes (some pale, others black) are very distinctly seen on the margins of the groove.

The black granular layer of each of the two toothlets is bent inwards, and passes into the plica, one on each side of the now central band, which is of light colour, and forms, as it were, the core of the plica. At first, for a short distance, straight, the central band becomes wavy, and then, in most of the long plicæ, zigzag; and from each of the angles a straight process is given off laterally, and ends in a blunt point, which partially separates two secondary toothlets. The concavities of these undulations and zigzags correspond to the concavities of the borders of the plica, and therefore to the secondary pulp-cavities before mentioned.

The granular layer accompanies everywhere on each side the sinuosities of the central band and its processes, and holds the same relation to the tubular dentine of the secondary toothlets as it does to the same tissue of the toothlets of the exterior of the tooth; and it can anywhere be seen that the dentinal tubules have a similar course through that layer to the central band.

On scrutinizing closely the pale central band of a plica with a $\frac{1}{8}$-inch object-glass, the tubules of dentine are clearly seen at its margins; many of them end there, or perhaps are cut off, whilst others (mostly, but not always or everywhere, colourless) are distinctly observed to cross over the pale band and unite with those of the other side, either as straight tubes, or forming with them a delicate and pale network, resembling that of the granular layer, but devoid of its colour.

V. The other bones of *Loxomma* that have been picked up are as follows:—eighteen separate centra of vertebræ, and twenty others imbedded more or less in slabs of shale in company with entire or fragmentary ribs; twenty-four ribs, of which a good many are nearly perfect, showing the head and tubercle; and seventeen bones of the extremities, one of which is a humerus, the rest digital, large and small. All these bones are well ossified, and their articular surfaces mostly perfect.

The centra of the vertebræ are commonly of considerable size, alternately larger and smaller, strongly compacted, and have the anterior and posterior surfaces concave, the former being less so than the latter; several show no facets for the heads of ribs.

The vertebral canal, where it can be seen, is small. The arches are therefore short, but strong, and unite above in a broad and high, but thin, spinous process; this is entire in only one specimen, but nearly perfect in two or three others; it stands up straight, inclining neither forward nor backward. All parts of the vertebræ are well ossified.

The following are the measurements of the vertebra, a dorsal, which is the most perfect, and is figured in Plate VI. fig. 4:—Length of the body $\frac{11}{16}$ inch, transverse diameter $1\frac{5}{16}$ inch, vertical diameter $1\frac{7}{16}$ inch; height of neural arch $\frac{5}{16}$ inch, height of spinous process 2 inches, length of same from front to back $1\frac{5}{16}$ inch, thickness $\frac{2}{16}$ inch. The body is grooved transversely, and has on each side of its upper and lower surfaces a more or less distinct half-facet for a half-head of a rib. The transverse processes are one inch in length, and have each a concave articular surface on the front of their extremities to receive the tubercle of a rib. The articular processes are sharply defined, their facets nearly circular and flat; the anterior pair face upwards and a little inwards, and the posterior downwards and a little outwards.

Of the ribs, the largest (see Plate VII. fig. 1) is $7\frac{7}{8}$ inches long and the distance from head to tubercle $1\frac{3}{16}$ inch; the heads, necks, and tubercles of the ribs are strong and well defined, and there is a well-marked groove on both surfaces running almost from end to end of the bones. The tubercle has an articular facet on its posterior face for the transverse process of a vertebra.

Out of the bones of the extremities it is not possible to construct a single paddle; there is only one humerus, no femur, nor are there any other bones of the anterior or posterior girdle.

The humerus is somewhat elongated, flattish, more convex on its outer than on its inner surface, broad below, narrow at the upper end; in length $3\frac{1}{2}$ inches, in breadth at the upper end $\frac{3}{4}$ inch, at lower $1\frac{5}{8}$ inch.

At each end is a pair of articular facets; these are differently disposed. The facets at the upper end differ in size, one occupying the whole of the end, the other being placed at the inner margin of the posterior part of the former; both face upwards and inwards, the lesser one more inwards than the greater; those at the lower end look downwards and inwards, are more on the same plan than the upper pair, and measure respectively 1 inch and $\frac{5}{8}$ inch in length.

As no epiphyses appear on any of these bones of *Loxomma*, the animal must have been adult, though of rather smaller size than some others the bones of which have been brought to light.

VI. Some of the relations that *Loxomma* bears to fishes and reptiles having been only incidentally mentioned in the course of this paper, we shall now endeavour to bring together such of them as at present occur to us, who are very far from being deeply versed in the intricacies of comparative anatomy; and in so doing we are bound to acknowledge with gratitude the indispensable assistance we have derived from the standard works of Professors Owen and Huxley.

Loxomma presents all the characters of the order Labyrinthodontia of Owen, except "two occipital condyles" for articulation with the atlas; and it has, besides, other characters which also show its affinity on the one hand with Fishes, and on the other with Batrachians and the higher Reptiles.

Its affinities with Fishes are evidenced by the presence of the following characters:—

By the existence of one concave articular surface, instead of a condyle or condyles, on the posterior face of the basioccipital bone, for articulation with the body of the first cervical vertebra. No atlas has been discovered; but it may be fairly presumed that the anterior face of its centrum was concave, since all the bodies of vertebræ of *Loxomma* that have been discovered are doubly concave, and the basioccipital itself is also concave behind.

By the existence of two facets on the exoccipitals for articulation with the neural arch of the atlas.

The former of these characters is almost altogether piscine; it occurs, however, only in *Rana* among Batrachians (Owen, 'Palæontolog.' p. 208), and is therefore rarely reptilian. The second appears to be exclusively piscine; for Prof. Owen (Lect. on Comp. Anat. vol. ii. p. 91) says that the "exoccipitals are immovably articulated in the cod below with the basioccipital, behind with the neurapophyses of the atlas," also that "in a few fishes (e. g. *Fistularia*) the exoccipitals send back articular processes modified to allow a slight movement upon the corresponding anterior articular surfaces of the neurapophyses of the atlas;" but we find no such articulations as these, that we are aware of, in Reptiles. The ossification of the parts here concerned, however, is less perfect in Fishes than in *Loxomma*.

It seems certain that the mode of articulation of the head to the spinal column has been of such a nature as to allow of only a very limited amount of motion, that *Loxomma* had little facility in turning its head, and that its movements in this respect resembled rather those of Fishes than of Reptiles.

By the possession of dentigerous vomerine plates on the palate. *Lepidosteus* and the Batrachia have these; but we also see that "in some alligators (*All. niger*) the divided vomer extends far forward, expands anteriorly, and appears upon the bony palate" (Owen, 'Anat. of Vertebr.' vol. i. pp. 138 & 146), though it has no teeth.

By the teeth being anchylosed to the bottom of their alveoli, the base of the tooth blending gradually into the bony structure around. This, however, is a reptilian as well as a piscine character. The same may be said of the inequality in height of the outer and inner alveolar borders of the mandible and, to a less degree, of the maxilla also. In *Loxomma* the inner border of the mandibular alveolus is very deficient, leaving the teeth as it were agglutinated to and supported by the external border only, which stands well up. This character exists in many fishes; and in Owen's 'Anatomy of Vertebrates,' vol. i. p. 388, we find, moreover, the following passage bearing on this character, and showing that it is found also in the Batrachia and the Lacertilia:—"In the Scincoids, the safeguards (*Tejus*), in most Iguanians, in the chameleons, and many Lacertian reptiles the tooth is anchylosed by an oblique surface extending from the base more or less upon the outer side of the crown to an external alveolar plate of bone, the inner alveolar plate not being developed; in the frogs the teeth are similarly but less firmly attached to an external parapet of bone."

In structure the teeth are labyrinthodont.

On the other hand the skull of *Loxomma*, by its form and size, its strength and solidity of ossification, its peculiarly reticulated surface, and by the massiveness of its mandible, resembles much more the skull of the Crocodilia, and especially of the alligator, than that of Batrachia or Fishes. The presence of limbs as paddles allies it with the orders above Fishes.

The nasal bones are a pair; the nasal apertures being both anterior and pharyngeal show that *Loxomma* was an air-breather like the crocodiles; and the existence of such ribs as that figured in Plate VII. fig. 1 confirms this view.

There is no anterior palatine foramen, neither are there posterior palatines or pterygo-maxillary vacuities as in the crocodile and alligator.

The doubtful perforation of the upper jaw in *Loxomma* is equally suggestive of the actual perforation of the corresponding part in *Lepidosteus*, and in the old crocodile of the Nile, for the reception of a tooth of the mandible when the mouth is closed.

The apertures in each parietal bone, so large in the Crocodilia, are not present in *Loxomma*; but the "parietal" foramen, which exists, is a character common to it and the other Labyrinthodonts, to Ichthyopterygia, Sauropterygia, and Anomodontia, but does not belong to Fishes.

The temporal fossæ are, in *Loxomma* as in Crocodiles, Alligators, Tortoises, and Batrachia, placed on the sides of the top of the skull, and are not arched over by bony plates as in the Protopteri and Ganocephala.

The articulations of the mandible with the skull resemble the corresponding parts of the higher reptiles rather than those of fishes.

The large size and great importance of the superior maxillary bones as compared with the premaxillaries is a decided reptilian and not at all an ichthyic character.

The skull of *Loxomma* has two pairs of bones that are wanting in Fishes and in the Crocodilia, namely the postorbital and the supratemporal; these contribute much to enhance both the length and the breadth of the cranium; they are present, however, in the Ganocephalous *Dendrerpeton* and *Archegosaurus*, in the Labyrinthodontia, and in the Ichthyopterygia; but the general ossification of the skull is much further advanced and consolidated in *Loxomma* than in these other animals, whilst in *Archegosaurus*, at least, it is very incomplete, having "been chiefly active at the surface" (Owen, Palæont. p. 195).

Besides the above two pairs of bones there is in *Loxomma*, as in *Archegosaurus*, another pair, to which attention was called above in the description of the bones, and which lies between the parietals in front and the occipital vertebra behind. This pair is called by Owen, Huxley, and Von Meyer "supraoccipital."

Now, in *Loxomma* at least (though not in *Archegosaurus*, on account of incomplete ossification) the occipital vertebra is formed by the basi- and exoccipitals and a fourth piece of triangular form which is the keystone of the arch, and which in consequence we have called the true supraoccipital: the same arrangement exists in the skulls of Crocodiles and Alligators; and in these the occipital vertebra so constituted articulates above with the posterior borders of the parietals, and is more or less overhung by them; but in *Loxomma* the pair of bones above mentioned is interposed between the arches of the parietal and occipital vertebræ, projecting beyond and overhanging the occipital vertebra exactly as the parietal arch does in Crocodiles &c.

Is this pair of bones properly designated supraoccipital, though it is actually so in position? Does it belong at all to the occipital or to the parietal vertebra, or is it a pair of dermal bones intercalated between the arches of these two? If it belong to the occipital, then there are three supraoccipitals; if to the parietal vertebra, then this must have had four pieces forming its arch. It seems most probable that it belongs to neither, but is a pair of independent pieces like the postorbitals (if these are not merely subdivisions of the postfrontals) and the supratemporals, and, like them, dermal ossifications, and let in, so to speak, between the regular vertebral arches. They cannot be the paroccipitals of Professor Owen.

That *Loxomma* had limbs, probably four, in the form of paddles, there can be little doubt; but they were probably not very large or strong; their digits were perhaps not more than four in number. The length of our *Loxomma* cannot even approximately be estimated, in the absence of caudal vertebræ.

The ribs are long and strong and of reptilian type, showing that the thorax was capacious, and that respiration must have been vigorously carried on by means of diaphragm and lungs.

As no scales or scutes have been found with the remains of *Loxomma*, the skin may have been soft; perhaps further researches may show that it had some defensive armour.

On the whole we conclude that *Loxomma* was a rather sluggish Reptile, capable, however, of vigorous movements, and predacious, inhabiting the waters, swimming mostly like a fish, but guided by its paddles, that it breathed air, however, like the Alligators and Crocodiles of modern time. It must find its place in the scale of animals somewhere between Fishes and Reptiles—between the salamandroid fishes and the Crocodilia; for whilst it resembles most the Labyrinthodontia, it possesses characters, more or less important, in common with all the orders lying between Ganocephala and Crocodilia.

It clearly links together, in a very remarkable manner, the two great classes of Fishes and Reptiles, and adds fresh confirmation, if indeed such were needed, to the opinion of Professor Owen that "other extinct orders (Ganocephala and Labyrinthodontia) have demonstrated the artificial nature of the distinctions between fishes and reptiles, and the close transitions that connect together all the cold-blooded vertebrates."

EXPLANATION OF THE PLATES.

Plate IV.

Upper surface of cranium of *Loxomma Allmanni*, half the natural size. *P.max*, premaxillary bone; *M.g*, mucous grooves; *A.n.o*, anterior nasal orifices; *N*, nasal bones; *Max*, maxillary bone; *L*, lacrymal; *Ju*, jugal; *Qu.ju*, quadrate jugal; *Qu*, quadrate; *S.t*, supratemporal; *O.v*, orbital vacuities; *Fr*, frontal bone; *Pr.fr*, prefrontal; *Pt.fr*, postfrontal; *Pt.o*, postorbital; *P*, parietals, with parietal foramen; *Sq*, squamous; *S.o*?, supraoccipitals, so-called; *Mast*, mastoid; *T.f*, temporal fossa; *S.o*, supraoccipital; *Ex.o*, exoccipital.

Plate V.

Under surface of cranium of *Loxomma*, half the natural size. *P.max*, premaxillary bone; *V.t*, vomerine tusks; *P.p.v*, palate-plates of vomers; *P.p.p*, palate-plates of palate-bones; *P.p.max*, palate-plates of maxillaries; *A.max*, alveolar border of maxillary; *Ap*, aperture in palate; *P.t*, palate-tusks; *Sect*, section of this tooth shown in Plate VII. fig. 5; *Ju*, jugal; *Qu*, quadrate; *Pter*, pterygoid; *R*, ridge on median line between palate and pterygoid bones; *Ec.pter*, ectopterygoid; *B.sph*, basisphenoid; *P.n.o*, posterior nasal orifices; *B.oc*, basioccipital; *Ar.cav*, articular cavity of ditto for atlas; *F.exoc*, facets of exoccipital for arches of atlas.

PLATE VI.

Fig. 1. Posterior part of inferior surface of skull of *Loxomma*, a different specimen from that shown in Plates IV. and V. Natural size. *R*, ridge on median line, fractured; *P.n.o*, posterior nasal orifice; *B.sph*, basisphenoid; *B.oc*, basioccipital; *Ar.cav*, situation of articular cavity, here broken away; *F.m*, foramen magnum, edge of; *F.exoc*, facets of exoccipitals; *Qu*, quadrate bone; *Mast*, mastoid bone; *Pter*, pterygoid bone.

Fig. 2. External surface right half-mandible of *Loxomma*, supposed to be of the same specimen as is figured in Plates IV. & V. Half natural size. The fractured part, the external end of the articular cavity, and the marginal groove along the lower border are well shown.

Fig. 3. Internal surface of fragment of left half-mandible, showing the symphysis, the difference of level between the alveolar borders, the teeth, and the interdental depressions. Half the natural size.

Fig. 4. Dorsal vertebra, natural size. *C*, centrum; *N.c*, neural canal; *S.p*, spinous process; *T.p*, transverse process; *A.z*, anterior zygomatic process; *P.z*, posterior zygomatic process.

PLATE VII.

Fig. 1. Rib, half the natural size.

Fig. 2. Longitudinal antero-posterior section through middle of a small tooth and its alveolar border, from right half-mandible, magnified four diameters. *A*, alveolus; *E*, enamel; *D*, dentine; *P*, pulp-cavity.

Fig. 3. Transverse section near apex of tooth, as indicated in fig. 2, sect. 3. Magnified 16 diameters. *E*, enamel; *D*, dentine; *P*, pulp-cavity.

Fig. 4. Transverse section just above the cessation of the plicæ, magnified 16 diameters. See fig. 2, sect. 4. *E*, enamel; *D*, dentine; *P*, pulp-cavity.

Fig. 5. Transverse section immediately below alveolar border, fig. 2, sect. 5. Magnified 16 diameters. *D*, dentine; *P*, pulp-cavity; *p*, radiations from pulp-cavity; *t*, toothlets; *B*, bone.

Fig. 6. Portion of fig. 5, to show minute structure. Magnified about 48 diameters. *B*, bone; *ex.l*, external layer of dentine; *gr.l*, granular layer; *D*, dentine, tubular; *pl*, plicæ, long and short; *ex.in*, external layer infolded; *gr.in*, granular layer infolded.

X.—*On a new Genus and Species of Bird belonging to the Family* Nectariniidæ. By R. BOWDLER SHARPE, F.L.S., F.Z.S., &c., Senior Assistant, Zoological Department, British Museum.

DR. ALEXANDER SMITH has very kindly presented to the Museum some birds received by him from Old Calabar; and amongst other interesting species is one which appears to be the type of a new and undescribed genus. I therefore propose to call it

LOBORNIS, gen. nov.

The characteristics may be thus, shortly, described. Very close to *Pholidornis*, and of the same diminutive size, but without the peculiarly pronounced scaly appearance of that genus, from which it is, moreover, at once distinguishable by the lobes near the gape. When the bird was first taken out of spirit these lobes were very distinct, three in number, and pure white; they have almost disappeared since the bird was skinned.

The type of this new genus I call

Lobornis Alexandri, sp. n.

General colour of upper surface umber-brown, the feathers of the head slightly scale-like in character; the upper tail-coverts rather more rufous brown, with which colour the wing-coverts and quills are margined; tail dull brown; entire under surface light brown, the throat and fore neck strongly tinged with rufous, as also are the flanks; the breast and under tail-coverts very slightly varied with wavy cross bars of dark brown; under wing-coverts light brown, slightly varied with obscure cross bars of darker brown; bill horn-brown, yellowish at base; feet very pale brown. Total length 3·8 inches, culmen 0·3, wing 1·65, tail 1·1, tarsus 0·6.

Hab. Old Calabar.

I name this bird after Dr. Alexander Smith, to whom the Museum has often been indebted for additions to its collection.

XI.—*On Priority in the Discovery of the Canal-System in Foraminifera.* By Messrs. Parker, Jones, and Brady.

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

Gentlemen,

There is one paragraph in our friend Mr. Carter's paper, "On the Structure called *Eozoon canadense* in the Laurentian Limestone of Canada," in the May number of the 'Annals,' which can hardly be allowed to pass without comment; for, as it at present stands (from some oversight, doubtless, on the part of the writer), it does serious injustice to two other observers. Our attention has been called to the passage, with the suggestion that perhaps its correction would come better from unbiased lookers on, friends alike of all concerned, than from those more immediately and personally interested.

The question has nothing to do with the *Eozoon* controversy, but is simply one of priority in discovery, apparently claimed by Mr. Carter, which only requires a few references to papers with which we have long been familiar to place on its right footing; indeed it scarcely requires an expression of *opinion* from us. The following is the passage referred to (p. 377):—

"Before Schultze's or Carpenter's books were published, I had described and illustrated, in the 'Annals,' the canal-system, 'nummuline' tubulation, and general structure of the Foraminifera, both in the recent *Operculina* and in the fossilized *Nummulite* ('Annals,' 1852, vol. x. p. 161, pl. iv.). Even Schultze in his book, as well as I can remember (for I have not the work by me to refer to), gives me the credit of having discovered the 'canal-system,' which at least proves the priority of my publications; and since then up to the present time I have more or less occupied myself with the structure of Foraminifera, as my papers in the 'Annals' will show."

As the first portion of this sentence stands, it appears as though Mr. Carter claims not only the discovery of the "canal-system," but also, by inference, that of the "nummuline tubulation," and ignores researches on the same subjects published before Max Schultze's 'Ueber den Organismus der Polythalamien' in 1854, and Carpenter's 'Introduction to the Study of the Foraminifera' in 1862. It seems incumbent upon us therefore to point out what the real sequence of discovery was; and this may be easily done by reference to the following memoirs, viz.:—

1. Williamson, "On the Structure of the Shell and Soft Animal of *Polystomella crispa*," 1848. Trans. Micr. Soc. Lond. vol. ii. p. 159.

2. Carpenter, "On the Microscopic Structure of *Nummulina*, *Orbitolites*, and *Orbitoides*," 1849. Q. J. Geol. Soc. vol. vi. p. 21.

3. Williamson, "On the Minute Structure of the Calcareous Shells of some Recent Species of Foraminifera," 1850. Trans. Micr. Soc. Lond. vol. iii. p. 105.

4. Williamson, "On the Minute Structure of a Species of *Faujasina*," 1851. Q. J. Micr. Science, vol. i. p. 87.

These were all published, as will be seen, before Mr. Carter's well-known and excellent paper "On the Form and Structure of the Shell of *Operculina arabica*," 1852 (Journal of the Bombay Branch of the Royal Asiatic Society, January part, 1853). We are well acquainted with Mr. Carter's previous paper "On Foraminifera, their Organization and their existence in a Fossilized State in Arabia, Sindh, Kutch, and Kattywar" (*ibid.* vol. for 1849); but it does not appear to us to contain any thing affecting the present issue. Neither need we allude to Dr. Carpenter's various contributions to the 'Philosophical Transactions' between 1856 and 1860, which, though published before his "book," were subsequent to Mr. Carter's memoir on *Operculina arabica*, the question really being how far the apparently sweeping claim of priority in discovery is justified by the researches embodied in this latter memoir.

In Professor Williamson's paper on *Polystomella crispa* we have the earliest results of the microscopical investigation of the minute structure of the shells of Foraminifera based upon transparent sections. The calcareous shells are therein spoken of as perforated by a multitude of minute foramina; and the solid umbilical nucleus is described as "pitted by small but deep depressions, which may be designed to facilitate the exit of pseudopodia from the innermost convolutions." This appears to us the first indication of the existence of the canal-system—an *indication*, of course, rather than an actual discovery.

Dr. Carpenter's paper, presented to the Geological Society in the following year (1849), "On the Microscopic Structure of *Nummulina*, *Orbitolites*, and *Orbitoides*," comes next in point of time. In it the minutely tubular structure of the shell of the Nummulite is described with a completeness and figured with an exactness that has left little for subsequent addition. A system of "canals" opening into the chambers by distinct orifices, and terminating in the "interseptal spaces," is described and figured; and the specialized condition of the marginal portion of each whorl, so far as the perforation by a smaller number of larger tubuli, is pointed out. Thus, though the "canal-system" (as a system) was not traced in its entirety, owing to the research being based upon fossil specimens alone, a large proportion of the facts necessary for its establishment were correctly laid down.

In 1850 Prof. Williamson made a further contribution to the subject in his memoir "On the Minute Structure of the Calcareous Shells of some Recent Species of Foraminifera," which contains chiefly the record of investigations on the structure of two species of *Amphistegina*, and on a so-called *Nonionina* from the Philippines (really an *Operculina*), together with other matters. Not only is the parallel tubulation in the chamber-walls herein described, but also the "canal-system" of the marginal portion of the spire, the large radiating tubes (of Dr. Carpenter's paper) being shown to be part of a plexus of canals communicating with the interseptal spaces, which plexus is minutely described and figured. The connexion of the interseptal spaces with at least one continuous tube in each of the spiral parietes separating contiguous canals is demonstrated; in fact Professor Williamson had, in 1850, made out almost the entire canal-system of the *Operculina* type.

The following year the same able investigator communicated a third memoir to the Microscopical Society, "On the

Minute Structure of a Species of *Faujasina*," the form now known as *Rotalia Schrœteriana*, in which he gave a complete and accurate account, with admirable figures, of the remarkable canal-system of what may be regarded as the most highly organized form of the Rotalian type.

Thus before Mr. Carter's paper of 1852 the "nummuline tubulation" and the "canal-system" of the Operculine and Rotalian types and an important part of that of *Nummulina*, as well as all that concerned the general structure of these, had been thoroughly worked out. It is no part of our present purpose to examine critically what Mr. Carter's paper really added to the facts established by previous observers; we have followed his researches in no unappreciative spirit: nor do we wish it to be inferred that living in India, as he was at that time, the papers published only a year or two previous to his own had prompted or guided his investigations: in a word, we do not desire in any way to detract from the originality of his work, except so far as in the memoir itself he acknowledges previous investigations; but whatever might be the case then, it cannot be right now, with the opportunity at hand of ascertaining how far his published results really had priority, to ignore the main facts of the papers we have quoted.

The value of Mr. Carter's labours seems to us to have been justly stated in Carpenter's 'Introduction;' and the researches of the three observers we have named are placed in honourable companionship by D'Archiac and Haime, in their classical work on Nummulites (published a year after Mr. Carter's paper), in the following terms:—

"L'étude de la structure intime des Nummulites a fait de véritables progrès par suite des recherches de M. W. C. Williamson, de M. W. B. Carpenter et de M. Carter."

We may just add that the appeal to Max Schultze's work in confirmation of priority is not very fortunate; for the same three observers are all mentioned in the same paragraph, the opening sentence of which is "Eine Erwähnung verdient hier das eigenthümliche System von Canälen welches Carter in der Schale von *Operculina arabica* und Williamson an einer *Faujasina* beschrieben haben;" and as the dates 1852 and 1851 respectively are given in the footnote, it cannot be said that the learned German professor assigns priority in discovery specially to Mr. Carter.

We are, Gentlemen,

Yours faithfully,

W. K. Parker,

T. Rupert Jones,

Henry B. Brady.

XII.—*On the Invertebrate Marine Fauna and Fishes of St. Andrews.* By W. C. M'Intosh.

[Continued from vol. xiii. p. 432.]

Subkingdom *ANNULOSA.*

Series I. ANNULOIDA.

Class ECHINODERMATA.

The Echinoderms of St. Andrews, though plentiful, are by no means remarkable, being those generally distributed over the north-east coast. We do not find the rosy feather, the bird's-foot, and the little cushion starfishes so abundant on the southern and western shores, the former extending to the tangles of Shetland and far into the Atlantic. The beautiful pale bluish-purple *Asterias glacialis*, so common under littoral stones at Herm, and the great *Luidia Savignii* of the surrounding currents are absent (though the former occasionally occurs on the east coast of Scotland); and so is *Asterias Mülleri* of the Hebridean lochs. The northern waters are further distinguished by the piper (*Cidaris papillata*) and swarms of *Echinus norvegicus*; and the southern by the splendid condition of the purple, Fleming's, and the silky-spined urchins. The profusion of sea-cucumbers characteristic of certain parts affords another contrast: thus, as truly said by Prof. Edward Forbes, the giant of the race seems to have rallied all his subjects around him in the rich tangle-forests of the Zetlandic voes. The vast numbers of *Synapta tenera* on the muddy banks of the numerous islets in the Sound of Harris is distinctive, just as the abundance of *Synapta Galliennii* (which the Rev. Mr. Norman seems inclined to link on to *S. inhærens*) is in Belgrave Bay, Guernsey, and a large brownish-purple species on the south-west coast of Ireland.

The places of the rare are filled by a multitude of the common forms, which abound on the beach after storms, and under stones between tide-marks, or are dredged in the surrounding waters. The ease with which the development of the young of this group can be observed opens up an excellent field for future investigators.

I have to thank the Rev. A. M. Norman for his kind assistance in revising the following list, and determining several Holothuroidea.

Order II. Ophiuroidea.

Fam. 2. **Ophiuridæ.**

Genus 4. Ophiothrix, Müller & Troschel.

Ophiothrix fragilis, O. F. Müller; Rev. A. M. Norman, Ann. & Mag. Nat. Hist. February 1865, p. 107.

Abundant under stones in rock-pools and near low-water mark, and dredged in the water beyond to a considerable depth. Many of the stones in the pools are covered with the ova of this species about the middle of November; and some of the starfishes have them attached to the disk.

Genus 5. Amphiura, Forbes.

Amphiura filiformis, O. F. Müller; Norman, *op. cit.* p. 107.

Occasionally in the stomachs of haddocks. Rare.

Amphiura Chiajii, Forbes; Norman, *op. cit.* p. 107.

Vast numbers are thrown ashore on the West Sands after storms. It is also common in the stomachs of the cod and haddock.

Amphiura elegans, Leach; Norman, *op. cit.* p. 109.

Frequent under stones in rock-pools and near low water, especially towards the Rock and Spindle.

Genus 7. Ophiocoma, Agassiz.

Ophiocoma nigra, O. F. Müller; Norman, *op. cit.* p. 111.

Not uncommon from deep water (by dredging and the deep-sea lines of the fishermen). It does not occur in profusion, as in many parts of the Zetlandic and southern portions of our seas.

Genus 8. Ophiopholis, Müller & Troschel.

Ophiopholis aculeata, O. F. Müller; Norman, *op. cit.* p. 112.

Rather plentiful in deep water, and common in the stomach of the cod; occasionally under stones near low water at the East Rocks.

Genus 9. Ophiura, Lamarck.

Ophiura lacertosa, Pennant; Norman, *op. cit.* p. 112.

Abundant off the West Sands, and thrown on the beach in great numbers after storms; it is then much preyed on by gulls.

Ophiura albida, Forbes; Norman, *op. cit.* p. 113.

Dredged off the East Rocks on a sandy bottom, and procured from the stomachs of haddocks.

Order III. ASTEROIDEA.

Fam. 1. **Astropectinidæ.**

Genus 10. ASTROPECTEN, Linck.

Astropecten irregularis, Pennant; Norman, *op. cit.* p. 116.

Very abundant on the West Sands after storms.

Genus 11. LUIDIA, Forbes.

Luidia Sarsii, Düben & Koren; Norman, *op. cit.* p. 118.

Occasionally from the deep-sea lines of the fishermen. It takes the place of the larger *L. Savignii* of the prolific waters of the Channel Islands.

Fam. 2. **Solastridæ.**

Genus 15. SOLASTER, Forbes.

Solaster papposus, L.; Norman, *op. cit.* p. 122.

Abundant on the West Sands after storms, and at all times at low water amongst the rocks.

Solaster endeca, L.; Norman, *op. cit.* p. 122.

Not uncommon on the West Sands after storms, but much less abundant than the foregoing.

Genus 18. CRIBRELLA, Agassiz.

Cribrella sanguinolenta, O. F. Müller; Norman, *op. cit.* p. 124.

Very common between tide-marks, often hanging to the dripping sides and roofs of caverns. A large and much softer variety occasionally occurs. The greater diameter in several instances reaches 5 inches; and one exceeds this size.

Fam. 3. **Asteriadæ.**

Genus 20. Asterias, L.

Asterias rubens, L.; Norman, *op. cit.* p. 128.

Abundant between tide-marks and beyond. Many singular varieties, from the loss or partial reproduction of the rays, occur. A specimen shows five large rays, two of which are formed by the splitting of one arm, while in the interspace two small rays situated one over the other occur. They spawn in November; and many are found in the peculiar stool-like position, grasping the ova, at this season. The same posture, however, is sometimes assumed when devouring *Littorina obtusata* or other mollusks.

Asterias violacea, O. F. Müller; Norman, *op. cit.* p. 128.

As common as the foregoing, and even more so between tide-marks.

Asterias hispida, Pennant; Norman, *op. cit.* p. 128.

This species has only been seen at St. Andrews by Prof. Edward Forbes, who found several specimens on the sands after a storm in 1839. Although hundreds of small forms have been examined, no specific character has occurred to separate them from the foregoing (*A. rubens* and *A. violacea*).

Order IV. Echinoidea.

Fam. 1. **Cidaridæ.**

Genus Echinus, L.

Echinus esculentus, L.; Forbes, Brit. Starfishes, p. 149.

Common amongst the tangles at extreme low water, and in the laminarian region beyond; young specimens occur under stones between tide-marks. In many the intestinal canal is loaded with fragments of laminarian stalks, pieces of *Delesseria*, and other seaweeds covered with *Membranipora*; in some there are fragments of the shells of *Balani* and tubes of *Serpulæ*.

Echinus miliaris, Leske; Forbes, Brit. Starf. p. 161.

Not uncommon under stones in rock-pools.

Echinus Flemingii, Ball; Forbes, Brit. Starf. p. 164.

Occasionally in deep water off the bay, and thrown on the West Sands after storms. The specimens are much less than those of the Channel Islands.

Genus TOXOPNEUSTES, Agassiz.

Toxopneustes dröbachiensis, O. F. Müller; Forbes, Brit. Starf. p. 172 (as *Echinus neglectus*).

Not uncommon on the West Sands after storms. The specimens are smaller than those from the Channel Islands.

Fam. 2. **Clypeastridæ.**

Genus ECHINOCYAMUS, Leske.

Echinocyamus angulosus, Leske; Forbes, Brit. Starf. p. 175.

Abundant in deep water and in the stomachs of the cod, flounder, and haddock. Worn specimens also occur at the East Rocks amongst the shell-gravel.

Fam. 3. **Spatangidæ.**

Genus SPATANGUS, Klein.

Spatangus purpureus, O. F. Müller; Forbes, Brit. Starf. p. 182.

Not uncommon in deep water, and occasionally thrown on the West Sands by storms.

Genus ECHINOCARDIUM, Gray.

Echinocardium cordatum, Pennant; Forbes, Brit. Starf. p. 190.

Very common off the West Sands, and tossed on the beach at all seasons.

Echinocardium ovatum, Leske; Forbes, Brit. Starf. p. 194 (as *Amphidetus roseus*).

Occurs in deep water, and on the beach after storms; somewhat rare.

Order V. HOLOTHUROIDEA.

Fam. **Psolidæ.**

Genus PSOLUS, Oken.

Psolus phantapus, L.; Forbes, Brit. Starf. p. 203.

Occasionally from deep water, and brought in by the fishing-boats.

Fam. **Pentactæ.**

Genus CUCUMARIA, Blainville.

Cucumaria —— ?

A large purplish-brown species, common on the West Sands after storms. Mr. Norman thinks "this is probably the species found by Mr. Goodsir off the Fifeshire coast, and referred to *C. frondosa* by E. Forbes. It is very like that species in most of its characters, especially in the total absence of skin-spicules, and in the form of the tentacular spicula, which are elongated and cribrose. It appears to differ from *C. frondosa* in its very thick test, and especially in appearing to have feet scattered over the body between the regular rows. At the same time it is possible that the firmness may be due to a state of rigid contraction from having been beaten about in a storm when alive; and with respect to the latter, the pores may not mark contracted feet. . . . . It does not correspond badly with the description of *C. Drummondi*, a species unknown to me."

Cucumaria elongata, Düben & Koren; Norman, Zetlandic Fauna, Rep. Brit. Assoc. 1868, p. 316.

= *Cucumaria pentactes*, Forbes (partim), the centre figure in woodcut, p. 213.

Specimens are occasionally brought from the coralline ground by the fishermen.

Cucumaria Hyndmanni, Thompson; Forbes, Brit. Starf. p. 225.

Not uncommon in the stomachs of haddocks and cod.

Cucumaria lactea, Forbes & Goodsir; Forbes, Brit. Starf. p. 231.

Abundant in the coralline region amongst zoophytes. Young specimens are numerous in June.

Genus THYONE, Oken.

Thyone fusus, O. F. Müller; Forbes, Brit. Starf. p. 233.

Common in the stomachs of cod and haddock.

Genus THYONIDIUM, Düb. & Koren.

Thyonidium Dubeni, Norman, *op. cit.* p. 317.

Occasionally in the stomachs of the cod and haddock. Mr. Norman states that he has found it on the coast of Ireland, as well as in Shetland. He observes (*in lit.*) that in this form there are no skin-spicula; feet with a large, circular, cribrose plate at the end, no spicula on sides; tentacles cased in large cribrose spicula of varied form—elongated, short, or most elegantly irregular and branched.

Thyonidium commune, Forbes & Goodsir; Forbes, Brit. Starf. p. 217, and Norman, *op. cit.* p. 317.

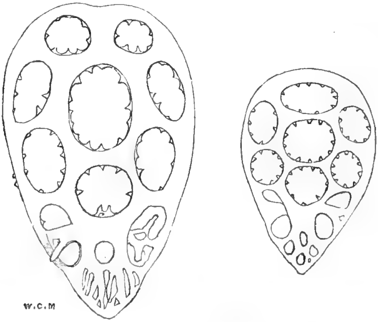
A fragmentary specimen in the stomach of a cod.

Fam. **Synaptidæ.**

Genus SYNAPTA, Eschsch.

Synapta inhærens, O. F. Müller; Dr. Herapath, Journ. Micr. Sc. 1865, p. 4.

The typical form occurs between tide-marks, as well as in the laminarian region, the anchor-plates having six apertures



surrounding the central, and comparatively few openings in the narrow part to which the anchor is attached (see smaller figure in woodcut, which represents both forms × 210 diam.). Such agrees closely with examples from the Channel Islands, the Hebrides, and other parts. An imperfect specimen from the stomach of a haddock diverges very considerably in the form of its anchor-plates (woodcut, larger figure), since the whole plate is much larger, and there are generally seven apertures round the central, instead of six as in the former case; while the slits in the smaller end (to which the anchor is attached) are much more numerous and linear. Various abnormal anchors occur in *S. inhærens*, such as one with five flukes (a bifid process on the summit, a bifid fluke and a normal serrated fluke), or an anchor with several processes on the stalk.

[To be continued.]

BIBLIOGRAPHICAL NOTICE.

A History of British Quadrupeds, including the Cetacea. By Thomas Bell, F.R.S., F.L.S., F.Z.S., F.G.S., &c. Second Edition, revised and partly rewritten by the Author, assisted by Robert F. Tomes, Corr. Memb. Z.S., and Edward Richard Alston, F.Z.S. London: Van Voorst, 1874.

This long-expected volume, which enterprise, science, and art have alike combined to render attractive, has at last issued from the press; and we heartily welcome its appearance. Of the beautiful series of works on British zoology which bear on their titlepages the name of its spirited publisher, few are likely to become so popular. Less bulky than its predecessor of five-and-thirty years ago, it possesses yet stronger claims to our admiration: the species and numerous varieties of our domestic animals have been wisely eliminated, and none but *feræ naturæ* of the British Islands now find a place within its pages.

From our previous acquaintance with the productions of the accomplished author, no less than from the qualifications of those who have rendered him assistance on the present occasion, we were, of course, prepared to meet with much that would be appreciated by the scientific, and that would prove interesting to the general reader: nor have we been disappointed. For many years it has been no secret that the delay in the appearance of this edition could not justly be attributed either to the author or his publisher. His change of residence from London, "the centre of literary and scientific society and information," to the classic and appropriate home of Selborne (the Mecca of field-naturalists), and other circumstances over which he had no control, induced him to call in the aid of two gentlemen, which is duly acknowledged on the titlepage, each of them fully qualified to impart the most recent information in the particular department to which his attention had been especially directed; but, as we are told in the Preface, "the dilatory manner in which, in one case, this assistance was bestowed, caused extreme uneasiness to both author and publisher, and occasioned the lamented delay." However, "All's well that ends well;" and we believe we are correct in saying that, although the charming introductory chapter to the history of the *Vespertilionidæ* appears almost in its original form, yet the greater part of what is new and interesting in the subsequent account of that hitherto little-known family has been contributed by the peccant coadjutor.

Those who are desirous of paying especial attention to the study of British bats will be grateful for the lucid arrangement of certain obscure groups, which until now have been frequently confounded. For example, the shape of the ear and tragus, and the relative proportions of the ear to the tragus and to the head, as well as the dentition, were formerly employed to point out two distinct divisions of the simple-nosed species (the formula of dentition and the shape and structure of the tragus combining to prove the correctness of this view); but, besides these well-known characters, the separation in the present edition of the old genus *Vespertilio* from *Scotophilus*, the arrangement of the former into two groups, and the latter into three (the distinguishing characters of which are principally obtained from the extent of the wing-membranes, reaching in some to the base of the toes, and in others only to the distal extremity of the tibia, leaving the foot free), appear to us equally justifiable and ingenious, while the author has happily avoided the too common error (*sin* we were almost about to say) of elevating these "groups" to the rank of subgenera. Many a youthful aspirant, indeed, has been deterred from prosecuting the scientific study of Natural History by the Babel of modern nomenclature. It should never be forgotten that species alone exist in nature; and the student is frequently lost in a labyrinth of genera and subgenera which are a mystery to him, but in the manufacture of which the mere closet-naturalist finds his chief delight.

We observe the same laudable disinclination to admit, or fabricate, a new species without anatomical evidence, in the account of the otter (*Lutra vulgaris*). In the Museum of the Zoological Society of London there is a specimen of an otter that was killed in Ireland; and we are told that the gentleman who presented it "has long considered the Irish otter as constituting a distinct species from that of England," on account of the intensity of its colouring, which approaches nearly to black, both on the under and upper surface, and a presumed difference in the size of the ears, and the peculiarity of its habits and manners, "being a more marine animal, and constantly betaking itself to the sea when alarmed or hunted." Now we have killed many otters in Ireland, both in inland rivers and in estuaries on the coast, and can corroborate the accuracy of this account as to their fondness for salt water and salmon (quite sufficient to account for their greater size as compared with their ill-fed representatives in this country); but we do not believe that there is any difference in the dimensions of the ears; and as to the colour of the skin, although generally of a much darker hue than that of

English examples, yet we possess in our own collection a beautiful specimen taken in the river Rother, in Sussex, a few years ago, whose fur is still as dark as that of any otter we ever met with in Ireland. But one species of *Lutra* can be recognized as a denizen of the British Islands.

We are reluctantly compelled to point out an error as regards the geographical distribution of the hedgehog* (*Erinaceus europæus*). "The hedgehog," our author says, "has not hitherto, so far as we know, been met with in Ireland." Now we can state, from our own experience, that it is generally distributed there; but if he had applied this remark to a different animal, the weasel (*Mustela vulgaris*), though not quite correct, he would have been nearer the truth. The stoat (*Mustela erminea*) is common in Ireland, where it never becomes white during the winter; and the term "weasel" is always applied to it and not to its lesser congener, which, in all probability, is now extinct. During our early youth, about the year 1824, in the far west of Ireland (county of Mayo) we once saw a weasel run across a road and take refuge under a heap of stones. Its diminutive proportions and short tail at once attracted our attention; and summoning to our assistance some men who were engaged in repairing a wall, the stones were removed, one by one, until at last the little animal made its appearance, and was quickly despatched. Bewick's 'Quadrupeds' was then a familiar book with us; and the admirable figure of the weasel, with which the specimen precisely corresponded, removed all doubt as to the species. Like "The Last of the Mohicans," it was probably the ultimate representative of its race. Such, indeed, was the opinion of the late Mr. Thompson of Belfast, to whom we related the incident several years afterwards. At any rate our subsequent exertions to procure another example of the true weasel proved fruitless; nor have we ever succeeded in obtaining a recent specimen in that country, or met with others who have been more successful than ourselves.

A propos of Ireland, we are glad to find that the so-called Irish hare (*Lepus hibernicus* of the first edition) has been rejected as a species, and now finds its true place as a geographical variety of the mountain hare (*Lepus variabilis*), so common in the hilly parts of Scotland. In the comparatively mild climate of Ireland this animal, like the stoat, does not become white in winter, a circumstance which probably first induced the late Mr. Yarrell to suggest that it should be specifically distinguished, as the osteological differences are really unimportant. But even when transported to the south of England the Irish hare will change colour during severe seasons, as we can assert from personal experience. About the year 1850 the late Lord Mayo sent fourteen to the late Lord Leconfield, who turned them down in Petworth Park, one of the finest in England, surrounded by a lofty wall of more than twelve miles circumference. Here they increased rapidly, being much more prolific than the

* This mistake has since been corrected in an erratum slip.

common hare (*Lepus timidus*), which also abounded in the same woods and plantations. Pied examples of the former were of common occurrence every year, in the months of January and February; and during the exceptionally severe winter of 1860 we ourselves shot one that was perfectly white, and it is now in our collection. In juxtaposition is a Scotch specimen from Banffshire, exhibiting the same snowy livery. We fully coincide in our author's remark that "the assertion of Von Tschudi that mules between *Lepus timidus* and *Lepus variabilis* are often met with in Switzerland is a statement which seems to require further confirmation." Not a single example of such a hybrid has ever been met with in Petworth Park.

The vexed question as to whether the ferret (*Mustela furio*) is specifically distinct from the polecat (*M. putorius*) receives but little light in the volume before us. It is admitted to be "impossible to point out any constant anatomical distinction between the animals, and they are said to breed freely with one another; on the other hand, the intolerance of cold of the ferret has been considered as evidence of its having been derived from an original stock brought from Africa or some other tropical land." In accordance with this latter belief in the exotic origin of the ferret, his portrait and biography are consistently excluded from the pages of this edition.

Mr. Colquhoun, the well-known author of 'The Moor and the Loch,' in his 'Lecture on the *Feræ Naturæ* of the British Islands,' expresses his belief that the dark ferrets so common in every ratcatcher's hutch owe their dusky hue to polecat parentage. He says, "Dark ferrets exactly resemble foumarts, only they are smaller and of lighter shade. Many of these brown ferrets are half polecats; in fact the polecat is just a wild ferret." Now, if these "dark ferrets" were ascertained to be prolific *inter se*, the identity of the two supposed species would be proved. As we formerly observed in our notice of Mr. Colquhoun's lecture*, "Surely this *quæstio vexata* might easily be decided by experiment."

"There is no rule," it is said, "without an exception;" and that which our author and his assistants have so laudably and generally observed, of excluding our domestic and semidomesticated animals, appears to us to have been transgressed in a single instance—that of the fallow deer (*Cervus dama*), which was originally an inhabitant of Asia Minor and countries bordering the Mediterranean, and therefore seems hardly to deserve a place among the *feræ naturæ* of the British Islands, to which the red deer (*Cervus elaphus*) and the roe (*C. capreolus*) are of course entitled. We believe that the new illustration of the former, in this edition, is from the gifted pencil of the greatest zoological artist now living, whose well-known portraits of living animals are beyond all praise. We sincerely wish, however, that he had not, in a facetious moment, stuck such an abnormal pair of antlers on his stag. Horns of this fantastic, semipalmated character, though met with in continental collections, are not typical of the species, are rare in the Scottish forests; and the

* Ann. & Mag. Nat. Hist. 1873, xi. p. 382.

figure in the first edition, with the characteristic tripods crowning the antlers, although inferior in every other respect, gives a more correct representation of the animal's usual appearance.

Perhaps no portion of the work exhibits more favourably the advance of zoological knowledge during the last thirty years than that which comprises the orders Pinnipedia and Cetacea, popularly known as Seals and Whales. The true seals (or *Phocidæ*), with the walrus (*Trichecus*), the only representative of its genus, and the eared seals (*Otaridæ*) are comprised in the former order. We have no British representative of the last-named family; but the walrus, an arctic animal, which has occasionally been killed on the northern coasts of Scotland, in some respects constitutes a link between them and the true seals, agreeing with the latter in its general anatomy, and with the former in the peculiar mode of using its limbs when on land. This is so well described by our author that we are tempted to quote the passage.

"Instead of resting on its belly and progressing by the action of its abdominal muscles, as we have seen to be the case with the true Seals, the walrus walks upright, though in an awkward and shuffling manner, the fore paws being turned backwards, while the hind feet are directed forwards and outwards. In its motions in swimming also it holds an equally intermediate position; for while the fore feet are hardly used by the true Seals, and are the main organ of propulsion in the *Otaridæ*, all four limbs are employed by the walrus; as Dr. Pettigrew remarks, 'so far as the physiology of its extremities is concerned, it may very properly be regarded as holding an intermediate position between the Seals on the one hand and the Sea-bears and Sea-lions on the other.'" (Page 270.)

We recommend such of our readers as take an interest in this subject to pay an early visit to the Zoological Gardens in the Regent's Park, where they will find the accuracy of the above account (as regards the different modes of progression, when on land, exhibited by the true seals and the sea-lions) verified by ocular demonstration. Two living members of the *Otaridæ* are now to be seen in the seal-pond, the sea-lion (*Otaria jubata*) and a smaller species (*O. pusilla*), both natives of the southern hemisphere—the former from the Falkland Islands, the latter from the Cape of Good Hope. Their intelligent and obliging keeper, François Lecomte, for whom they exhibit the strongest affection, has succeeded in so thoroughly domesticating them, as well as others of the common British species, that they come on shore when summoned by his whistle, walk along a plank that extends into the centre of the pond, and clamber up into two chairs purposely placed at the further extremity for their reception. Nay, we have even seen the sea-lion follow Lecomte into an adjacent building furnished with a sliding door, and on the latter coming out and shutting it, remain perfectly quiet inside until ordered by him to open it for himself, a feat which he performed with facility and expedition.

We may here mention that a living example of that extraordinary animal the hooded seal (*Cystophora cristata*) has been lately added to the Society's collection, and occupies a smaller pond by himself. This species, having occurred twice in the British Islands, of course finds a place in the volume before us.

It is greatly to be regretted that the annual persecution of the interesting and intelligent family of *Phocidæ* has reduced its numbers so sensibly, even on the coasts of Scotland, that in process of time its members will, in all probability, become as scarce as the walrus. In the British Islands, as our author remarks, seals are hardly plentiful enough to be of more than local importance; but

"It is very different in the far north, where vast herds of *Ph. grœnlandica*, *Ph. barbata*, and *Cystophora cristata* assemble in spring on the ice of the Greenland and Spitzbergen seas, as well as in Davis's Straits and around Newfoundland. Every spring a large fleet of European vessels sails northwards, and coasts along the southern margin of the ice-fields till the seals are met with, when the hunters endeavour to cut off their retreat to the open water, and then despatch them with heavy clubs. The numbers thus destroyed are very great; Dr. R. Brown estimates the value of those killed in the Greenland seas alone at about £116,000 (Proc. Zool. Soc. 1868, p. 439). It appears inevitable, as Dr. Brown remarks, that such indiscriminate slaughter must soon greatly diminish the numbers of the northern seals, and eventually destroy the value of the fishery."

To many, who have never paid any attention to natural history, the admission of the order Cetacea (in which are included the British Whales, Dolphins, and Porpoises) into this volume would appear, at first sight, erroneous and absurd; but this subject is so lucidly explained in the admirable introduction to the order Cetacea, that we must quote our author's own words:—

"The outward appearance of the Cetaceans, organized as they are for a permanent residence in the ocean, resembles so nearly that of fishes that they have been arranged together by the ancients and by the ignorant. Ray himself was not prepared to separate them; and even the example of the great Linnæus, who, with his wonted correctness and judgment, placed the Whales in their true position, was not sufficient to counterbalance the prejudices of Pennant, who regarded the Cetacea as forming a division of the class of Fishes, although he was well aware that they bring forth their young alive, and nourish them by means of mammary organs, similarly constructed to those of the whole class of Mammalia. Their true position, however, being established, it becomes a matter of great interest to ascertain what relation the other organs of the body bear to the corresponding ones in the other groups of this class, and by what modifications of structure they are rendered subservient to a mode of life so different from that of the more typical forms. A brief notice of the principal points of their organization, so far as they bear on these apparent anomalies, will show that the important variations in form and habits are provided for by the modification of the structures which are essentially the type of the class, rather than by their abolition and the production of new organs."

Our space will not permit us to indulge in further quotations from this interesting portion of the volume; but our readers can form some idea of the research and labour that have been employed when we say that no less than ten species of the order Cetacea have been added to the British list; and although the illustration of *Ziphius cavirostris* at page 428 exhibits an impossible tail (being vertical instead of horizontal), yet the woodcuts and vignettes throughout the volume are really beautiful as works of art, while the literary and scientific portion is well worthy of the distinguished naturalist to whom, principally, we are indebted for this valuable contribution to the zoology of the British Islands.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

March 12, 1874.—Joseph Dalton Hooker, C.B., President, in the Chair.

"Contributions to the Developmental History of the Mollusca. Sections I., II., III., IV." By E. Ray Lankester, M.A., Fellow of Exeter College, Oxford.

Section I. *The ovarian Egg and early development of* Loligo.

The points of greatest interest to which the author draws attention in the present memoir are:—

1. The explanation of the basketwork structure of the surface of the ovarian egg by the plication of the inner egg-capsule.
2. The increase of the yelk by the inception of cells proliferated from the inner egg-capsule.
3. The homogeneous condition of the egg at fertilization.
4. The limitation of yelk-cleavage to the cleavage-patch.
5. The occurrence of independently formed corpuscles (the autoplasts) which take part in the formation of the blastoderm.
6. The primitive eye-chamber, formed by the rising up of an oval wall and its growing together so as to form a roof to the chamber.
7. The origin of the otocysts by invagination.
8. The rhythmic contractility of a part of the wall of the yelk-sac.
9. The disappearance of the primitive mouth, and the development of a secondary mouth.
10. The development of a pair of large nerve-ganglia by invagination of the epiblast immediately below the primitive eye-chambers.

General Considerations relative to the Observations contained in Sections II., III., IV. (*containing the developmental histories of* Pisidium, Aplysia, Tergipes, Polycera, *and* Neritina).

In these observations the author points out briefly their bearing on two matters of theoretical importance, viz. (1) the origin and significance of what has been called the *Gastrula*-phase of development, and (2) the homologies or homogenies (as the author prefers to say) of the shells, ligaments, and internal pens of the Mollusca. More facts have to be sought out and brought to bear on these questions; but the author, while occupied in that further search, indicates the anticipations which must guide and stimulate it. Before doing so he mentions that there are a variety of other matters of interest in the facts recorded in the paper which cannot yet be brought into any theoretical structure, but which are not on that account kept back, as they will probably be of some service in their isolated condition.

Kowalevsky was the first to describe, in a precise manner, the formation of the foundations of the alimentary tract in a developing embryo, by invagination of the wall of a simple primitive blastosphere, or hollow ball of embryonic cleavage-corpuscles. He detected this mode of development in *Amphioxus*, and subsequently in *Ascidia*. By later researches he was able to indicate the same mode of development in certain Vermes (*Sagitta*, *Euaxes*, *Lumbricus*); and he mentioned incidentally that he had observed a similar development in the Heteropodous mollusk *Atalanta*. At that time the author was studying the development of *Pisidium* and *Limax*, and obtained evidence of the invagination of the primitive blastosphere in those two widely separated mollusks. Subsequently at Naples he found the same process occurring in Nudibranchs. The probable identity of this process of invagination with that so well known in the Batrachians, especially through Stricker's admirable work on the subject, became clear, to those occupied with embryological studies, from the facts established by Kowalevsky; and the "anus of Rusconi" could now be recognized in the "orifice of invagination" present in members of the three large groups of Vermes, Mollusca, and Vertebrata.

The embryonic form produced by this invagination-process is a simple sac composed of an ectoderm and endoderm, with an orifice connecting the exterior with the cavity lined by the endoderm. It, in short, presents the typical structure of the simplest Cœlenterata, and corresponds exactly with the so-called *Planula* of the polyps and corals. Hence we are tempted to see in this primitive invagination-form the representative of the Cœlenterate phase of development of the whole animal kingdom. In a paper published in May 1873*, containing the substance of lectures delivered in the preceding October, the author discussed this notion at some length, and other points connected with the attempt to work out the correspondences of the embryonal cell-layers of the various

* Annals and Mag. Nat. Hist. 1873, xi. p. 32

groups of the animal kingdom. At the end of the year 1872, Professor Häckel's splendid Monograph of the Calcareous Sponges appeared, in which the same questions are methodically discussed. The name *Gastrula* is given by Professor Häckel to the embryonic form which the author proposed to designate by the old name *Planula*; and the multicellular blastosphere, from which the *Gastrula* is developed, which the author had proposed to speak of as a *Polyplast*, he well christens the *Morula*. Professor Häckel was able to show in his monograph that the Calcareous Sponges exhibit a beautifully definite *Gastrula*-larva, which swims freely by means of cilia. Lieberkühn, Miklucho-Maclay, and Oscar Schmidt had previously shown that certain sponges exhibit such an embryonic form; but Professor Häckel described it in many cases, and showed fully its mode of development and structure.

This brings us to an important point in what Häckel calls the "Gastræa theory"*. The *Gastrula* form of the Calcareous Sponges is *not* formed by invagination, but, without any opening in the blastosphere making its appearance, the cells constituting its walls divide into an endoderm and an ectoderm; then, and not until then, an orifice is formed from the central cavity to the exterior by a breaking through at one pole. Careful accounts of the development of Cœlenterata, with a view to determine the mode of development of the *Planula* or *Gastrula* form in regard to the question of invagination, are not to hand in a large number of cases. But, on the one hand, we have Kowalevsky's account of the development of *Pelagia* and *Actinia*, in which the formation of a *Gastrula* by invagination is described, as in the cases already cited among Vermes, Mollusca, and Vertebrata; on the other hand, we have Allman's observations on the Hydroids, Schultze's on *Cordylophora*, Kleinenberg's on *Hydra*, Häckel's on the Siphonophora, and Hermann Foll's on the Geryonidæ, in which the ectoderm and endoderm of the embryo (which is at first a *Planula* without mouth, then a *Gastrula* with a mouth) are stated to arise from the splitting or "delamination" of a single original series of cells forming the wall of the blastosphere. Hermann Foll's observations are of especial value, since he shows most carefully how, from the earliest period, even when the egg is unicellular, its central part has the character of the endodermal cells, its peripheral part that of the ectodermal cells.

The question now arises, can the *Gastrulæ* which arise by invagination be regarded as equivalent to those which arise by internal segregation of an endoderm from an ectoderm? and if so, which is the typical or ancestral mode of development, and what relation has the orifice of invagination in the one case to the mouth which, later, breaks its way through in the other?

It is not within the scope of the present memoir to discuss these questions at length; but the author is of opinion that we must regard the *Gastrula*-sac with its endoderm and ectoderm as strictly

* His most recent views on this matter are contained in a pamphlet dated June 7, 1873, 'Die Gastræa-Theorie.'

equivalent (homogenous, to use another expression) in the two sets of cases. One of the two methods is the typical or ancestral method of development, and the departure from it in the other case is due to some disturbing condition. He believes that we shall be able to make out that disturbing element in the condition of the egg itself as laid, in the presence in that egg of a greater or less amount of the adventitious nutritive material which Edouard van Beneden calls "deutoplasm." This and certain relations of bulk in the early developed organs of the various embryos considered, determine the development either by invagination or by delamination. The relation of bulk to the process of invagination may be illustrated from a fact established in the preceding communications. In *Loligo* the large otocysts develop, each, by a well-marked invagination of the epiblast, forming a deep pit which becomes the cavity of the cyst. In *Aplysia* the smaller otocysts develop, each, by a simple vacuolation of the epiblast without invagination. In *Loligo* the chief nerve-ganglia develop by invagination of the epiblast, in *Aplysia* by simple thickening. Again, in Vertebrata the nerve-cord develops by a long invagination of the epiblast; in *Tubifex* and *Lumbricus* the corresponding nerve-cord develops by a thickening of the epiblast without any groove and canal of invagination.

The bulkier structures in these cases are seen to develop by invagination, the smaller by direct segregation. Invagination therefore acts as an economy of material, a hollow mass being produced instead of a solid mass of the same extent.

That the presence of a quantity of deutoplasmic matter, or of a partially assimilated mass of such matter, in the original egg is not accompanied by well-marked invagination of the blastosphere, while the absence of much deutoplasm is the invariable characteristic of eggs which develop a *Gastrula* by invagination, is shown by a comparison of *Aplysia* and *Loligo* with *Pisidium* and *Limax*, and of the Bird with the Batrachian. In some cases, such as Selenka has characterized by the term "epiboly," it seems that the enclosure of the large yelk-mass by the overgrowth of cleavage-cells may be held as equivalent to the invagination of the large yelk-cells by "emboly;" and the intermediate character which the development of *Euaxes* and *Lumbricus* presents in this respect, as described by Kowalevsky, tends very strongly to establish a transition.

But the mode of development of the *Gastrula* of Geryonidæ, described with so much minuteness by Foll, which is obviously the same as that of the *Gastrulæ* of Spongiadæ and most Hydroids, is clearly no masked case of invagination. There is no question of "epiboly" here, but a direct and simple splitting of one cell into two; so that what was a sac formed by a layer of cells one deep, becomes a sac formed by a layer of cells two deep, or of two layers each one deep.

It is yet a question for much further inquiry as to how this mode of forming a double-walled *Gastrula* can be derived from, or harmonized with, the formation of *Gastrulæ* by the embolic or epibolic forms of invagination.

It would certainly seem at present that the orifice of invagination of the invaginate *Gastrula* must *not* be regarded as the equivalent of the later erupting *mouth* of the segregate *Gastrula* *, which is the true permanent mouth of the Sponge or Cœlenterate. In no case is the orifice of invagination of the invaginate *Gastrula* known to persist under any form; it appears solely to effect the invagination, and when that is effected vanishes.

Enough has been said to show the importance of observations relating to the *Gastrula*-phase of development. In the paper well-marked invaginate *Gastrulæ* are described from:—

1. *Pisidium* (Lamellibranch).
2. *Tergipes* (Nudibranch).
3. *Polycera* (Nudibranch).
4. *Limax* (Pulmonate).
5. *Limnæus* (Pulmonate).

In addition to these cases of the development of invaginate *Gastrulæ* among Mollusca, the examination of the very beautiful figures in the papers of Lovén on molluscan development leaves no doubt that he has observed invaginate *Gastrulæ* in the following cases, but has not understood their structure:—

6. *Cardium* (Lamellibranch).
7. *Crenella* (Lamellibranch).

Similarly, Karl Vogt's observations on *Actæon* indicate the same state of things as the author has pointed out in *Polycera*; and hence we may add:—

8. *Actæon* (Nudibranch),

and, finally, from Kowalevsky's statement, though not accompanied by figure or description,

9. *Atalanta* (Heteropod).

The second matter of theoretical interest (namely, the early features in the development of the shell) has not been previously discussed, since the structures described in the paper as shell-patch, shell-groove, and shell-plug were unknown.

If, as seems justifiable, the Cephalopoda are to be regarded as more nearly representing the molluscan type than do the other classes, or, in other words, more closely resemble the ancestral forms than they do, we might look, in the course of the development of the less typical Mollusca, for some indication of a representative of the internal pen of the higher Cephalopoda. We might expect to find some indication of the connexion between this and the calcareous shell of other forms; in fact the original shell of all Mollusca should be an internal one, or bear indications of a possible development into that condition.

In *Pisidium*, in *Aplysia*, and in *Neritina* the author has submitted evidence of the existence of a specially differentiated patch of

* In his paper in the 'Annals' for May 1873 the author has inclined to the view that it *may* be so regarded.

epidermic cells at the aboral pole, which develops a deep furrow, groove, or pit in its centre almost amounting to a sac-like cavity opening to the exterior. The first (chitinous) rudiment of the shell appears as a disk on the surface of this gland; but also, in some cases, the cavity or groove is filled by a chitinous plug.

Let the walls of the sac close and the activity of its lining cells continue, and we have the necessary conditions for the growth of such a "pen" as that of the Decapod Cephalopoda.

At present the details of the development of the "pen" in the Cephalopoda are not fully known; but the author has evidence that it is formed in an enclosed sac-like diverticulum of the epidermis, but he has not yet ascertained the earliest condition of this sac. The history of its development becomes surrounded with additional interest in relation to the shell-gland of the other Mollusca.

The position of the groove of the shell-gland in *Pisidium* suggests a possible connexion of its chitinous plug with the ligament, which it will be worth inquiring into in other developmental histories of Lamellibranchs.

The internal shells of other Mollusca besides the cuttlefish are certainly not in some cases (e. g. *Aplysia*) primitively internal, but become enclosed by overspreading folds of the mantle. But in the case of *Limax* and its allies, it is possible, though the matter requires renewed investigation, that the shell is a primitively internal one representing the shell-plug.

There is yet one more possible connexion of this shell-gland and plug: this is the chitinous secretion by which *Terebratula* and its allies fix themselves to rocks &c. The position of the peduncle exactly corresponds to that of the shell-gland; and an examination of Professor Morse's recently published account of the development of *Terebratulina* leaves little doubt that at the pole of attachment, which very early develops its function and fixes the embryo, an in-pushing occurs, and a kind of shallow gland is formed which gives rise to the horny cement. The author's own observations on the development of *Terebratula vitrea* do not extend to so early a period as this.

It is perhaps scarcely necessary, in conclusion, to point out the close resemblance of shell-gland and plug to the byssal gland and its secretion. They are closely similar structures; but there does not appear to be any reason for considering them "serial homologues," or more closely related than are, say, the hairs on the head of a man with the hairs on his chest.

April 16, 1874.—Joseph Dalton Hooker, C.B., President, in the Chair.

"Studies on Biogenesis."
By William Roberts, M.D., Manchester.

The object of the investigation is to inquire into the mode of origin of *Bacteria* and toruloid vegetations. The inquiry is divided into three sections.

SECTION I. *On the sterilization by heat of organic liquids and mixtures.*—When beef-tea or a decoction of turnip is boiled for a few minutes and afterwards preserved from extraneous contamination, it passes into a state of "permanent sterility."

This state is characterized by loss of power to *originate* organisms with conservation of the power of *nourishing and promoting the growth* of organisms.

All organic liquids and mixtures seem capable of being brought to this state by exposure to the heat of 212° F.; but the length of time during which exposure to this heat is necessary to induce sterilization varies greatly according to the nature of the materials. Ordinary infusions and decoctions were sterilized by boiling for five or ten minutes; but milk, chopped green vegetables in water, pieces of boiled egg in water, and other mixtures were not sterilized unless the heat was continued for twenty to forty minutes. Hay-infusion was sterilized, like other infusions, by boiling for a few minutes; but when the infusion was rendered alkaline with ammonia or liquor potassæ, it was not sterilized except after an exposure to the heat of boiling water for more than an hour. Sometimes it germinated after two hours, and once after three hours of such exposure.

There appeared to be two factors of equal importance in the induction of sterilization—namely, the *degree* of heat and the *duration* of its application. These two factors appeared to be mutually compensatory in such fashion that a longer exposure to a lower temperature was equivalent to a shorter exposure to a higher temperature. For example, speaking roughly, an exposure for an hour to a heat of 212° F. appeared to be equivalent to an exposure for fifteen minutes to a heat of 228° F.

SECTION II. *On the capability of the normal tissues and juices to generate* Bacteria *and* Torulæ *without extraneous infection.*—The following substances were examined:—egg-albumen, blood, urine, blister-serum, milk, grape-, orange- and tomato-juice, turnip and potato. These substances were conveyed into previously prepared sterilized bulbs and tubes, which were hermetically sealed at one end and plugged with cotton-wool at the other end. When the several steps of the experiment were quickly and dexterously performed, the risks of extraneous contamination, although not altogether avoided, were reduced to small proportions. The bulbs and tubes thus charged were afterwards maintained at a temperature ranging from 60° to 90° F., and were finally examined at periods varying from four to ten weeks. Out of 90 experiments performed in this way, 67 preparations remained barren and 23 became fertile. When the ideal conditions of the experiment could be carried out in approximative perfection, as with urine, blister-serum, orange-, grape-, and tomato-juice (34 experiments), the preparations, all save one, remained barren; but when the risks of extraneous infection were (from the mechanical difficulties) obviously greater, as with blood, milk, turnip, and potato, the proportion of fertile preparations was considerable, though even with these (except in the case of milk) the barren preparations were in a large majority.

The experiments seemed clearly to lead to the conclusion that the normal tissues of plants and animals were incapable of breeding *Bacteria* and *Torulæ* except under the stimulus of extraneous infection.

SECTION III. *On the bearing of the facts adduced in the preceding sections on the origin of* Bacteria *and* Torulæ, *and on the real explanation of some of the alleged cases of Abiogenesis.*—Seeing that organic liquids and mixtures sterilized by heat, and the normal juices and tissues, continued permanently barren under the most favourable conditions of air, moisture, warmth, and light, so long as they were preserved from extraneous contamination, and seeing that the admission of ordinary air or water into contact with them was invariably followed by germination, it was impossible to avoid the conclusion that ordinary air and water contain, in addition to their proper elements, multitudes of particles capable of provoking germination. The exact nature of these particles may be a matter of dispute, but the reality of their existence is not doubtful; nor is it doubtful that the ordinary and common development of *Bacteria* and *Torulæ* is directly due to their agency.

The greatest difficulty hitherto encountered to the general acceptance of the panspermic theory has been the appearance of *Bacteria* (without the possibility of fresh infection) in certain liquids which have been exposed for a considerable time to a boiling heat. Only two explanations of this fact seem possible—either germs preexisting in them have survived the heat, or the organisms have arisen in them abiogenetically. These alternatives were subjected to two series of test experiments. In the first series it was proved directly that there exist in ordinary air and water particles which preserve their germinal activity after being boiled for five minutes in previously sterilized liquids. The second series of experiments showed that, in the extraordinary increase of resistance to sterilization by heat exhibited by alkalinized hay-infusion, the action of the alkali is to heighten the surviving power of preexisting germs, and not to exalt the abiogenic aptitude of the infusion itself.

The issue of the whole inquiry has been to fully confirm the main propositions of the panspermic theory, and to establish the conclusion that *Bacteria* and *Torulæ*, when they do not proceed from visible parents like themselves, originate from invisible germs floating in the surrounding aërial and aqueous media.

Nevertheless the author is unable to withstand the impression that this general and common mode of origin is possibly supplemented, under rare conditions, by another and an abiogenetic mode of origin. The facts on which this impression rests are comparatively few. They consist in certain instances of greatly retarded germination of *Bacteria* in liquids which had been exposed to a boiling heat, and in two very remarkable instances of the growth of fungoid vegetations (not identical with those usually developed after air infection) in plugged bulbs which had been boiled in a can of water.

If it should be hereafter established that *Bacteria* and fungoid vegetations do, under exceptional circumstances, arise abiogenetically, this would not overturn the panspermic theory, it would merely limit the universality of its application.

MISCELLANEOUS.

New Observations on the Habits of the Ants of the South of France. By T. Moggridge.

A young Englishman, Mr. Traherne Moggridge, having been compelled for several years, on account of his health, to pass the winter at Mentone, has devoted himself with ardour to the study of the natural history of that portion of the shore of the Mediterranean. He published first, in 1871, an illustrated Flora* of the principal plants which blossom during the winter, with very interesting information respecting their mode of vegetation—and next, in 1873, a little work on the habits of the ants and spiders†, which indicates a very remarkable spirit of observation.

We have thought an abstract of Mr. Moggridge's last memoir would be interesting as showing that a subject which was believed to have been long since exhausted, resumed by an intelligent and patient naturalist, may still reveal much that is new and curious. This task has, moreover, been singularly facilitated by the author himself, who has not only most obligingly given us all the information that could be desired upon the places where his observations were made, but communicated several facts which were not known to him at the time of the publication of his work, for which we beg him to accept our best thanks.

[The following is the first of the two sections into which the abstract is divided—that, namely, on the ants.]

In 1869 Mr. Bentham, President of the Linnean Society of London, called the attention of naturalists to the paucity of knowledge possessed on the origin of certain plants which appear suddenly in localities where they had been previously unknown, after works necessitating the conveyance of earth. This observation suggested to Mr. Moggridge the idea that the ants which he had seen at Mentone carrying seeds might very probably be an indirect cause of that dissemination. On communicating this opinion to some naturalists, he was much surprised to learn that it was unhesitatingly regarded as a fact by Messrs. Huber, Gould, Kirby, Smith, and recently by

* Contributions to the Flora of Mentone, and to a Winter Flora of the Riviera, including the coast from Marseilles to Genoa. 1 vol. 8vo. London: L. Reeve & Co.

† Harvesting Ants and Trap-door Spiders—Notes and Observations on their Habits and Dwellings. 1 vol. with plates.

M. Blanchard, that the ants of Europe make no provision, and that the good La Fontaine was in error when he took, in his Fables, those insects as the type of foresight.

Yet, on the other hand, the most positive assertions are found in several Greek and Latin authors, such as Hesiod, Horace, Virgil, Esop, as well as in the Proverbs of Solomon, that ants accumulate, during the summer, provisions for the winter; and it is also well established, from the observations of Sykes, Jerdon, Lincecum, Bates, &c., that the ants of India, Texas, and Brazil hoard up in their ant-hills a considerable quantity of seeds. Confronted by affirmations so contradictory, our author determined, immediately on his return to Mentone in October 1871, to scrutinize with care that which he had previously observed superficially, and thus endeavour to decide the three following questions:—

(1) Are the seeds which are carried into the ant-hills employed as materials of construction? or are they deposited in the interior as provisions?

(2) Do the ants which gather seeds search for grubs as do the other ants?

(3) Do all the ants of the south of Europe, or only some species, convey seeds?

Mr. Moggridge ascertained at once that seeds are transported by three species only:—*Atta barbara*, of which there are two varieties—one entirely black, the other having a red head; *Atta structor*, a species very nearly allied to *A. barbara*; and, lastly, *Pheidole* (*Atta*) *megacephala*, a minute yellow ant with a very large head. The facts we will now retrace refer especially to *A. barbara*, which is more readily observed than the other two.

On visiting the ant-hills with which he was already acquainted, he soon found numbers of ants which, assembling in a little meadow in the vicinity, returned loaded with seeds and capsules taken from divers plants (*Capsella bursa pastoris*, *Alsine media*, Linn., *Calamintha*, &c.). When, for example, a capsule of *Bursa pastoris* is to be gathered, an ant ascends the cluster, and, neglecting those at the base (which, being dry, let their seeds drop out too readily), attacks those of the centre, green and well filled; vigorously biting the base of the peduncle, while another ant endeavours to twist it, it is soon detached; the capsule falls on the ground, and is then taken up by other ants.

Can the ants be deceived and carry to their dwelling small bodies having only the appearance of seeds? To enlighten himself on this point Mr. Moggridge strewed the ground with minute grains of porcelain of various colours; a few were carried to the habitation; but soon the intelligent animals perceived their error, and, returning to their plants, paid no more attention to those objects of no use to them.

The seeds and capsules brought are either deposited for the moment at the entry, or at once carried into the interior of the nest, which, being always excavated in more or less compact sandy soil, requires no foreign substance for its construction, and of which the extent may sometimes be very considerable. We may note by the way that, at the end of summer, the ground is covered at a great distance from the entrance with a heap, often considerable, of glumes and empty capsules continually brought from the interior, where the seeds alone are preserved.

The nature of the soil in which ant-hills are found renders very difficult the observation of what takes place within. Mr. Moggridge, desiring much to know the end of the history of these seeds, which he saw enter in so large a quantity, was not discouraged, and at last found an ant-hill which, being parallel to the wall of a terrace, could be with sufficient facility explored throughout. Following the galleries, he ascertained that the seeds (which belonged to more than eighteen families of plants) were carefully accumulated in little cavities or granaries, the size of which varies between that of a watch and that of the palm of the hand. These have a floor carefully made with small grains of mica and quartz cemented together; the upper part has in general the form of a vault. He proved moreover the curious fact that the seeds found in these granaries scarcely ever (hardly one in some thousands) present a commencement of germination, although they are often in conditions of humidity, depth, and temperature very favourable to their development. How can the ants obtain this result? This problem of vegetable physiology has not yet been solved; but Mr. Moggridge has been able to convince himself that it was absolutely necessary, in order that germination should be arrested, that the ants should be able to visit the granaries. If the visits are interrupted, then germination commences immediately. Mr. Moggridge asked himself if formic acid might not be the cause of the suspension of germination; but his recent experiments do not permit him to conclude so.

When, in consequence of certain circumstances, a seed in one of the granaries sprouts, as soon as the radicle has attained a certain length it is cut at its free extremity by the ants; the seed is then taken out of the nest, exposed to the sun, then brought back to the interior and devoured with avidity, as at that time it contains a saccharine substance.

Different colonies of *Atta barbara* often wage fierce war for the possession of their provisions; and Mr. Moggridge has followed the various phases of a struggle between two swarms, which lasted 46 days (from the 18th January to the 4th of March). It appears that, in fighting, the ants mostly try to seize one another by the antennæ; and when one of them has been thus laid hold of, it immediately loses all energy. Some of the ants appear to be specially charged with the office of plunder; for, on several occasions, Mr. Moggridge observed that the ants which returned loaded with booty delivered it at the entrance of their dwelling to other workers, and set off again immediately.

Although *Atta barbara* and *A. structor* spend most of their time in gathering seeds, they also pursue small insects, which they either devour at once or carry into their habitations.

Having installed a colony of *Atta barbara*, with their queen and several larvæ, in a large glass bottle full of earth placed in his garden, Mr. Moggridge was able to trace their labours during four months, and to note down the following observations:—

The ants at once commenced digging galleries, working with ardour day and night. As the earth at their disposal was little for the number of workers placed in the bottle, instead of making only one entrance as is usually the case, they made a great number, in order that all the members of the colony might be able to pass in and out without obstruction. Afterwards, when the galleries were more advanced, the entrances, which have often the form of small cones (formed by the accumulation of earthy matters proceeding from the piercing of the galleries), were reduced to three, and at last to one only. At the end of the nineteenth day the ants, quite settled, commenced conveying regularly the seeds which Mr. Moggridge had scattered round the new habitation.

It often happens that the small roots of plants growing at the surface of the ground penetrate into the galleries, thus obstructing the traffic of the ants; but they take care to cut them as soon as they make their appearance, as our author has observed more than once.

Do ants know the value of the treatment of diseases by cold water? One might believe so from the fact, observed by Mr. Moggridge, of an ant immersing another in a little pool of water, on the surface of which a bit of grass floated, which served for a bridge; the ant which had been immersed was afterwards, with difficulty, drawn out of the water, and carried into the sunshine to dry itself.

Mr. Moggridge also convinced himself that the seeds accumulated in the granaries did really serve for the nourishment of the ants; for more than once he had occasion to see the insects detach the particles of a grain of millet, moist and divested of its perisperm, and introduce them into their mouths. When seeds of different sorts were placed at their disposal, some could be eaten at once, others had to be moistened previously. Never in any case were these ants attracted by plant-lice which he placed in their vicinity.

Mr. Moggridge having seen the ants he kept in captivity working at night, he wished to be certain whether this took place habitually. With this view he visited some ant-hills one very dark and hot night, and found a colony actively conveying seeds taken from a neighbouring garden; and if he has not been able to observe the habits of *Pheidole megacephala*, it is precisely because that species works mostly at night.

The collection of seeds by *Atta barbara* has been observed at Mentone, Cannes, Marseilles, the Isle of Capri, and Algiers. This species is also found in Germany, Switzerland, and the north of France. What are its habits in the countries of the north? does it there also make provision for the winter? This is not very probable after the precise study bestowed on them by Huber. Nevertheless Mr. Moggridge is very desirous of some naturalist resuming this subject.—*Bibliothèque Universelle, Archives des Sciences Phys. et Nat.* tome l. pp. 49–56.

On Nearctos *and* Ælurina. By Dr. J. E. Gray, F.R.S. &c.

Dr. Theodore Gill, in the 'Annals and Magazine of Natural History' for this year, xiii. p. 15, with his usual industry as a compiler, points out that I overlooked two generic names that have been used by Gervais in his 'Hist. Nat. Mammifères,' ii. 1855. Though this book bears the date 1855, the second volume is not in the Museum Library, nor have I seen it in any other scientific or other library in this country; and being a history of Mammalia intended only for popular use, it is scarcely a place in which a zoologist would look for a new genus.

Dr. Gill states that M. Gervais has established the genus *Tremarctos* on account of a "supracondyloid foramen of the humerus, in which it is said to differ from all other Ursidæ;" but Dr. Gill points out that this foramen is found in other Ursidæ, and is doubtless exceptional and monstrous in them. I would ask, as only one skeleton of *Ursus ornatus* is known, may it not be an individuality in that specimen? Certainly it is a novelty in zoology to establish a genus on the existence or non-existence of a foramen in the humerus. My genus *Nearctos* is established on the peculiarity in the form of the lower jaw, shown to be a characteristic peculiarity by the examination of several skulls, a true zoological character.

In 1867, I established the genus *Viverriceps* for *Felis Bennettii* and several other Asiatic cats, because they have an elongate skull and a complete bony orbit. I referred *Felis planiceps* to this genus, because it had the same kind of skull—overlooking the peculiarity of its having a compressed double-rooted first false grinder in the upper jaw, which is figured by De Blainville in his 'Ostéographie,' and that Professor Gervais had proposed the genus *Ailurin* (*Ælurina*) for this animal in 1855; and Fitzinger called it *Ailurogale* in 1869.

I have examined four skulls of this species and find that the peculiarity of the false grinder is a permanent character of the species, and therefore propose, as Dr. Gill has done, to retain both *Ælurina* and *Viverriceps*.

The front upper grinder of *Viverriceps* is subcylindrical and one-rooted, and differs in size in different species. Thus, in *Viverriceps Bennettii* it is small and conical; in *Viverriceps Ellioti* it is very small and rudimentary; it is similar in *V. rubiginosa*, but very soon falls out.

On the Metamorphoses of the Acarina of the Families Sarcoptidæ *and* Gamasidæ. By M. Megnin.

In July and August of last year I communicated to the Academy two notes on the zoological position and physiological function of the little parasitic Acarina referred to the genera *Hypopus*, *Homopus*, and *Trichodactylus*, which, according to my observations, are merely the heteromorphous nymphs of certain Sarcoptidæ—among others, of the *Tyroglyphi*.

Since this period I have continued my investigations of the metamorphoses of the Acarina of this and some other allied families; and I now communicate the results to the Academy.

Besides the curious facts of heteromorphism mentioned in the two notes just referred to, and which are only produced under certain determinate conditions, I find that the Sarcoptidæ arrive at the adult state by a series of moults, by which the little animal gradually acquires all its organs, but without its general form departing from the normal type; the hexapod larva becomes the octopod nymph and then the sexual individual, always presenting the specific characters in the form and constitution of the rostrum and legs.

It has hitherto been supposed that these moults were effected as in the Insects with an incomplete metamorphosis or in the Crustacea—that is to say, that a sort of caducous epidermis was alone detached, retaining the impression of the parts of the skeleton which remained intact, and that the mite issued from it after having successively drawn its rostrum and its legs from the old envelope as from a sheath. This is the opinion expressed by all French and foreign authors who have attended to the embryogeny and development of these microscopic creatures. Claparède, the last of these authors, says* with reference to the moults of the *Tyroglyphi*:—"The rostrum and the legs are drawn out of their chitinous sheaths, a new segmentation of the thorax into three parts takes place in the soft animal, and the octopod mite is gradually formed under the protection of the integuments of the hexapod larva."

Nevertheless Claparède had made so complete an investigation of the extraordinary moults of the aquatic Acarina known under the name of *Atax*, that I am surprised he should have found the moults of the common terrestrial Acarina of the genus *Tyroglyphus* so simple.

M. C. Robin†, while admitting that the rostrum and legs are drawn out of the envelope corresponding to them, and folded under the belly between the old and new integuments, has nevertheless recognized that we cannot see the hairs torn out from the interior of the older ones, and that, being more numerous, they originate at the points where they are inserted as soon as the new integument is separated from the old one, and that this is the case with all the organs to which there is nothing to correspond in the old form, such as the fourth pair of legs in the nymphs and the caudal processes of the males of most of the avicolar Sarcoptidæ.

My observations show that in all the Sarcoptidæ all the organs, both those which are represented in the older form and those which are not, are completely formed anew, without the assistance of the old organs and completely independent of them. It is a *new birth*, if we may say so—a production of a new creature in the body of the old one.

Claparède, in the memoir which I have quoted, proves that in

* "Studien an Acariden," in Zeitschr. für wiss. Zool. xviii. 1868.

† "Mémoire sur les Sarcoptides avicoles, et sur les métamorphoses des Acariens," in the Comptes Rendus, tome lxvi. p. 776 (1868).

Atax, at each moult, the animal returns to the state of an egg, and entirely loses all its old apparent organs. Now it is precisely the same phenomenon that occurs in the Sarcoptidæ; only here the new egg is formed beneath the old envelope, which is not destroyed as in *Atax*, no doubt on account of the different medium in which the animals live: in the water the integuments of the male organ of the *Atax* disappear by dissolving; in the air the same organs persist, but desiccated.

When the hexapod larva or the octopod nymph of a *Psoroptes*, a *Tyroglyphus*, &c. is about to moult, it becomes inert and as if dead; then we see its limbs and rostrum empty themselves, by a sort of liquefaction, of the muscles and other soft parts which they contain. The product of this liquefaction accumulates in the body, becomes granular, surrounds itself with a true blastodermic membrane; and a true egg is thus constituted within the body of the animal, which it almost entirely fills.

This secondary egg afterwards presents precisely the same phases as the primary egg which gave birth to the larva, which have been so well described by Claparède: that is to say, its blastodermic membrane becomes mammillated or buds towards the cephalic extremity and on the sides. At the former point three pairs of mammillæ make their appearance; two of these give origin to mandibles, two others to palpi, and the last two to maxillæ, which quickly become soldered together; a new rostrum is thus formed. The lateral mammillæ, of which there are four pairs, become elongated, fold down upon the ventral surface, become cylindrical, then show perfectly marked articulations, and finally become legs with all their accessories, such as claws, caruncles, hairs, and spines. When the animal is fully formed, it issues from the old envelope, which tears along the dorsal surface and the transverse cephalothoracic furrow, precisely as the larva escapes from the ruptured shell of the original egg.

I have traced all these phenomena in two new *Tyroglyphi*, very common on Agarics attacked by black putrefaction; these I have named *Tyroglyphus mycophagus* and *T. rostroserratus* (Megnin). I have also followed them in *T. siro* (Latr.), in *Sarcoptes incurvatus* (Megn.), and *Psoroptes equi* (Gerv.), in which they are especially easy of observation.

I have also observed them in several species of Gamasidæ, among others in *Pteroptes vespertilionis* (L. Duf.). Here, however, probably in consequence of the enormous volume of the legs, the secondary egg has diverticula which are produced into each of the old ones, and it is in the interior of these cæca that the new legs are formed; thus, at a certain moment, we see the old legs bearing all their accessories, presenting in the interior of their tarsi another foot, with its claws, caruncles, and hairs, the latter laid transversely and longitudinally upon the new limb.

In the Gamasidæ the old envelope does not remain entire, as in the Sarcoptidæ, but it breaks up irregularly to liberate the new animal which it contains. This explains why we do not find the remains of the moults in places inhabited by the Gamasidæ, as we do in those frequented by species of *Tyroglyphus*, *Psoroptes*, &c.

After the last moult the form acquired is unchangeable, and broken limbs are not renewed. I have often met with adult Gamasidæ, especially males, having one of the posterior legs broken; but the stump, formed then by the trochanter, never bore any trace of renovation such as we see in the crayfish.—*Comptes Rendus*, June 8th, 1874, pp. 1657–1660.

Observations on the Fecundation of the Batrachia Urodela. By M. C. Robin.

I have the honour to communicate to the Academy the results of a series of observations proving that in the oviparous Batrachia Urodela (*Siredon*, *Triton alpestris*, *palmatus*, *cristatus*, *abdominalis*, or *punctatus*) the fecundation is internal, as in the viviparous Urodela, and not external, as in the Anura. The ova at the moment of deposition and even in the cloaca are fecundated; that is to say, they contain spermatozoids which have penetrated between the vitelline membrane and the vitellus. On opening the females during oviposition we find spermatozoids in the cloaca and at 3 or 4 millimetres up the oviducts. They are also found in pregnant females not engaged in oviposition and the oviducts of which do not even contain eggs coming from the ovary; this fact shows that the intromission of the semen takes place some days before the commencement of the oviposition. Thus when expelled artificially, or deposited by females separated from the males, the eggs become segmented at from 4 to 16 hours after their escape, and are developed like those deposited quite independently of all experimental conditions.

The male axolotl introduces his spermatozoids in bundles forming a small, solid, white mass 2 or 3 millimetres in thickness, surmounted by a conoidal transparent mass about 1 centimetre in length and thickness, composed of small, cell-like, hyaline bodies; the whole forms a sort of spermatophore, which sometimes, not penetrating into the cloaca of the female, falls and floats in the water.—*Comptes Rendus*, May 4, 1874, p. 1254.

The Large Seal (Halichœrus grypus) *in Cornwall.*

There is little doubt that this seal inhabits the north coast of Cornwall. Mr. R. N. Worth, of Plymouth, informs me that "the seals there are of a large size, and at times they are even abundant, and have favourite caverns which they seem to haunt." It has not before been recorded as occurring so far south.—J. E. Gray.

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XIII.—*On the Nature of the Seed-like Body of* Spongilla; *on the Origin or Mother Cell of the Spicule; and on the Presence of Spermatozoa in the* SPONGIDA. By H. J. CARTER, F.R.S. &c.

[Plate X.]

EVER since 1849, when my figure of the development of *Spongilla* from the seed-like body was published ('Annals,' September 1849, vol. iv. pl. iv. fig. 2), I have been uncertain of the real nature of this body; but lately, as I have been studying the living *Grantia compressa* in its oviparous state, light has been thrown on its nature which seems to show its real import.

By reference to the 'Annals' (*l. c.* pl. iii. fig. 6), it will be observed that the seed-like body is composed of a horny globular case with a hiliform opening, the cavity of which case is filled with spherical transparent cells, each of which again is charged with a great number of minute capsular granules that I have termed "ovules."

As the contents of the seed-like body grow out into the water from the hiliform opening, each spherical cell takes up its place in the "intercellular substance" or sarcodal mass, which appears at the same time to form the body of the young *Spongilla*; and all the "ovules" respectively become developed into monociliated and unciliated, polymorphic, monad-like organisms, which, in their aggregation, form a pavement layer around the spherical cell. This is well shown in the figure to which I have first alluded.

Again, if the so-called ovules be forcibly pressed out into the water from the spherical cell, they will also there, in their isolated state, become monociliated and unciliated polymorphic organisms respectively.

Lastly, if the young *Spongilla* which grows out from the hiliform opening of the seed-like body be fed with carmine or indigo, these monad-like organisms will be still more evidently seen aggregated, in the midst of the intercellular substance, into the form which I have called the "ampullaceous sac." I have also lately termed the monad-like organisms "spongozoa," as their peculiar form &c. seem to demand this distinction.

Let us now consider what the "ampullaceous sac" is.

In 1827, Prof. R. E. Grant (my kind friend and former teacher), with exceeding truthfulness and great ability, described the "ova" of the marine siliceous sponges (Edinb. Phil. Journ. vol. xiii. & Edinb. New Phil. Journ. vol. ii.) as ovoid bodies covered with cilia, which, after issuing from the sponge, sought a place to settle down upon and become developed into a miniature form of the parent.

In 1856, Lieberkühn discovered and figured the same kind of body in *Spongilla*, to which he applied the name of "Schwärmspore" (Müller's Archiv f. Anat., Phys. &c. Heft iv. pl. xv. figs. 35–39).

In 1872, Häckel did this also, with his usual ability, in the Calcisponges ('Die Kalkschwämme,' 1873, Text & Atlas)—proposing the terms "*Planula* or Flimmerlarve" for the advanced state of the ovum, and "*Gastrula*" for that of the following embryonal form—that is, where the internal cavity is formed but does not communicate with the exterior, and where it does, respectively.

Moreover Häckel, in several places, rightly figures the *Gastrula* as consisting of an *ectoderm* or crust of monociliated cells, radiating round the *endoderm*, which again is a layer of much larger and unciliated cells lining the internal cavity in juxtaposition (but not in radiation), and extending out over the aperture of the *Gastrula* in a botryoidal form; thus the convexities of the latter are of course much larger than those of the mulberry surface formed on the exterior by the ends of the monociliated cells of the *ectoderm*. Häckel's illustrations can hardly be too highly praised.

Searching after these ova lately in the marine sponges, I have as yet, from the examination of several gatherings, only found them, in the stages of development just mentioned, in *Grantia compressa* (*Sycandra compressa*, H.); that is to say, the rest of the sponges have either passed through this oviparous state, are coming to it, or, if in it here and there now, the specimens I have obtained (which have been very numerous) do not any of them present it; while its occurrence in every specimen of *Grantia compressa* already becoming effete under the circumstances, seems to point out that, like the inflorescence of plants, this state in sponges also occurs and goes at certain periods, and its elements are in vain sought for before or after these periods in any individual of the same species.

Having now become acquainted with the ovum of the marine sponges, and its development from the egg-like form to the embryo (for it is probable that in all it is more or less alike), it appears to me evident that each spherical cell of the seed-like body is also a distinct ovum; but its development from the seed-like body in the midst of the intercellular substance, where it has to remain, somewhat differs from that of its comparatively isolated condition in the marine sponges, where it has to seek an object for itself to settle down and grow upon.

Thus in the former it requires no crust of *ectodermal* monociliated cells for locomotion, nor does it require the *endodermal* cells for further increase; but the ovum and its capsular granules at once pass into a pavement of monociliated spongozoa, which arrange themselves in the form of the ampullaceous sac, in the midst of the intercellular substance (see figure in the 'Annals,' to which I have first referred). As this is going on, the pores and the branched excretory canal-system are formed, which become respectively connected with the two apertures of the ampullaceous sac. But whether this takes places synchronously, or the cavities of the ampullaceous sacs respectively push themselves through the intercellular sarcode, and, as regards the latter, like streams of water, at last all join together in one common excretory canal, is unknown to me. (For the further development of the young *Spongilla* from the seed-like body see my paper entitled "Ultimate Structure of *Spongilla*," 'Annals,' 1857, ser. 2. vol. xx. p. 21, pl. 1.)

Viewing the seed-like body, then, as a capsule filled with ova, which issue from its hiliform opening and thus become developed *en masse* into the young *Spongilla*, it may be a question whether the entire body may not be the ovarium of a spongozoon in the first place, while, as in hundreds of instances of the same kind in the animal kingdom, all the other parts have perished, their functions having ended when sufficient nutriment had been gathered and assimilated to support the reproductive elements until they could do this for themselves.

But, although this "question" of the origin of the seed-like body remains to be answered, the *object* of the process seems to derive explanation from the fact that the freshwater sponges are, from their habitat, exposed to variable periods of long dryness, from the subsidence of the water in which they dwell; while the marine sponges, in which the absence of a seed-like body is as constant as its presence in the freshwater sponges, not only in many instances are never uncovered, but under no circumstances can be long so, by the sea.

In Bombay most of the freshwater sponges grow many feet above the bottom of the tanks, probably for the sake of purity; so that as the water is withdrawn for domestic purposes, they are soon left dry, in horizontal lines which they occupy along the sides. Under these circumstances, most of them are uncovered by water for six months at least during the year; while their increase is so rapid that herbaceous plants which spring up just below the water's edge in the month of July, may have pieces of *Spongilla Carteri* about them, two or three inches in diameter, by the time the water again begins to recede from these plants in the following October and November.

At last, then, the true nature of the seed-like body of the freshwater sponges appears to be thus revealed. It is an assemblage of ova, which are at once developed together into a young *Spongilla*; and hence my statement in the last volume of the 'Annals' (p. 436), that the ampullaceous sac is Häckel's *Gastrula* developed *in situ*.

On the Origin or Mother Cell of the Spicule in the Spongida.

In August 1856, Lieberkühn published, as one of the results of his study of *Spongilla*, that the spicule originates in the interior of a cell, "die Kieselnadeln entstehen innerhalb der Zellen," which had been illustrated in the preceding "Heft" (Müller's Archiv f. Anat. Phys. &c. Hefts iv. & v. p. 513, and Tab. xv. fig. 22, respectively). In this figure the spicule may be observed to be enclosed by a cell bearing a distinct nucleus and granules.

In the following April (1857), my paper on the "Ultimate Structure of *Spongilla*" was presented to the Bombay branch of the Royal Asiatic Society (B. B. A S. Journ. vol. v. p. 574), and reprinted with illustrations in England ('Annals,' July 1857, ser. 2. vol. xx. p. 21, pl. 1), where in fig. 8 will be found an almost fac-simile of Lieberkühn's representation, with the exception that in the former the spicule appears to have been smaller. That there should be such a close resemblance between our figures is not extraordinary, because we were studying the same organism with a similar purpose, about the same time, although one of us was at Berlin and the other at Bombay, thus working independently of each other.

The result of my observations may be found in the paper to which I have alluded; and at p. 23 ('Annals,' *l. c.*), on the development of the spicule, I have thus expressed myself:—

"At the earliest period that a spicule becomes visible it appears under a hair-like form of immeasurable thinness, and enclosed in a sponge-cell of a spindle-shape, which has assumed this figure to accommodate it. The nucleus of the cell is now seen in its centre, and the spicule, about 1-400th of an inch in length, lying across it (fig. 8, *a'*), &c."

It will be seen by the form of the figures that both Lieberkühn's and my own observations had reference to the *skeleton*-spicules, viz. those spicules which are essentially connected with the horny fibre of the sponge, in contradistinction to those minuter forms which are essentially connected with the sarcode, for which I have lately proposed the name of "*flesh*-spicules."

Let us now see how far later observations have confirmed these views in the latter.

In a copy of a report on the siliceous sponges of the North Sea collected during the German expedition of 1871, kindly forwarded to me by the author (Dr. O. Schmidt) in July 1873, my attention is directed to a part where he states that the anchorates and bihamates of an *Esperia* were observed to originate in genuine cells. "An einer bei Arendal vorkommenden *Esperia* habe ich nun die sehr interessante Entdeckung gemacht, das sowohl die Spangen als die Haken aus einem Verkieselungsprocess von Zellmembranen oder wenigstens der membranähnlichen Oberflächenschicht von echten Zellen hervorgehen, &c." (p. 431).

This I have just now been able to confirm in *Halichondria ægagropila*, Johnston (Brit. Sponges, p. 119, and type specimen in Johnstonian collection, British Museum), the common *Esperia* here (Budleigh-Salterton, Devon). It is desirable, however, before going further, to give the diagnosis of what I have arranged in the British Museum under the head of "Esperiadæ." Briefly this consists in the presence of one kind of skeleton-spicule *only*, and an anchorate which is *generally inequi*-ended (Pl. X. fig. 12, *a*, *b*); while Schmidt would almost as strictly confine his "Desmacidinæ" to the presence of the tricurvate (Bogen). Still, how far groups or species of sponges may be determined by the "flesh-spicule" remains to be seen, since in many, otherwise widely different, I have observed the same form of flesh-spicule, almost, too, as if the latter prevailed in certain localities.

But to return to our subject: the specimen of *Esperia* to which I have alluded was charged with four kinds of cells, to each of which separately it is necessary to direct attention, viz.:—

1st. A spherical, transparent, empty one, about 10-6000ths of an inch in diameter, bearing a granular lenticular nucleus in the periphery about 1-6000th of an inch in diameter, from which occasionally might be seen very delicate branched lines of sarcode streaming over the inner aspect (Plate X. fig. 1).

This kind of cell was very numerous, and, shortly after the fragment of *Esperia* had been torn to pieces for microscopic examination, was observed to congregate more or less here and there together, and become united with the neighbouring granules and polymorphic bodies of the sponge into separate agglomerations, well represented by Schmidt in his figure of the like from *Esperia Contarenii* (Adriatic Sponges, Histologie, 1864, 1st Suppl. Taf. i. fig. 5). It was observed too that there were many lenticular bodies about the field, composed entirely of granules without visible nucleus (fig. 2), almost identical with the nucleus of the large empty transparent cell; while the addition of alcohol caused the latter so to collapse round its nucleus, that this also then presented the same appearance: hence it became evident that the large, empty, spherical cell was derived from a plastic layer united to the circumference of the lenticular nucleus, but otherwise capable of being separated from its inner side by aqueous distention into the globular form mentioned.

2nd. A cell bearing the *inequi*anchorate of *Esperia* in different stages of development, from 2 to 5 6000ths of an inch long. This, from the generally elliptical form of the spicule, assumed by contraction a similar shape, and thus, through its living plasticity, often became so closely wrapt round its contents as to leave hardly any thing visible beyond the nucleus and granular plasma of which the cell was composed (figs. 13–16).

Here it is desirable to state that, in its early development, viz. when the cell is perfectly elliptical and about 2 6000ths of an inch long, the embryo spicule appears in the form of an *equi*anchorate (fig. 13), and does not pass into the *inequi*-anchorate form until it has got beyond this size, when the inequianchorate end appears to proceed and the other to be arrested in its development (fig. 16). This to me is a matter of interest, inasmuch as I have made the presence of minute *equi*anchorates, in addition to the others, in some specimens of *Esperia* a point of distinction; while it would now appear that they are merely the early stage of the *inequi*anchorate, and therefore so far valueless. Indeed I am quite convinced that great confusion will arise from this point having hitherto been so neglected, that, in many instances, sponges have been stated to contain, as distinctive characters, spicules which, although widely differing in form and size from, are nevertheless the early stages only of the fully developed ones.

So preeminently living is the sarcode-cell about the anchorates, that in getting them in particular to turn over, it is frequently necessary to use considerable force to detach them from the surface of the glass (fig. 15).

3rd. A similar cell, about 7 by 4 6000ths of an inch in diameter, stretched over a single bihamate like parchment over a drum. Here the cell, being prevented from contracting beyond the confines of the spicule, retains the transparency of its wall, in which the granular, lenticular nucleus is perfectly visible (fig. 11).

4th. A similar cell (differing according to its developmental size), from 2 to 10 6000ths of an inch long, stretched over a variable plurality of tricurvates. Here, too, the cell being prevented from collapsing by the plurality of the spicule, and its often lying crosswise (fig. 7), the transparency of the wall remains, making the granular cytoblast or nucleus more visible (figs. 5–9).

Thus it would appear that all these cells are connected with the production of the "flesh-spicules," and that therefore, with the foregoing observations by Lieberkühn, Schmidt, and myself, it may now be considered settled that the spicule does originate in the interior of a cell.

After the spicules have grown beyond the power of their cells to contain them, the latter, which are still living, would appear to allow them to pass through their parietes, without rupture in the manner of sarcode-cells generally. What becomes of these cells afterwards I know not; but the number of empty cells of the kind first described, with which the *Esperia* may be charged, seems to point out that *they* have either thrown off their spicules, have never had any, or are going to produce more, or never will produce any.

Clear, however, as it now is that the spicule originates in a cell, the *immediate* origin is not known. That they all commence from a minute cell *within* the parent one seems to derive confirmation from the fact that they grow by the extension of the central canal (in the *flesh*- as well as in the *skeleton*-spicule), on which the substance of the spicule is deposited in concentric and therefore successive layers, which central canal probably commenced in a single point or cell. Indeed this is proved by the occurrence in some sponges of globular or ellipsoidal monstrosities, where the natural form of the spicule is exclusively long and linear.

From what part of the mother cell this minute cell or point comes, can hardly be conjectured. All that can be now said on this point is, that the nucleus or cytoblast appears to be entirely composed of a granular plasma, in which the granules are of a uniform size and may afford the first points or cells for the development of the spicules; or this may be furnished by the granular plasma of which the cell-wall itself is composed.

On the other hand, the final development and finishing of the spicule must take place in the intercellular substance or basal sarcode of the sponge; for when even moderately developed, there is not a *single* sponge-cell large enough to contain the spicule. Therefore, however clear it may be that the spicule originates within a cell, that all-important intercellular substance the basal, so-called "structureless," sarcode must be viewed as the agent or "contractor" for the finishing of the spicule as well as for the development of the whole structure.

I had often noticed, in my mounted specimens of *Tethya lyncurium* (*Donatia*, Gray), that the minute stellates were in a vacuole of the dried sarcode, and therefore concluded that each must be formed in its proper cell. But, as Schmidt has stated, the sponge must be *fresh* for the *cells themselves* to be seen; and the fresher it is, and the quicker viewed with the microscope after the fragment for observation has been torn to pieces, the better; for the contraction of the living sarcode goes on so quickly that after a little, especially as regards the anchorates, the cell becomes so tightly wrapt round its contents that it is hardly distinguishable.

Again, I had often noticed that among the sheaf-shaped bundles of minute linear spicules, which exist in many sponges of different kinds, there seemed to be a passing of them into the form of a tricurvate; and when I saw Kölliker's figure of *conjectured* spermatic filaments in *Esperia* ('Icones Histologicæ,' Feinere Bau, 1864, pl. vii. f. 11), represented within a nucleated cell, I also saw at once that these were spicules, and concluded that the tricurvates were produced in like manner. Now this is confirmed.

As I have only found two examples of the occurrence of the bihamate in its mother cell, and in each instance it was single, I am not able to say that it also may not, in some cases, be produced, like the tricurvates, in greater or less plurality. We also know that the inequianchorates in *Esperia* often abound in the form of "rosettes"—that is, where a great number of them with their small ends inwards radiate thus in all directions from a common centre. Here, I think, we must also conclude that the whole bunch is produced in one cell; but I have not yet seen an instance of it. If developed from the granules of the nucleus, the whole of this body of the latter might thus pass into one of these "rosettes." In one cell I observed two *inequi*anchorates together end to end, or slightly overlapping each other; but this was in the *equi*anchorate stage—that is, when neither of these embryo spicules exceeded 2-6000ths of an inch in length (fig. 14).

In order that the full size of the flesh-spicules of *Esperia ægagropila*, C. (*Halichondria ægagropila*, Johnston), might be compared with the embryonic ones in their mother cells respectively, figures of the inequianchorate (fig. 12, *a*, *b*), bihamate (fig. 10), and tricurvate (fig. 3) of Bowerbank (*Haken*, *Spangen*, and *Bogen* of Schmidt) have been represented on the *same scale* among the illustrations.

On the Presence of Spermatozoa in the Spongida.

In January 1856, Lieberkühn observed, with reference to my figures conjecturally termed "zoosperms in *Spongilla*" ('Annals,' Nov. 1854, vol. xiv. pl. xi.), that they were not so, but those of "*Trachelius trichophorus*" (Müller's Archiv f. Anat., Phys. &c. p. 18); and, so far as the negative goes, I believe he was right.

But in August 1856, two years after the "zoosperms in *Spongilla*" appeared, I also published a figure of a minute monociliated sponge-cell attached to a much larger unciliated one, with the following explanation in the index to the plates, viz. "Fig. 43. Small sponge-cell with so-called 'zoosperm' attached, &c." (Annals, vol. xviii. p. 245, pl. vi.), and in the figures close to it, viz. 45 to 48, four representations of *Astasia limpida* = *Trachelius trichophorus*, Ehr., with anatomical detail.

Now, without reference to the identity here of the smaller monociliated sponge-cell with a spermatozoon of *Spongilla*, I would submit to the reader whether (on comparing all these figures, which are within an inch of each other in the same plate) it is likely, as implied by Lieberkühn (*l. c.*), that I could have mistaken a sponge-cell for a *Trachelius trichophorus*, especially as I allude, in the text of my paper on the supposed "zoosperms in *Spongilla*," to the cilium as the "tail"—seeing that the sponge-cell is propelled by the cilium from *behind*, and *Trachelius trichophorus* drawn on by the cilium *in front*, as shown respectively in the figures to which I have just alluded.

With the explanation of this little difference, which may also tend to show the distinction between a monociliated sponge-cell and *Trachelius trichophorus*, let us return to the more valid object of the communication, viz. the developmental discovery, as it may be termed, of the spermatozoa in sponges.

In January, also of 1856 (p. 18, *op. cit.*), Lieberkühn announced his discovery of the spermatozoa in *Spongilla*, which he states, at the conclusion of the article, to have been previously observed by his respected teacher Johannes Müller; and in August of the same year their development is described, accompanied by figures of them separately and within the mother cell (p. 500, pl. xviii. figs. 10 & 15–17, *op. cit.*). They are here represented as minute conical bodies, of which the pointed end is prolonged into a single cilium, but are unaccompanied by any measurement.

From this period up to 1870 I am not aware that any additional information on the subject was communicated, when, in the October of that year, I published the following account of some spermatic-looking monociliated cells which I found in *Microciona atrosanguinea*, Bk. (Annals, vol. vi. p. 339):—

"This monociliated body, which may now [July 30th] be seen in great plurality, with every portion of the *Microciona* torn to pieces for microscopical observation, consists of a rounded triangular head and long cilium [Pl. X. figs 17, 18, & 20]. The head is pyriform or shaped like a Florence flask with the neck drawn out to a sharp point or beak, and the cilium attached to the large end, close to which there appears to be a single granule or nucleus; but in other respects the head is transparent. At first these bodies are in contact with the glass cover, but soon sink to the plane of the slide, about which they move with the head foremost, apparently urged on in a zigzag course by the undulations of the cilium behind. For the most part they are single; but occasional groups of four [fig. 19] are seen rolling over the field after the manner of monociliated cells or spermatozoa which want to become separated from each other. When measured, the head, including the beak, was found to be 1-3000th of an inch long by about 1-12000th broad at the large end, and the cilium seven times as long as the body, or about 1-400th inch long. Under the action of iodine, the head became amber-coloured. While portions of *Microciona atrosanguinea* taken from different localities abounded with this body, together with a number of scarlet gemmules [ova?], in addition to the ampullaceous sacs and monociliated cells of the rest of the sponge, portions of other sponges, even on the same piece of rock, failed to present a similar body when torn to pieces under the microscope. Could this monociliated body with triangular head have been the spermatozoon of *Microciona*?"

This description was unaccompanied by the figured representations which I have now added (Pl. X. figs. 17 to 20), as there was no plate to the paper; and it was not until I saw the illustrations of Dr. T. Eimer (Schultze's Archiv f. mikroskop. Anat., Band viii. Heft 2, p. 281, 1872) that my attention was again called to the subject, when I recognized in his figures almost fac-similes of my own.

In the months of March to July 1871, Dr. Eimer discovered, both in the siliceous and calcareous sponges, on the shores of the island of Capri, similar bodies to those which I have described and have *now* for the first time figured, as may be learnt from his descriptions and those he has illustrated from the Calcispongiæ (*op. et loc. cit.*).

Häckel did the same at the island of Lesina in the Adriatic about the same time, viz. in the month of April (Jenaische Zeitschr. f. Med. und Naturw., Bd. vi. 1871, p. 644 *ap.* H). But he went further; that is, he not only saw the spermatozoa of certain Calcispongiæ in their mother cells *in situ*, but actually saw them entering the ovum of *Grantia ciliata*, Bk. (*Sycortis quadrangulata*, H.) (Die Kalkschwämme, Atlas, Taf. 48. figs. 6, 7, & 8, and vol. i. p. 396). Thus the fact of spermatoid development and impregnation in the sponges was so far established.

The shape of the head of the spermatozoon in Häckel's illustrations differs; for while in most instances it is globular or conical, with the pointed end prolonged into a cilium (like that in *Spongilla* figured by Lieberkühn), it is elliptical accuminated in *Grantia ciliata*, Bk., where the anterior end is extended into a kind of beak; but in no instances does it resemble that of the bodies figured by Eimer or those described by myself in *Microciona* and *now* published. Still, as every living part of the sponge that is soft is subject to polymorphism, no great stress is to be laid upon this difference.

Taking advantage of Häckel's work on the Calcisponges already mentioned, which is a *sine quâ non* to their study, I sought among our calcareous sponges here for those which might be in an oviparous condition, what in plants we should term in a state of "fructification;" but it so happens that there is only one here in this state now, viz. *Grantia compressa* (*Sycandra compressa*, H.); and it also so happens that there are no illustrations of the generative elements of this species in Häckel's work.

Nevertheless, as this is the commonest and hardiest form here, growing on seaweeds in pools easily got at at every fall of the tide, and well known to me to go through its reproductive functions in the months of March, April, and May, so as to become effete and disappear for the most part in June (eaten both inside and out by small Crustaceans), it has afforded me abundance of opportunities of witnessing what Häckel has so truthfully and lucidly described and illustrated of several other species in his work.

Yet in only one instance have I been able to see what appeared to me to be the spermatozoa of the species, and then not living but scattered dead about the field in considerable number (fig. 21).

These bodies, comparing small things to great, were shaped like a sky-rocket, with a long cilium (figs. 22 & 23); the head conical and based on the body, which was somewhat constricted at the point of union, and slightly increasing backwards to an obtuse end, from which projected the cilium. The head and body together measured 1-6000th of an inch long, by about 1-24000th of an inch thick; and being divided into three parts, the body appeared to be just twice as long as the head. The cilium was 10-6000ths of an inch long.

Had these bodies been active and living instead of still and dead, I probably, from their minuteness, should not have been able to obtain the measurements; but, as it was, these with the form were too plain to be mistaken, although the general opacity of the body obscured all differentiation in *its* composition.

That they were not the disintegrated ectodermal cells of the embryo (*Planula* or *Gastrula*), the attachment of the cilium to the *longer* portion (that is, the body) instead of to the shorter one or head (according to Häckel's figures of these cells), seems to point out; besides, the latter was conical and pointed, not obtuse and round like the outer or monociliated end of the *ectodermal* cell. Again, they could not have been dead long, or they would have vanished by "diffluence;" while the adhesive sarcodal composition of the ectodermal cells seems to defy any separation of them into individuality, although I often tried to produce it.

Of course I can only state and show what these bodies were; for although they may look very much like spermatozoa, yet, seeing them enter the ovum is the only proof that they are such and do belong to the sponge.

I have also observed another monociliated body in a fresh specimen of *Halisarca Dujardinii*, equally pregnant with ova as the *Grantia compressa*, but not so far advanced (figs. 24 & 26, *a–i*). It was circular in form, like a coin with a rounded thick obtuse edge, diminishing to extreme thinness towards the centre, where there appeared to be a *single* granule, the rest of the body being homogeneous. From some part, whether towards the centre or at the circumference I could not determine, projected a single cilium. The body while in activity exhibited a subpolymorphic form and often became cup-shaped or conical towards the middle on one side (fig. 26, *g*); while the rim as often became thicker and seemed to hold the granule just opposite the cilium, giving the translucent centre a kind of horseshoe-shape (fig. 26, *e*).

The cilium propelled the body forwards, but as often too presented a bulbous soft swelling at the end, which seemed to act as a sucker in anchoring the body to other cells and sarcodal objects in the field (fig. 26, *h*). After a time, when the body was still, the whole became indolently polymorphic and amœboid in shape, while the cilium shrunk up to a short process (fig. 26, *i*). They were often seen in twos and fours together in a flexible mother cell about the field of observation (fig. 25); and each individual measured 1-6000th of an inch for the diameter of the body and 5-6000ths of an inch for the cilium.

These bodies were numerous while the *Halisarca* was quite fresh—that is, on the first day of capture and for three or four days afterwards, when it disappeared, as vibrios and other monadine bodies announced coming decadence in the sponge.

While their appearance in this sponge in its fresh state, together with the presence of the ova considerably advanced, led me at first to think they might be the spermatozoa of the species, the bulbous inflation of the tail and its power of anchoring the body looked so monadine that, together with its unusual appearance, whether spermatozoon or monad, its publication may not be altogether useless. Having since seen the free ends of the ectodermal cells of a *Gastrula* become bulbous, this alone is only proof of their sarcodal, polymorphic composition.

I have stated that the specimen of *Halisarca Dujardinii* in which these bodies were *exclusively* observed was "as pregnant with ova as that of *Grantia compressa*, but not so far advanced;" that is to say, the ova were in that stage of development when the granular yelk is clearly seen investing the nucleus, nucleolus, and germinal vesicle, measuring about 7-6000ths of an inch in diameter, and still reptant; while in a specimen which came from the Isle of Man and was sent to me by Mr. T. Higgin of Liverpool, they measure 45-6000ths of an inch in diameter (nearly seven times as much), and thus are visible to the naked eye, having passed through the nuclear stage and become probably nearly ready for delivery.

Hence, as the largest specimens of *Gastrula* in *Grantia compressa*, which appear to be equally ready for exit, do not measure more than 15-6000ths of an inch in diameter, it would seem that there is a difference in size, if not in development, between the ovum of the siliceous and calcareous sponges, when sufficiently matured to leave the parent.

From this I almost question whether the ovum in the siliceous sponges does not leave the parent before it arrives at the *Gastrula* state—that is, in the state of the *Planula*, when the cavity of the endoderm does not communicate with the exterior, but when the ciliated cells of the ectoderm are sufficiently developed to give the ovum full power of locomotion. This, however, is for future observation to determine. One point is evident, viz. that in the siliceous sponges the spicules are plentifully developed before the ovum leaves the parent, which is not the case with the *Gastrula* in the calcareous sponges, so far as my observation extends.

Since the above was written, I have obtained specimens of *Grantia ciliata*, Johnston (*Sycandra*, H.), in the oviparous state, but have not been able to detect any thing like spermatozoa in them. Indeed, only in the instances above mentioned have I ever met with any thing like spermatozoa, although I have examined living sponges hundreds of times under the microscope. Still I am well aware, from long experience, that, among the lower organisms, the meeting with the spermatic element is a matter of chance rather than of certainty.

EXPLANATION OF PLATE X.

N.B.—All the figures in this Plate, from 1 to 16 inclusive, have been taken from a piece of *Esperia ægagropila*, Carter (*Halichondria ægagropila*, Johnston, Brit. Sponges, p. 119, and type specimen, Johnstonian collection, British Museum). They also have all been drawn to the scale of 1-12th to 1-6000th of an inch (with the exception of 13, *c*, and 16, *a*), in order that their relative sizes may be at once appreciated. Of course the finer lines are diagrammatic.

Fig.* 1.** Transparent, empty, distended globular cell: *a*, cell-wall; ***b, nucleus or cytoblast.

***Fig.* 2.** Granuliferous nucleus or cytoblast (undistended?).

***Fig.* 3.** Tricurvate spicule, full-grown.

***Fig.* 4.** Mother cell of tricurvate spicule. The young tricurvates in plurality arranged parallel to each other in a bundle, as they are wont to be in natural development: *a*, cell-wall; *b*, nucleus; *c*, tricurvates.

***Figs.* 5 & 6.** The same, but with some of the tricurvates reversed.

***Fig.* 7.** The same, where the tricurvates cross each other at nearly right angles.

***Fig.* 8.** The same as figs. 5 and 6, but at an earlier stage of development, therefore smaller.

***Fig.* 9.** The same, and the smallest size recognized, being not more than 1-3000th of an inch in longest diameter.

***Fig.* 10.** Bihamate spicule, full-grown.

Fig. 11. Mother cell of bihamate spicule, containing a single spicule: *a*, cell-wall; *b*, nucleus; *c*, bihamate.
Fig. 12. Inequianchorate spicule, full-grown: *a*, lateral view; *b*, front view.
Fig. 13. Mother cell of inequianchorate spicule at a very early stage of development, when the embryo spicule is in the *equi*anchorate form: *a*, cell-wall; *b*, spicule; *c*, the same amplified to show the *equi*anchorate or hooked ends.
Fig. 14. The same, where two individuals were in one cell.
Fig. 15. The same, where the cell has become polymorphic.
Fig. 16. The same, in a more advanced stage, where the spicule has become *inequi*anchorate: *a*, cell-wall; *b*, nucleus; *c*, inequianchorate spicule; *d*, the same, amplified to show the nucleus and granuliferous state of the cell-wall.
Fig. 17. *Microciona atrosanguinea*, Bk., spermatozoid-looking bodies in. Scale 1-24th to 1-6000th of an inch.
Fig. 18. The same, single one. Scale 1-12th to 1-6000th of an inch: *a*, head and granule; *b*, cilium.
Fig. 19. The same; group of four together. Same scale.
Fig. 20. The same. Scale of 1-4th to 1-6000th of an inch: *a*, head; *b*, granule; *c*, cilium.
Fig. 21. *Grantia compressa*; spermatozoid-looking bodies. Scale 1-24th to 1-6000th of an inch.
Fig. 22. The same, single one. Scale 1-6th to 1-6000th of an inch.
Fig. 23. The same. Scale 1-3rd to 1-6000th of an inch.
Fig. 24. *Halisarca Dujardinii*; spermatozoid (?) bodies. Scale 1-24th to 1-6000th of an inch.
Fig. 25. The same; group of four in a cell. Same scale.
Fig. 26. The same: *a*, individual attached to a group of sponge-cells by the *head*; *b*, rim; *c*, granule; *d*, cilium; *e*, the same, showing inflation of the rim opposite the cilium; *f*, lateral view of head; *g*, cap-like projection of centre of disk; *h*, individual attached to a group of sponge-cells by the *end of the cilium*, rendered bulbous under polymorphism; *i*, polymorphic state with shrunk-up cilium.

XIV.—*On some Species of* Amphithoë *and* Sunamphithoë. By the Rev. Thomas R. R. Stebbing, M.A.

[Plates XI. & XII.]

It will be seen by the following descriptions how very closely allied these two genera are to one another, and how closely allied also are certain species within the genera. It will be seen likewise that some readjustment is probably necessary.

A new species is added to the genus *Amphithoë*, and one which appears to have been partially, but only partially, described before as a species of *Amphithoë* is found to have a hooked telson, which will transfer it to the genus *Sunamphithoë*; but this species, not content with a single hook to its telson, has a couple, and might, on the strength of this, almost claim a new genus to itself. It so happens that all the specimens described in this paper had red eyes, though some of their kinsfolk have been described from the same localities as having a more sober and temperate appearance. No explanation has as yet been offered of this variation in the colour of the eyes between different individuals of the same species, a variation which also sometimes occurs, according to Messrs. Bate and Westwood in *Anonyx* (*Edwardsi*) *serratus*, even in one and the same individual at different ages.

Amphithoë cuniculus, n. sp. Pl. XI. figs. 1, 1*a*, 1*b*, 1*c*, 1*d*, 1*e*.

This little bright yellow species of *Amphithoë* has come into the net from rock-pools both at Meadfoot, Torquay, and at Prawle Point. It does not appear to be very common. The head with its bulging cheeks and not very intellectual forehead, and something in its general gait and bearing when alive, are suggestive of a little rabbit, whence the specific name.

The antennæ are short and sturdy, set back in a frontal concavity; the two pairs very close to one another, the upper having the peduncle shorter, and the flagellum longer than the lower. The last joint in the peduncle of the upper antennæ can scarcely be distinguished from the flagellum. The eyes are small and red.

The first gnathopods have the wrist and hand parallel-sided and about equal in length, the wrist, if any thing, the larger. The finger exceeds the palm, against which it closely impinges.

The second gnathopods are large and powerful. The thigh is dilated into a lobe, which runs the whole length, and at the distal end swells out so as to occupy a vacant space left by the reentering angle of the knee. The wrist is short and shallowly cup-shaped. The hand is large, increasing in width towards the distal end, but narrowing again before it reaches the finger-joint. The powerful finger curves across the concave palm, and, with a slender nail on its truncated tip, closes down upon the blunt tooth-like process which terminates the palm and carries a little outwards the thin anterior edge of the hand. The remainder of the hand may be described as bulging. There are a few hairs on the tooth and palm and other parts of these gnathopods. When not in use these limbs are drawn closely up between the coxæ, and are prone to cherish that position after the death of their owner; so that without great care the force required to draw them out ends by breaking them off. The whole creature is comparatively hard, and readier to break than to bend.

In the first two pairs of pereiopods the thigh is largely developed. Of the three following pairs the first is short and the last long, the second being intermediate in size.

The telson, which, with the preceding segment, is sulcate, is almost buried between the last pair of pleopoda; these converge at their distal ends, each bearing a pair of sharp hooks with their points facing outwards.

The length is one fifth of an inch nearly.

Amphithoë rubricata. Pl. XI. figs. 2, 2*a*.

This is not an uncommon species, found occasionally within tide-marks, but generally rather further out. The principal distinction from its first cousin, *A. littorina*, which is generally a pure green speckled with black, consists in its bright red colouring, sometimes varied by a white pattern along the central line of the back. Colour, however, and habitat are in general so little to be depended on for discriminating species, that it seems, in the present instance, worth while to point out how minute all the other differences are between *A. rubricata* and *A. littorina*. The former appears pretty constantly to have the flagellum of the upper antennæ slenderer and of greater comparative length. Its eyes are said by Mr. Spence Bate to be white with black spots, whilst those of its congener are described as black. According to my own experience they are red in both cases. In the 'British Sessile-eyed Crustacea' the hands of the first and second gnathopods of *A. rubricata* are described as "having a slightly defined palm;" but in Mr. Spence Bate's British-Museum Catalogue the palm is said to be "not defined." In the former work the second gnathopods of *A. littorina* are said to have the palm "long and not clearly defined." We are also there told that "there is a deep semilunar fissure between the wrist and the hand and between the wrist and the preceding joint, which does not occur in *A. rubricata*." Of this nothing is said in the Catalogue, in which, indeed, the gnathopods of the two species are described in terms almost identical. The truth seems to be that the palm of the second gnathopods is subject in both forms to a certain amount of variation, its tendency being towards a well-defined concavity in the deep-water form. In this form also the fingers of both gnathopods have a well-defined serration, and that in adult as well as in young specimens. But this serration occurs certainly also in the finger of the first gnathopods of *A. littorina*; and though this form is less conspicuous than the other for beautiful fringes of shining hairs on various parts of the meros, the wrist, and the hand, it nevertheless has these fringes, only of less length, and, what is more, has them disposed just as they are in the other species: in both gnathopods they are set round the distal extremity of the meros and distally round the back and front of the wrist, on the back and front margin of the hand, on the palm, and on the inner side of both hand and wrist. The antennæ also are adorned with similar hairs—long ones at the articulations of the peduncle, and short tufts or fringes at intervals round the cylindrical or subcylindrical pieces which compose it: these ornaments, again, are shorter and less attractive in *A. littorina*.

In the 'British Sessile-eyed Crustacea' there is a slight difference in the figuring of the telsons of the two forms—a difference, however, not again mentioned by Mr. Spence Bate in his British-Museum Catalogue. The specimen of which I have drawn the tail-piece appeared to be *A. rubricata*, but was taken within tide-marks. The telson differs from both the forms previously figured, being truncate and indented at the distal end. The stems of the last pair of pleopoda have their distal ends toothed or crenated.

On the whole we may, I think, accept these two species as an example of those insensible gradations between varying forms of a common origin, in which some persons find it so difficult to believe.

Sunamphithoë gammaroides (male and female). Pls. XI. & XII. figs. 3, 3*a–f*.

This species is probably the same as Mr. Spence Bate's *Amphithoë gammaroides*, which, however, was described and named from "dried and imperfect specimens" not exhibiting the telson, in the shape of which consists the one generic distinction between *Amphithoë* and *Sunamphithoë*.

My specimens were taken throughout the year in rock-pools at Meadfoot and Goodrington, Torquay. The colouring is a bright yellowish green, with sparse but conspicuous black dots, chiefly on the coxæ. In these respects and in the shape of the pereiopoda they agree with *Amphithoë gammaroides*. The eyes, however, are not black but red—a point of minor importance, as the colour of the eyes seems to vary in more than one species. The peduncles of the antennæ agree approximately: in the upper pair the second joint is scarcely so long as the first, in accordance with the figure, but not with the description of *A. gammaroides.* In one specimen out of five the flagella agree with those described by Mr. S. Bate, the lower reaching beyond the extremity of the superior. In the other four examples the upper flagellum extends beyond the extremity of the lower.

The first gnathopods are similar in the two sexes. The hand with its closed finger may be described as narrowly ovate. The palm is oblique, but slightly defined, with a few hairs rising from near the edge; the finger a little overlaps it. The second gnathopods differ in the two sexes, being more quadrate in the male, more ovate in the female; in both the wrist is continuous with the hand, being slightly more dilated in the female than in the other sex. The palm of the male is remarkable, differing in shape on the inner and outer sides of the hand; it is bounded anteriorly by the bulging outwards to a very moderate extent of the anterior edge of the hand, whence it runs obliquely in two concave curves on the outer side to the base of the finger. The finger is large and powerful, serrated on the inner edge, and curving over to the extremity of the palm, which, on the inner side, makes three curves, the central and best-displayed one being not concave like the others, but convex. The palm on this side has a small triangular spine and several hairs springing from near its margin. Between the two sides of the palm the hand appears to be grooved or partially hollowed out.

In the female the palm, though oblique as in the male, is straight, with no tooth or special prominence to define it, while the inner edge of the finger seems to be less concave than in the male.

The fourth, fifth, and sixth pairs of pereiopoda, which gradually increase in length in the order named, agree rather closely with those of *Sunamphithoë hamulus*, Spence Bate. They have the distal extremity of the hand dilated, with a large arcuate finger; and near to where the inner margin of this meets the palm, springs a long, blunt, curved spine, while three or four other spines, also blunt, but short and straight, are set on the rounded anterior portion of the palm.

The telson, which moves up and down between the last pair of pleopoda, and is thus sometimes completely hidden from view in profile, has this peculiarity, that instead of a single hook at its extremity it has a couple, with apparently a small intervening level space.

The last pair of pleopoda have two rami each—the inner foliaceous, the outer (as in the allied species) armed with a pair of spines so set as in conjunction with the ramus to form hooks. The two preceding pairs of pleopoda are set with spines in the ordinary manner, each branch terminating in a single long straight one; the antepenultimate pair have a slightly curved process at the distal end of the stem beneath the rami.

There is a curvature in the palm of *Amphithoë gammaroides*, as figured both in the 'British Sessile-eyed Crustacea' and in the British-Museum Catalogue of Amphipoda, which is not noticed in the description in either of those works. But it seems probable that this curvature really corresponds with the convexity, spoken of above, on the *inner* side of the palm of the present species.

Should it hereafter prove that *Amphithoë gammaroides* is a *Sunamphithoë*, though not the *Sunamphithoë* we have here described, this latter species will have to resign its name. In that case it might well be called *inæquipalmata*.

The length without the antennæ is about one fifth of an inch.

Sunamphithoë conformata, Spence Bate (male and female). Pl. XII. figs. 4, 4 *a–d*.

It may seem like going over old ground to figure and describe this species; but one important part of it, namely the telson, had not been clearly observed at the time of the original description, and there are one or two other points requiring comment.

Only the male form has been hitherto described, at any rate under the present name. Another form, which I have taken at Salcombe in the same dredging with the male, and with the young upon it at Meadfoot, Torquay, from the same rock-pools in which the male has also been taken, is undoubtedly the female of this species. The only observable difference is in the shape and size of the second pair of gnathopods; these in the female are similar to the first pair, which have the same form in both sexes. But hence a doubt arises whether this female of *S. conformata* may not probably be the *Sunamphithoë hamulus* of Mr. Spence Bate, the first and second gnathopods of which are described and figured as very similar in size and shape. When there is a marked distinction between the two pairs of gnathopods, it is quite consistent with analogy that it should be found in the male and not in the female. The flagellum of the upper antennæ in *S. hamulus* is described as much shorter than that of *S. conformata*; but the length of the flagellum is apt to vary, both by accidental circumstances and with the age of the animal—the female of *S. conformata* certainly, in my specimens, having this upper flagellum exceedingly long, as in the adult male, while in the young ones it is exceedingly short. The articulations are coloured alternately white and brown.

The eyes of *S. hamulus* are said to be black, those of *S. conformata* white with a red spot in the middle. The eyes of my specimens, both male and female, are red.

The first gnathopods have the wrist for its distal half and the hand parallel-sided. The hand is longer than the wrist, with a straight palm, forming a right angle with the margin. The finger is stout, projecting beyond the palm, and terminating in a nail. In the female the wrist is perhaps a little more triangular than in the male.

The second gnathopods in the male have a short cup-shaped wrist continuous with the hand, which is large, long-ovate, tapering; its palm very oblique, waved, having two lobes, which are partially obscured when the long, slightly waved, and much-curved finger is doubled closely against them. In this position the point of the finger overlaps the hand on the inner side.

In the first two pairs of pereiopoda the meros is much dilated and produced distally into a lobe, which overlaps the carpus; the third pair are considerably shorter than the two following pairs, the fifth being slightly longer than the fourth. These three pairs have spines along the anterior of the hand.

The posterior pair of pleopoda have the inner ramus foliaceous, and the outer terminating in two powerful hooks. Unfortunately, in the 'British Sessile-eyed Crustacea,' the inner ramus is figured as the outer—no doubt by one of those accidents which, in small figures of minute parts, it is almost impossible to avoid. A character of the outer ramus, conspicuous under the microscope, is not noticed either in the above-mentioned work or in the British-Museum Catalogue of Amphipodous Crustacea—namely, that the upper edge is set with a row of small spines pointing towards the head and looking like a fine saw. The two preceding pairs of caudal appendages are strongly spined. The telson with its hook is very short, and often balks the observer by its aptitude for hiding between the stems of the pleopoda.

EXPLANATION OF PLATES XI. & XII.

Fig. 1. *Amphithoë cuniculus.* 1 *a.* Head and antennæ. 1 *b.* Front view of head, showing the insertion of the antennæ. 1 *c.* First and second gnathopods, much enlarged. 1 *d.* Second gnathopod, another specimen, much enlarged. 1 *e.* Telson and caudal appendages, seen from above.

Fig. 2. First and second gnathopods of *Amphithoë rubricata.* 2 *a.* Telson and posterior pleopoda of another specimen, seen from above.

Fig. 3. *Sunamphithoë gammaroides*, male. 3 *a*. First gnathopod. 3 *b*. Second gnathopod. 3 *c*. First and second gnathopods of female. 3 *d*. Last pereiopod of male. 3 *e*. Tail-piece, enlarged. 3 *f*. Tail-piece, still more enlarged, of another specimen which had just shed its skin.

Fig. 4. *Sunamphithoë conformata*, male. 4 *a*. First gnathopod. 4 *b*. Second gnathopod. 4 *c*. First pereiopod. 4 *d*. Tail-piece.

XV.—*On the Longicorn Coleoptera of New Zealand.* By H. W. Bates, F.L.S.

[Continued from p. 24.]

Family Lamiadæ.

Hexatricha pulverulenta.

Lamia pulverulenta, Westw. Arc. Ent. ii. p. 26, t. 56. f. 5.
Hexatricha pulverulenta, White, Voy. Ereb. & Terr., Ins. p. 21.

Waikouaiti; Port Nicholson.

Xylotoles lynceus.

Saperda lynceus, Fab. Syst. Ent. p. 185.

The specimen of this insect still preserved in the Banksian collection, though in bad condition, is recognizable as a species of *Xylotoles*, and doubtless a male; but I have seen no second example of the species, among the hundreds of specimens of *Xylotoles* sent home by Mr. Lawson from Auckland and a smaller number by Mr. Fereday from Christchurch. It is remarkably elongate and parallel-sided, 5½ lines long, with the apices of the elytra produced and divaricate; in colour it resembles *X. griseus*.

Xylotoles griseus.

Xylotoles griseus, Westw. Arc. Ent. ii. p. 27, t. 56. f. 2.
Saperda grisea, Fab. Syst. Ent. p. 186.
Lamia heteromorpha, Boisd. Voy. de l'Astrolabe, Ent. ii. p. 505, t. 9. f. 14.
Xylotoles lentus, Newm. Entom. p. 12.
Xylotoles Westwoodii, Guér. Rev. Zool. 1847, p. 170.

The descriptions of Boisduval and Newman agree very well with a common species, to which the type of Fabricius belongs. Mr. Lawson has sent it in great numbers from Auckland, and I have also received it from Christchurch. It varies in size from 3 to 6 lines; and the apices of the elytra are singly rounded in both sexes (rather more acutely in the male), never divaricated. The shape of the body is elongate-elliptical, the elytra at the shoulders being scarcely wider than the base of the thorax. The colour of the integument is coppery brown, but veiled with a laid ashy pubescence, never dense enough wholly to conceal the ground-colour—fresh examples showing, besides, a few condensed white linear spots, placed some on the anterior disk and others as an oblique macular fascia behind the middle; but these spots are sometimes wanting. The elytra are faintly striated (except the sutural stria), and have a number of large punctures arranged in irregular rows near the base. The antennæ are pitchy red, with the bases of some of the joints paler.

Xylotoles humeratus, n. sp.

X. griseo proxime affinis; magis nitidus; elytris ad humeros thoracis basi distincte latioribus, humeris rectangulatis, maculis pubescentibus fulvis; oculis pilis fulvis marginatis. Long. 3–5 lin. ♂ ♀.

Difficult at first sight to distinguish from *X. griseus*, but certainly distinct. The difference in general form first strikes the eye—a difference which arises from the thorax being much shorter and more narrowed at the base, and from the elytra at the base being much wider, with wide outstanding rectangular shoulders. The colour is also constantly different, being more brassy greenish and shining, especially on the thorax. The general laid pubescence is greyish, and the striæ and punctures are nearly the same as in *X. griseus*; but the denser pubescent spots are always orange-tawny and conspicuous, arranged in two groups—one near the base (some of them forming an oblique line), and the other behind the middle (forming a line oblique in the opposite direction to the former). The orbit of the eyes has also a dense fringe of the same tawny-coloured hairs; and there is a patch of the same on each side of the thorax.

Many examples from Mr. Lawson of Auckland, mixed with *X. griseus*.

Xylotoles subpinguis, White, Voy. Ereb. & Terr. p. 22.

One example from Mr. Fereday, Christchurch, agreeing well with White's description.

The species much resembles *X. griseus*, but has a more spotty pubescence, and the elytra are more prolonged and pointed at the apices (♂).

Xylotoles nudus, n. sp.

X. elongatus, angustus, cuprascenti-niger, glaber, nitidus; elytris basi thorace vix latioribus, apice utrinque productis et paulo divaricatis, basi grossissime lineatim punctatis; antennis pedibusque castaneis; femoribus obscurioribus. Long. $4\frac{1}{4}$–5 lin.

Body entirely destitute of pubescence, except spots on the sides of the ventral segments; antennæ and legs finely griseous pubescent. Colour glossy coppery black; head and thorax impunctate and smooth. Elytra elongated, not perceptibly broader at the base than the thorax, very slightly bulging in the middle, and gradually narrowed and prolonged at the apex, where they are slightly divaricate; the surface has rows of very large punctures, from the suture to the sides and extending to the middle.

Several examples sent from Auckland by Mr. Lawson.

Xylotoles rugicollis, n. sp.

X. fusco-niger, subæneus, nitidus; thorace elongato-quadrato, supra passim transverse rugato; elytris ellipticis, apice utrinque productis, acutis, supra striatis interstitiis elevatis, fulvo-guttatis; antennis pedibusque castaneis. Long. 4–6 lin. ♂ ♀.

Distinguished by the thorax being elongate-quadrate in outline, a little dilated immediately behind its anterior angles, where it is widest, and covered with irregular transverse wrinkles. The sides have some patches or lines of tawny pubescence, as well as the front of the head. The elytra have no distinct shoulders, and are dilated in the middle, whence they taper gradually to the pointed apices, most prolonged in the male, but not divaricate; their surface is coarsely sculptured, deeply striated almost to the apex, and marked with large punctures. The underside is very glossy, with spots of tawny tomentum on the sides of the breast and abdomen.

Auckland (*Mr. Lawson*); a few examples.

Xylotoles lætus, White, Voy. Ereb. & Terr., Ins. p. 22.

This species (if I refer it correctly to White's *X. lætus*) is shorter and much more ovate than its allies, the apices of the elytra not being produced, but somewhat obtusely rounded together. The colours are more gaily metallic. White describes the thorax as violet, and the elytra green; but in a larger series many varieties are seen, some being wholly brassy green, others coppery or violaceous; the thorax and elytra concolorous or not. The elytra are narrow and rounded at the shoulders. The thorax has a few coarse rugæ on the sides; but is nearly smooth on the disk.

Auckland (*Mr. Lawson*); several examples, measuring from $2\frac{3}{4}$ to $4\frac{1}{4}$ lines in length.

Xylotoles nanus, n. sp.

? *Xylotoles parvulus,* White, Voy. Ereb. & Terr., Ins. p. 22.

Similar in form to *X. griseus*, but much smaller and more densely clothed with spotty or lineated griseous pubescence, with darker spots on the elytra, forming in well-preserved examples a somewhat tessellated pattern, the dark colour often concentrating in a patch on each side of the elytra. The thorax is very similar in form, but the two transverse impressed lines are less marked. The elytra are very nearly of the same width at the shoulders as the base of the thorax, their apices are not prolonged but singly rounded, and they have an irregular number of punctures near the base arranged in rows; they are destitute of impressed striæ, except the usual sutural one.

A further distinction from *X. griseus*, even the smallest examples, is the colour of the antennæ, the apices of the joints being always distinctly fuscous or black.

The general ground-colour is extremely variable, from brown with a scarcely perceptible brassy tinge to dull tawny or pale testaceous. Long. $2–2\frac{3}{4}$ lin.

Auckland. Mr. Lawson has sent home a very large number of this small, variable species.

White's description (!) of his *X. parvulus* consists of the following words:—" Testaceous, covered with a greyish pubescence; base of elytra with several dots and four rows of small punctures in two lines, extending to the middle of elytra." No size is given; and the description applies equally well to our *X. ægrotus.*

Xylotoles ægrotus, n. sp.

X. elongatus, angustus, omnino fulvo-testaceus, subtiliter griseo-pubescens; elytris ♂ apice dehiscentibus, singulatim prolongatis, perparum divaricatis, ♀ acute conjunctim rotundatis. Long. $2\frac{1}{2}–2\frac{3}{4}$ lin.

Similar in form to *X. nanus*, but always of a tawny testaceous colour, with fine scant grey pubescence, arranged more or less in lines on the elytra. The antennæ are not ringed with dark colour, but pallid like the rest of the body, or at most a little browner at the extreme tips of some of the joints. The elytra are relatively much longer and are narrowed and prolonged towards their apices ; in the male strongly dehiscent at the suture ; they are a little wider at the base than the base of the thorax, and have the usual lineated punctuation from the base to the middle. The sutural stria is deeply sunk.

Auckland, six examples (*Mr. Lawson*) ; Christchurch (*Mr. Fereday*), three examples.

The punctuation at the base of the elytra varies considerably. In some specimens there are only two simple rows of punctures ; but in others there are two or three rows, each composed of a larger number of punctures, arranged often without order. The difference is not sexual, but the two varieties are strongly pronounced.

Xylotoles pulchellus, n. sp.

X. nano proxime affinis, at differt elytris magis ellipticis fusco fasciatis, corpore subtus dense cinereo-tomentoso. Parvus, nigro-cupreus, alutaceus, pube grisea vestitus ; elytris ad humeros angustis, regulariter ellipticis, apice conjunctim subacute rotundatis, plagis fuscis magnis duabus fasciiformibus, altera pone medium, altera apicali. Long. $2\frac{1}{4}$ lin.

Closely resembling *X. nanus*, but the elytra decidedly more elliptical in form, *i.e.* narrower at the shoulders and more regularly rounded on the sides, the apex being jointly rounded ; the surface is of the coppery black or dark brown of the full-coloured examples of *X. nanus* ; and the grey pubescence is spotty in the same way on the elytra ; but the dark patches lie in two places, forming irregular broad fasciæ, one at the middle and the other at the apex. The antennæ are rather more slender, and have a larger portion of the apices of the joints pitchy black. Beneath, the insect is more densely clothed with grey pubescence.

Christchurch (*Mr. Fereday*) ; one example.

Xylotoles scissicauda, n. sp.

X. elongato-ellipticus, castaneo-fuscus, griseo-pubescens ; thorace medio utrinque dilatato-tumido, supra sulcis duobus transversis fortiter impressis, alteroque dorsali, basi subtiliter transversim multistrigoso ; elytris humeris paululum productis, obliquis, postice gradatim attenuatis, apice dehiscentibus ibique sutura emarginata, supra fere ad apicem lineatim punctatis, costulisque utrinque tribus. Long. $3\frac{1}{2}$–4 lin.

This very distinct species may be recognized at once by the thorax—tumid, almost tubercular in the middle on each side, with the anterior and posterior transverse sulci deeply impressed and united in the middle by a longitudinal dorsal impressed line. The tubercle on each side is coarsely sculptured ;

and the basal surface is covered with a multitude of fine transverse striæ. The punctuation of the elytra extends nearly to the apex, and is interrupted by three raised costæ on each elytron; the apex is tapering, and the suture widely gaping, having on each edge a curved sinuation. The sides and apex of the elytra have a few whitish bristles. The legs are concolorous; the antennæ have a speckled pubescence and are robust.

Christchurch (*Mr. Fereday*); three examples. This species tends to connect *Xylotoles* with *Tetrorea.*

MICROLAMIA, nov. gen.

Gen. *Xylotoli* affine; differt antennis articulis brevibus, primo basi extus haud subito dilatato, femoribusque fortiter tumido-clavatis. *Corpus* minimum, longe hirsutum; elytris quam corpore anteriore haud longiore. *Elytra* basi transverse depressa, humeris rotundatis. *Thorax* magnus, lateribus tumidis. *Mesosternum* brevissimum. *Pro-* et *mesosterna* inter coxas latissima, plana.

Microlamia pygmæa, n. sp.

M. elongato-ovata, rufo-castanea nitida, antennis pedibusque pallidioribus, illis undique pilosis; capite punctato; thorace lateribus grossissime punctatis, disco lævissimo, sine linea dorsali, basi et apice transversim strigoso; elytris sparsim, basi densius punctatis, apice subabrupte declivibus. Long. $1\frac{1}{2}$ lin.

This curious and minute Longicorn in the proportions of its body resembles the genus *Deucalion* rather than *Xylotoles*; but the thorax is unarmed at the sides. The basal joint of the antennæ forms a pyriform club, as in the genus *Blax*. Its chief peculiarities reside in the great width of the pro- and mesosterna between the coxæ, and in the very thick clavate thighs, also in the robust filiform antennæ—not ciliated, but hairy on all sides, and with rather short joints, the third and fourth not much longer than the rest.

Auckland (*Mr. Lawson*); one example.

SOMATIDIA, Thomson, Syst. Ceramb. p. 39.

Gen. *Parmenæ* affine; differt thorace haud armato, femoribusque fortiter clavatis basi pedunculatis. *Corpus* ovatum, grosse punctatum. *Caput* inter antennas haud concavum. *Antennæ* filiformes, ciliatæ; scapo ovato, articulo tertio cæteris paulo longioribus. *Prosternum* inter coxas arcuatum. *Mesosternum* oblongum, declive. *Epimera* mesothoracica obliqua, acetabula haud attingentia. *Tibiæ* intermediæ extus emarginatæ. *Ungues* divaricati.

Closely allied to the Mediterranean genus *Parmena*, and very similar in facies, except that the general form is shorter and more ovate.

Somatidia antarctica.

Parmena antarctica, White, Voy. Ereb. & Terr., Ins. p. 22.

The elytra have distinct, almost toothed humeral angles; but their outline is very oblique from the angle to the true base; each elytron has two small tufts of hair. Long. $2\frac{1}{2}$–3 lines.

Port Nicholson; also Auckland (*Mr. Lawson*).

Somatidia ptinoïdes, n. sp.

S. cupreo-fusca, fulvo-griseo pubescens, setosa; thorace ovato, crebre grosse punctato; elytris a medio usque ad basin fortiter angustatis humeris nullis, macula utrinque exteriore basali, fascia mediana maculaque apicali suturali nigris, penicillis nullis; antennis et pedibus rufescentibus. Long. $1\frac{1}{2}$–$2\frac{1}{4}$ lin.

Auckland (*Mr. Lawson*); four examples. The fourth joint of the antennæ is very short.

STENELLIPSIS, nov. gen.

Corpus angustum, ellipticum, convexum, subtile tomentosum, læve. *Caput* exsertum, inter antennas modice late concavum, fronte quadrata. *Palpi* subelongati, robusti, articulis ultimis fusiformibus. *Thorax* transversus, antice et postice constrictus, medio convexo, lateribus tumidis, inermibus. *Elytra* convexa, prope basin transversim depressa, apice obtuse rotundata, fere truncata; stria suturali solum impressa, versus basin abbreviata. *Acetabula* antica et intermedia extus clausa. *Prosternum* inter coxas vix arcuatum, angustissimum, apice dilatatum; mesosternum oblongum, vix declive. *Mesothorax* paululum abbreviatus. *Pedes* elongati; coxæ magnæ, globosæ; femora fortiter clavata; tibiæ intermediæ extus leviter emarginatæ; tarsi vix elongati, articulo primo cæteris subæquali; ungues divaricati. *Antennæ* corpore triente longiores, graciles, sparsim ciliatæ; articulo primo basi extus subito sed modice dilatato, cæteris elongatis ab tertio gradatim brevioribus.

This genus has many of the peculiar characters of *Xylotoles*, and is evidently allied to it; but its facies is very different, resembling that of many *Acanthocininæ* (e. g. *Driopea*). The metathorax, without being conspicuously abbreviated as in the *Dorcadioninæ*, is so much shortened that the distance between the middle and posterior coxæ is somewhat less than that between the anterior and the middle. The prosternum also, although very narrow between the coxæ, is nearly plane as in *Xylotoles*. The head is of precisely the same shape.

Stenellipsis bimaculata.

Xylotoles bimaculatus, White, Voy. Ereb. & Terr., Ins. p. 22.

White's description, though brief, is sufficient to enable us to recognize his species, as he mentions the "bulging middle of the thorax," the anterior and posterior transverse impressions of the same part, and the tomentose yellow spot in the depressed part near the base of each elytron.

Auckland. Sent sparingly by Mr. Lawson.

Stenellipsis gracilis.

? *Xylotoles gracilis*, White, Voy. Ereb. & Terr., Ins. p. 22.

The above-cited description of this species leaves us in doubt whether it applies to our insect, as no mention is made of the "bulging" middle of the thorax, although it is as conspicuous as in the allied *S. bimaculata.* The elytra are more cylindrical and less ovate than in *S. bimaculata*, and are clothed with fine grey tomentum, prettily spotted with brown, and having a brown fascia across the middle and a streak of the same colour behind, near the suture.

Auckland. Several examples sent by Mr. Lawson.

Stenellipsis latipennis, n. sp.

S. latior, elytris oblongo-ovatis, ad humeros thoracis basi fere duplo latioribus. Chalybeo-nigra, subtiliter cinereo-pubescens, antennis (scapo excepto) tibiisque basi et unguibus castaneis; thorace breviore, medio rotundato, lævi; elytris cinereis, guttis majoribus rotundis lineatim ordinatis, ad basin, in medio et versus apicem in plagas aggregatis. Long. 3 lin.

A true *Stenellipsis*, although differing from its congeners by the broader shoulders of the elytra; the latter have an obtuse elevation near the scutellum and a few punctures arranged in rows; with this exception the body is smooth and clothed with very fine laid pile, as in the other species.

Auckland (*Mr. Lawson*); one example.

Psilocnæia, nov. gen.

Gen. *Xylotoli* affine, sed corpore lineari, et metasterno haud abbreviato. Linearis, subdepressa. *Antennæ* corpore paulo longiores; articulo primo basi extus subito dilatato, tertio et quarto cæteris multo longioribus. *Caput* exsertum, inter antennas vix concavum. *Thorax* fere cylindricus, inermis. *Elytra* humeris valde obliquis, apice singulatim rotundata. *Prosternum* inter coxas ut in *Xylotole* planum, apice fortiter dilatatum. *Acetabula* antica extus haud angulata; intermedia extus clausa. *Femora* gradatim incrassata. *Tibiæ* intermediæ extus emarginatæ. *Ungues* divaricati.

This genus partakes of the characters of *Xylotoles* and *Tetrorea*, and is equally allied to both these genera, which have been placed by Lacordaire in two widely separated subfamilies.

Psilocnæia linearis, n. sp.

P. linearis, pube adpressa cinerea vestita; elytris plaga utrinque laterali fusca, interdum obsoleta, basi sparsim lineatim punctatis, stria suturali fortiter impressa. Long. $2\frac{1}{2}$–$3\frac{1}{2}$ lin.

The ground-colour, visible only on portions of the thorax and head and in abraded parts, is of the same coppery brown as prevails in the genus *Xylotoles*; the head is of precisely similar form. The transverse impressions of the thorax are only vaguely marked; the fuscous lateral streak on each elytron is generally varied with grey spots, and is sometimes reduced to a few dark lineated spots, or disappears altogether; the legs and antennæ are partly reddish testaceous; the pubescence of the thorax is somewhat lineated and denser on the sides.

Auckland. Mr. Lawson has sent home a very large number of specimens.

SPILOTROGIA, nov. gen.

Gen. *Stenellipsi* affine, sed facies multo diversa. Cylindrica, subtilissime pubescens. *Antennæ* graciles, corpore duplo longiores, vix pubescentes; scapo basi extus gradatim dilatato. *Caput* inter antennis concavum, fronte infra paulo angustata. *Thorax* cylindricus. *Elytra* cylindrica, basi thorace distincte latiora, humeris fere rectangulis, apice declivia obtuse rotundata, supra prope basin transversim depressa, stria suturali solum distincta. *Pro-* et *mesosterna* angusta, plana. Cætera ut in *Stenellipsi*.

Belongs to the same group as *Stenellipsis*, from which it differs in the mesosternum between the coxæ being nearly as narrow as the prosternum, and in the thorax and elytra being cylindrical; the metathorax appears somewhat shortened, the distance between the anterior and middle coxæ being no less than that between the middle and the hind pair.

Spilotrogia maculata, n. sp.

S. ochraceo-testacea, subnitida, capite thoracisque disco obscurioribus; elytris castaneo-fusco maculatis, interdum plaga majore transversa communi pone medium. Long. $1\frac{1}{2}$–2 lin.

The maculation of the elytra is peculiar in this little Longicorn, as it is the derm and not the pubescence merely which is variegated in colour; the spots are very irregular, and lie chiefly near the suture, the yellow ground-colour prevailing on the sides.

Auckland (*Mr. Lawson*).

EURYCHÆNA, nov. gen.

Gen. *Enicodi* affinis, sed elytris ♂ haud prolongatis. *Corpus* parvum, sublineare, sericeo-pubescens. *Caput* subretractum, inter oculos latum, planum, ore (♂) latissimo, labro parvo quadrato, mandibulisque vix exsertis. *Antennæ* corpore vix longiores, graciles, sparsim ciliatæ; articulo primo subcylindrico, basi extus angustato, tertio et quarto modice elongatis. *Thorax* quadratus, inermis. *Elytra* apice singulatim rotundata, lateribus verticalibus; dorso planato, stria suturali solum impresso. *Pedes* parum elongati; femora clavata; tibiæ intermediæ extus emarginatæ; tarsorum ungues divaricati. *Metathorax* nullomodo abbreviatus. *Pro-* et *mesosterna* inter coxas angusta sed plana. *Acetabula* antica et intermedia extus clausa.

♀. Capite antice haud dilatato, ore normali.

Belongs to the same group as the curious New-Caledonian *Enicodes*, but differs totally from that genus in facies and in the narrow pro- and mesosterna. The head of the male is very similar, the orbit of the eyes being abruptly salient, and the mouth, though narrow, extremely broad; the eyes are simply reniform, with the upper portion rather narrow.

Eurychæna fragilis, n. sp.

E. fusco-testacea, pube subtili olivaceo-cinerea vestita, antennis pedibusque olivaceo-testaceis; thorace lævi, antice et postice transversim leviter impresso; elytris basi thorace latioribus, humeris exstantibus, supra, basi excepta, punctulatis; corpore subtus plus minusve rufo-testaceo. Long. $2\frac{1}{2}$–3 lin. ♂ ♀.

The elytra in the male taper a little towards the apex; in fine fresh examples they have a few dark brown spots and an oblique fascia of the same colour after the middle.

Auckland (*Mr. Lawson*).

Eurychæna Feredayi, n. sp.

E. fragili similis, at differt colore obscuriore; elytris fusco-submaculatis; capite, corpore subtus, femoribus et tarsis nigro-fuscis; antennarum articulis apice fusco-maculatis. Long $2\frac{1}{4}$ lin. ♀.

Christchurch (*Mr. Fereday*); one example.

Tetrorea cilipes, White, Voy. Ereb. & Terr., Ins. p. 21, t. 4. f. 9.

Auckland (*Mr. Lawson*).

Hybolasius, nov. gen.

Gen. *Hebeseci* affine. *Corpus* oblongum, tomentosum. *Caput* retractum, fronte quadratum. *Antennæ* corpore paulo longiores, ciliatæ; scapo quam articulo tertio multo breviore, breviter clavato; articulis tertio et quarto cæteris singulis multo longioribus, hoc paulo curvato. *Thorax* lateribus tuberculatis. *Elytra* apice rotundata, basi utrinque cristata. *Pedes* robusti; femora clavata; tibiæ gradatim dilatatæ, intermediis vix emarginatis.

This genus is founded on a common New-Zealand insect, the *Lamia crista* of Fabricius, which White placed in the genus *Pogonocherus*. It agrees with *Pogonocherus* in many essential characters—such as the structure of the sterna, the form of the sockets of the anterior and middle coxæ, and the divaricate claws; but the antennæ resemble much more nearly those of *Hebesecis* and the allied genera, differing chiefly in the shorter and more regularly clavate scape. There is, however, scarcely any difference in the formulæ given by Lacordaire of the two groups *Hebesecides* and *Pogonocherides*, although he places them so widely apart. The genus is also closely allied to the Chilian *Œctropsis*, placed by Lacordaire in the *Exocentrides* group.

Hybolasius crista.

Lamia crista, Fab. Syst. Entom. p. 170.

Fabricius describes the basal tubercles of the elytra as tridentate; but, as I have satisfied myself by examination of his type specimen in the Banksian collection, they are not toothed at all, but surmounted by a compressed pencil of hairs. This type is a large form of the species ($3\frac{3}{4}$ lines), of tawny brown colour, with the narrow black posterior fascia unaccompanied by a broader dark belt. Most of the examples I have seen (from Auckland) are smaller, about 3 lines, with much darker brown elytra, having the shoulders and an apical spot tawny, and a broad posterior blackish fascia, the anterior margin of which is black, margined again anteriorly with light tawny. But all connecting gradations occur, and I believe they form only one variable species. It may be known from its congeners by the elevated penicillated crests, the robust acute lateral thoracic tubercles, and the finely striated integument of the thorax.

Hybolasius viridescens, n. sp.

H. subdepressus, hirsutus, fuscus; elytris herbaceo-viridibus, medio dorsi fulvescentibus, strigaque obliqua nigra; thoracis tuberculis lateralibus magnis obtusis, dorso haud striato, medio trituberculato;

elytris cristis basalibus parvis vix penicillatis, costa marginali altera flexuosa dorsali obtusis. Long. $2\frac{1}{4}$–$2\frac{1}{2}$ lin.

Auckland (*Mr. Lawson*).

Distinguishable from *H. crista* at once by the small basal crests of the elytra, which have a minute pencil of hairs, sometimes absent; the thorax has not the finely sculptured transverse striæ of that species, and the lateral tubercles are not pointed. The elytra are depressed, coarsely and sparsely punctured, with a raised flexuous dorsal costa; their colour is brassy green, especially visible on the base and sides, the middle of the back being tawny with an oblique dusky belt, sometimes absent. The antennæ are much longer than the body, but of the same form and proportions as in *H. crista*, the cilia only being longer; they are dull reddish, varied with dusky.

Hybrlasius simplex, n. sp.

H. gracilior, piceo-rufescens, sparsim griseo-pubescens; elytris subconfertim punctatis, haud costatis, cristis basalibus fere obsoletis, parum convexis, haud penicillatis; thorace angustiore, fere nudo, subtilissime et confertissime punctulato-rugoso, tuberculis lateralibus conicis. Long. $2\frac{1}{3}$ lin.

Auckland (*Mr. Lawson*); three examples.

Much more slender than *H. crista*, and less convex; distinguished also by the absence of penicillated crests, which are replaced by obtuse elevations. The general colour is pitchy or chestnut-red, lighter on the antennæ, and darker on the undersides of the body and femora and at the apices of the tibiæ; the thorax is minutely sculptured throughout, and has rudiments of three small discoidal tubercles; the pubescence is very scant; the antennæ have the same form and proportions as in *H. crista*; and there can be little doubt of the near affinity of these two extreme species, notwithstanding the great difference in the elytral crests.

Pœcilippe, nov. gen.

Gen. *Nicippæ* et *Disternæ* prima facie simile, sed antennis basi haud approximatis, acetabulis intermediis fere clausis et elytris apice rotundatis. *Caput* ut in gen. *Hybolasio*, inter antennas concavum, fronte quadrata. *Antennæ* corpore longiores, graciles, ciliatæ; articulo primo quam tertio multo breviore, clavato, basi extus magis angustato, tertio et quarto cæteris singulis multo longioribus. *Thorax* brevis, antice et postice transversim fortiter impressus, medio utrinque tuberculo forti acuto armatus. *Elytra* elongato-subtrigona, modice convexa, tubere utrinque basali elevato. *Pro-* et *mesosterna* inter coxas angusta. *Ace-*

tabula antica extus angulata, intermedia fere clausa. *Femora* clavata; tibiæ intermediæ extus perparum emarginatæ; tarsi breves, articulo primo omnium breviter triangulari. *Ungues* divaricati.

Although resembling the Australian *Disternæ* in general appearance, this genus differs much from them in structural characters and approaches much more nearly *Hybolasius*, the form of the scape of the antennæ being very nearly the same. The thorax, however, is much shorter, and has a far larger and more acute median spine. The apical ventral segment is much elongated and broadish at the apex in my single specimen; but I suspect this is a sexual character; otherwise it would be a good structural distinction from *Hybolasius*.

Pœcilippe stictica, n. sp.

P. nigro-fusca, nitida, antennis pedibusque castaneis; thorace sparsim ochreo-pubescente, impunctato, tuberculis discoidalibus tribus parvis; elytris apice obtuse rotundatis, grosse punctatis, punctis versus apicem sparsioribus; griseo maculatim pubescentibus, maculaque tomentosa ochracea reniformi utrinque ad trientem longitudinis ornatis. Long. 4 lin.

Auckland (*Mr. Lawson*); one specimen.

The close grey pubescence of the elytra is divided by the large punctures, producing a spotty appearance; these large punctures are very dense near the base, but become confined to lines posteriorly, leaving smooth spaces, and as such extend to the apex.

Lamia flavipes, White, Voy. Ereb. & Terr., Ins. p. 21.

I have not seen this insect, which, from the description, resembles somewhat the *Pœcilippe* above described.

Diastamerus tomentosus, Redtenb. Reise Novara, Col. p. 177, t. v. f. 1.

The intermediate tibiæ are without notch, the claws divaricate, and the pro- and mesosterna broad and plane, with a declivity on their opposing extremities. The genus is very distinct, and approaches the *Hebesecinæ* in its chief characters, with some resemblance to *Ranova* and *Tetradia*. I am indebted for a specimen to Mr. Pascoe.

Tympanopalpus dorsalis, Redtenb. Reise Novara, Col. p. 180, t. v. f. 3.

The cicatricized apex of the scape of the antennæ and general form show that this very remarkable genus belongs to the *Monohamminæ*, or some group nearly allied thereto.

NOTE.—*Dorcadida bilocularis*, mentioned by White as a New-Zealand insect, is from Tasmania, and was doubtless introduced by White into the New-Zealand fauna by error.

Hesperophanes unicolor (*Saperda unicolor*, Fab. Mant. i. p. 147), cited as from New Zealand in Harold and Gemminger's 'Catalogus,' t. ix. p. 2808, does not belong to that country, being, as Fabricius states, from Amsterdam Island. According to the type, still preserved in the Banksian collection, the species belongs to the genus *Ceresium* or *Diatomocephala*, and is distinguished by its clothing of long hairs.

XVI.—*Descriptions of two new Species of* Fulgora *from India.* By ARTHUR GARDINER BUTLER, F.L.S., F.Z.S., Senior Assistant, Zoological Department, British Museum.

THE two following species have been procured from Mr. Whitely subsequent to the publication of my monographic list of the species (P. Z. S. 1874, pp. 97–102). They are both referable to the subgenus indicated in my paper at p. 101.

Fulgora curtiprora, n. sp.

Closely allied to *F. gemmata* of Westwood, but with the cephalic process one third shorter, and the colouring different: tegmina with corium bright green speckled with black, area beyond black; the veins green, becoming ochraceous near apex; the entire surface covered, as in *F. gemmata*, with small orange spots; wings shining black, varied with pale transparent green as in *F. gemmata*; cephalic process, head, and thorax testaceous, thorax spotted with black; abdomen black, the segments edged with green above, with ochreous below; legs and anus red.

Length of body, including cephalic process, 11 lines, of cephalic process 4 lines; expanse of wings 2 inches.

Hab. Sikkim. Type, B.M.

The above will come into my Section 4, next to *F. gemmata*.

Fulgora cardinalis, n. sp.

Allied to *F. pyrrhochlora* and *F. virescens*, but differing structurally from both in its short, abruptly compressed cephalic process: tegmina yellowish olivaceous, the veins and costal area bright green; the entire surface covered with black-edged orange spots, arranged as in *F. virescens*, but larger and better defined; outer margin brown: wings carmine; outer margin brown, broadest at apex: cephalic process, head, and prothorax above, and the entire pectus green, spotted with black; meso- and metathorax testaceous, black-spotted; abdomen above reddish, below testaceous varied with emerald-green; legs emerald-green.

Length of body, including cephalic process, 1 inch, of cephalic process 4 lines; expanse of wings 2 inches 1 line.

Hab. Nepal. Type, B.M.

Mr. Whitely has shown me a second example from Sikkim. This species will come at the end of my Section 5.

XVII.—*On* Dendrohyrax Bakeri, *a new Species from Tropical North-eastern Africa.* By Dr. J. E. Gray, F.R.S. &c.

Sir Samuel Baker, K.C.B., collected during his travels a *Dendrohyrax* at Latiko, in lat. 3° 0′ N., in tropical Eastern Africa, and has presented a skin with its skull to the British Museum. The skull shows that it is a species of the genus *Dendrohyrax*, and is peculiar in that genus for having the back edge of the orbit incomplete, whereas in the skulls of the two species of this genus which we have in the British Museum the bony orbit is complete.

The lower jaw is moderately narrowed in front, with a straight lower edge, and rather dilated behind, somewhat as in *Dendrohyrax dorsalis*—and very different from that of *Dendrohyrax arboreus*, which is dilated, and has a rounded outline to the lower edge.

The fur is short, uniform, soft, and brown, grizzled with pale tips to the hairs, very unlike the long, soft, fluffy fur of *Dendrohyrax arboreus* from South-east Africa, and the harsh dark brown fur, with a large white dorsal patch, of *Dendrohyrax dorsalis* from West Africa.

It is certainly a species that has not been hitherto entered in our catalogues; I therefore propose to call it *Dendrohyrax Bakeri*, after its discoverer.

The skull in many respects, especially in the incompleteness of the orbits, agrees with a skull without lower jaw in the British Museum, which we received in 1858 from the museum of the Zoological Society, without any special habitat, and which, if I recollect right, was obtained attached to a spear as a *fetish*. I figured this skull in the 'Hand-list of Edentate and Thick-skinned Animals,' plate xi. fig. 3, as *Dendrohyrax Blainvillei*; but as it differs in the form of the intermaxillary bone, in the dilatation of the lower side of the orbit, and in several other particulars, and as we do not know the lower jaw, it is very uncertain if it may not belong to a different species; and therefore I think it best to give the complete animal a distinct name. The form of the intermaxillary of *D. Blainvillei* is very like that of *D. dorsalis*, though it differs from the latter in the orbit being incomplete; but this may be an accidental variation.

The three species of *Dendrohyrax* in a perfect state in the British Museum may be distinguished thus:—

1. *Dendrohyrax Bakeri.*

Fur soft, short, and close; the hair is reddish, with a black subterminal band and pale tips, giving the animal a grizzled appearance, with a very narrow white dorsal streak, which has a blacker edge; the top of the head is darker, the lips, throat, chest, and underside of body and inside of limbs yellowish white.

Hab. Eastern Tropical Africa, Latiko (*Sir Samuel Baker, K.C.B.*).

This animal has much the appearance of the true *Hyraces* from Abyssinia and North-eastern Africa, but has quite a different form of skull.

Of this animal, or an allied species of *Hyrax*, Dr. Schweinfurth, in the 'Heart of Africa,' p. 385, says "Abdoo, a native, observed that the rock-rabbits at Mvolo clamber up and down smooth rocks that are almost perpendicular, and that, when you shoot one of these creatures and catch hold of it, it sticks to the rock with its feet in its death-struggles as though it had grown there." Dr. Schweinfurth states:—"The under part of the foot is dark and elastic as india-rubber, and has several deeply indented cushions. This arrangement, which no other Mammalia or warm-blooded animals seem to possess, enables the creature, by opening and closing the centre cleft, to throw off part of its weight and to gain a firm hold upon the smooth surface of the stone. The toes are nothing but pads of horny skin without regular nails, the hind foot alone being furnished on the inner toe with one claw, which is sharply compressed. For some time I could not at all comprehend how, with such a plump foot, the rock-rabbit could climb so safely over precipitous walls of granite, or even along the polished branches of the little trees in the ravines; but the mystery was solved when I tried to pick up an animal which I myself had wounded. The granite was as smooth as pavement; yet when I seized the creature by the neck it clung like bird-lime to the ground, and required some force before it could be removed."

The rock-rabbits, called "Kako" by the Nubians, from the noise that they make, "dwell among the crevices of the gneiss. Immediately after sunset or before sunrise they can be seen everywhere, squatting like marmots at the entrance to their holes, into which at the approach of danger they dart with wonderful snorts and grunts."

2. *Dendrohyrax arboreus.*

Fur very long and soft; hair blackish, with greyish tips; back with a short, broad, whitish spot; the ears hairy; the lips, throat, chest and underside, and inner side of limbs whitish.

Hab. South-east Africa; Natal.

This species is most distinct in appearance from all other *Hyraces*.

3. *Dendrohyrax dorsalis.*

Covered with harsh brown fur, rather paler on the chest and beneath; has a large yellowish-white dorsal streak.

Hab. Western tropical Africa. "Makes a great noise," according to the account of Mr. Winwood Reade, who informed me that the specimen of this animal which he gave to the British Museum was the only mammalian taken during the march to Coomassie.

This species is known from all other *Hyraces* by the large size of the head, the harshness of the fur, and the large size of its dorsal spot.

The skulls of *Dendrohyrax* may be divided thus:—

I. *The intermaxillaries squarish, with a broad truncated hinder end.*

1. *Dendrohyrax dorsalis*, Gray, Hand-list, pl. xiii. fig. 1.

Infraorbital foramen large, far in front of the orbit; orbit roundish.

2. *Dendrohyrax arboreus*, Gray, Hand-list, pl. xiii. fig. 2.

Infraorbital foramen small, just in front of the orbit; orbit nearly circular.

3. *Dendrohyrax Blainvillei*, Gray, Hand-list, pl. xi. fig. 3.

Infraorbital foramen small, under the front edge of the orbit; orbit oblong, longer than high.

II. *The intermaxillaries triangular, produced and acute behind above.*

4. *Dendrohyrax Bakeri.*

Interorbital foramen large, in front of the front edge of the orbit; orbit longer than high.

I. *The lower jaw deep, becoming much broader behind, with an arched lower edge, being most convex under the condyle, and with a long rounded hinder edge. The orbit complete.* Dendrohyrax.

1. *Dendrohyrax arboreus*, Gray, Hand-list, pl. xiii. fig. 2.

South Africa.

Blainville, in his 'Ostéographie,' figures a skull under the name of *Hyrax arboreus* (plate ii.); but it is from an imperfect skull. It may represent a specimen of this species; but if it does, the proposed restoration of the lower jaw gives a very erroneous idea of the proper form of the jaw.

II. *The lower jaw moderately broad, with a straight lower edge, having the hinder end rounded and expanded backwards.*

2. *Dendrohyrax dorsalis*, Gray, Hand-list, pl. xiii. fig. 1.

Orbit complete behind; lower jaw very long.
Western tropical Africa.

3. *Dendrohyrax Bakeri.*

Orbit incomplete behind; intermaxillary bone triangular, acute behind.
North-eastern tropical Africa.

The skull of *Dendrohyrax Bakeri* has a good deal of resemblance to the skull of *Euhyrax Bocagei* from Angola (no. 1515 *a*), 'Hand-list,' pl. xi. fig. 2, which I have referred to the genus *Euhyrax*; but unfortunately the occipital bone is broken away. However, the comparison of the animals shows that, should this species prove to be a *Dendrohyrax*, which I do not think is likely (as it has a triangular interparietal bone), it is a species quite distinct from any of the other specimens of that genus in the British Museum, as the fur of the upper part is of a nearly uniform whity brown colour with greyish tips to the hairs, whiter beneath, and with a small, round, white dorsal spot.

III. *The lower jaw not known.*

4. *Dendrohyrax Blainvillei*, Gray, Hand-list, pl. xi. fig. 3.

Orbit incomplete behind; intermaxillary bone square, truncated behind; lower side of orbit much produced, with a thick, rounded edge and a large concavity on the underside, as in *D. dorsalis*.

Africa.

XVIII.—*On Sexual Variations in the Nestling-Plumage of the Booted Eagle* (Nisaëtus pennatus). By Howard Saunders, F.Z.S. &c.

The ordinary adult plumage of the Booted Eagle is so well known that it is unnecessary to do more than remark that the upper parts in general are of an umber-brown, whilst the underparts are of a buff or creamy white, sometimes deepening into fawn-colour, and with striations more or less distinct down the shafts of the feathers of the throat, breast, abdomen, and flanks. That this plumage is common to both sexes has been abundantly proved by numerous carefully sexed specimens obtained of late years from various localities between Spain on the west and India on the east. But with regard to the plumage of the immature bird there has existed some difference of opinion, although most naturalists have stated that it has the underparts of a dark colour. Mr. R. Bowdler Sharpe, in his recently published 'Catalogue of the Accipitres in the British Museum,' p. 254, describes the underparts of the young as "entirely dull brown;" but, on the other hand, Dr. Jerdon, in his 'Birds of India,' vol. i. p. 64, has described an immature bird as having a light breast. Herr A. v. Pelzeln, again ('Ibis,' 1868, p. 305), mentions a young bird just able to fly as "underneath brown:" and subsequently Dr. Jerdon ('Ibis,' 1871, p. 246) was inclined to modify his former opinion; but as the specimens there alluded to are the ones I am about to describe, it is needless to recapitulate his views. Mr. Hume, however ('Rough Notes,' p. 184), hazarded the opinion that the dark plumage was the adult stage (!), apparently basing this upon an instance of a *female* in the brown plumage having been shot from her nest. Previously, however, to the publication of his brochure, MM. Amédée Alléon and Jules Vian ('Rev. et Mag. Zool.' p. 342 *et seq.*) had pointed out that in two instances they had found an adult male mated with a female in immature plumage. If any of these naturalists had thought of leaving the eggs for the time, and revisiting the nests when the young birds were nearly fledged, they would probably have solved the question of the immature plumage of this species.

Of the numerous specimens of both sexes which had come into my possession, many of them shot from the nest, all had exhibited light-coloured underparts, with merely slight variations in the intensity of the striations; until in 1870 my collector at Granada sent to me a pair of Booted Eagles, and the *two nestlings* which they were in the act of feeding when shot from the nest, on the 20th of June, at Soto de Roma, the Duke of Wellington's estate. The male was in the usual adult plumage; but the whole of the underparts of the *female* were of a *deep coffee-brown*, with darker striations down the shafts of the feathers. This was an interesting stage, and one which I had not hitherto possessed; but so far it merely confirmed what MM. Alléon and Vian had already made known as to the *female* breeding in immature livery. But the plumage of the young birds, which were fully feathered except that the outer primaries were still in the quill, was most remarkable. The larger of the two had the whole of the *underparts* of a *dark brown*, of a somewhat deeper hue than those of the female parent, whilst the smaller nestling had the underparts of a *creamy buff*, with the usual striations down the shafts of the feathers covering the breast. It would have been more than human virtue, especially in a Spaniard, if my collector had tried to ascertain the sexes of these nestlings by actual dissection and with the help of a microscope; but from the size there can be no reasonable doubt that the *dark brown nestling* is the *female*, and the *light-breasted nestling* is the *male*.

This variation in the nestlings clears up at once the apparent discrepancies in the descriptions of the young. Dr. Jerdon's young bird was doubtless a male; and the British-Museum bird is a female. In further corroboration of this view, it should be noticed that whilst we have abundant and independent testimony of various females being obtained in this dark plumage, yet there is not on record a single instance of a *carefully sexed male* with dark brown underparts. The male evidently starts from the *nestling* stage with light-coloured underparts, and with a plumage almost identical with his adult livery; whilst the female does not assume the white breast &c. until after one or, perhaps, several moults. It is generally supposed that most eagles in a wild state assume their adult plumage after the third change; but, from the comparative rarity of specimens in the brown plumage, it is possible that the female *Nisaëtus pennatus* may assume the adult livery at the first moult.

With regard to the male, as I have said, there is little alteration from the nestling-plumage beyond a gradual change to a paler cream-colour on the abdomen and flanks, and a gradual narrowing of the striations. These last, however, are by no means a safe guide to the age of a specimen; for some individuals of the same sex are less streaked than others. The very lightest-coloured male in my series, and lighter also than any breeding female, is pronounced to be a remarkably clean young bird which has never moulted, by Col. Delmé-Radcliffe, who is probably the highest living authority upon raptorial birds.

I am not writing the history of the Booted Eagle, and it is therefore unnecessary to say more upon the subject; but the fact of the plumage of the two sexes being different in the nestling stage, and subsequently becoming the same, is, so far as I am aware, unparalleled in any other raptorial bird; and I have consequently deemed it worthy of being placed on record.

Note.—I am well aware that nestlings of *Archibuteo sancti-johannis* are subject to considerable variation; but it has never been shown that these variations are either sexual or constant.

XIX.—*On the Striæ of Foraminiferous Tests; with Reply to Criticism.* By H. J. Carter, F.R.S. &c.

Whoever has studied fossilized Nummulites must have been struck with the striated appearance which their sections present; and hence it is very desirable to remember that this is of two-fold origin, viz. arising partly from what may be termed mineralogical, and partly from organic causes.

The mineralogical structure of the foraminiferous test consists of laminæ cut perpendicularly by striæ, which therefore in a globular Nummulite may often be seen to run directly and continuously from the circumference to the centre. The laminæ represent the lines of deposit, and the striæ the lines of cleavage. In some instances the fossilized Nummulite breaks out in rhombs like the fossilized test of an Echinoderm; this also may be worth remembering.

The organic structure, on the other hand, consists of cavities called "chambers" superposed upon each other with straight tubes running between them, and a dendriform branched canal-system, which pervades the whole Nummulite, both opening on the surface—the former through the intervention of the chambers, and the latter by themselves.

Such is the general structure of the Nummulite, which, so far as the "organic" part goes, it is as well to premise can in its totality or "system" be seen only in an *infiltrated* fossilized specimen, or in a recent one (ex. gr. *Operculina arabica*) whose canal-system has been filled with carmine.

Now, taking the chambers and their connecting tubuli first, we may easily arrive at the *principle* upon which this structure has been *elementarily* built by figuring to ourselves a narrow cone with its pointed end downwards, and this cone composed of half a dozen or more lenticular chambers, and as many short cylinders with concave ends, respectively piled upon each other, beginning with a cell or chamber at the bottom and ending with a cylinder at the top, whose end in the unworn state is more or less convex, to correspond with the surface of the test. Further, conceive that each of the cylindrical portions consists of a mass of parallel tubuli running perpendicularly between each pair of chambers; and, lastly, place a sufficient number of such cones together, with conical portions, composed of shell-substance only, here and there between them, having all their sides respectively in contact throughout, and you will have a prismatic or columnar structure which in the aggregate must form a globular or doubly convex test, as the case may be. On account of the difference in the form of the chambers, this will be more like an *Orbitoides* than a Nummulite; but the *principle* of structure is the same in all. Of the "dendriform branched canal-system," which pervades the whole Nummulite outside the chambers, suffice it to say that *siliceous casts* of this present a smooth surface; while *those* of the chambers, towards the tubuli, present a granulated surface corresponding to the ends of the tubuli, which are conical.

Still, as the "striæ" and the "tubuli" all radiate from the centre, the former are very likely to be confounded with the latter in the *un*infiltrated specimen. This is well proved by the woodcut which Dr. Carpenter has introduced from one of D'Archiac and Haime's illustrations ('Annals,' vol. xiii. p. 457, June 1874) to "dispose of the objection" which I have urged against the so-called "foraminiferous structure of *Eozoon canadense*." Had the illustration been taken from an *infiltrated* specimen, it might have shown the differences to which I have alluded, and so have defeated the author's purpose, while in its present state it is as unintelligible as it is harmless.

On the other hand, in a vertical section of an *infiltrated* Nummulite or *Orbitoides*, in which every part of the structure which was hollow in the recent state is filled with red or brown oxide of iron, while the white substance of the test remaining unaltered contrasts strikingly with the *infiltrated* tubes (some of which are less than the 6000th of an inch in diameter), the *un*infiltrated striæ may be observed to run more or less continuously from the circumference to the centre, while the *infiltrated* lines running in the same direction are not only confined to, but interrupted in their course at intervals by, the chambers of the column to which they belong—being, in fact, the tubuli which run perpendicularly between each pair of cells, viz. that above and that below them, and which, as a matter of course, must be absent in the columns *composed of shell-substance only*.

Returning, however, to the "conical element," we observe that each chamber of the lamina (which, it should be remembered, is not concentric, but spiral) is formed *exogenously*, and that, although the expansion of the circumference, owing to the increase of size in the test, requires that here and there new columns should be added to fill up the spreading mass, like the shorter medullary rays in a woody stem, still the "tubuli" all progress from within outwards. Each set of tubuli passes from the chamber below to the chamber above it, and no new tubuli are formed *after this* (that is, backwards); so that none belonging to the *same* column of chambers can *pass by* a chamber of *that* column up or down.

Still, again, it is possible, under certain circumstances, that the chambers of one column may not be *on a level* with those of the neighbouring column, and therefore that the lenticular chambers and the cylinders of our elementary column may be so placed that in two neighbouring columns, the tubuli of one being opposite the chambers of the other, the tubuli may be said to *pass by a chamber*, as Dr. Carpenter would have it. But the tubuli of one column of chambers thus passing by the chambers of the *neighbouring* column is totally different from their passing by these chambers up or down (as I have before stated) in *their own column*. Were the latter the case, then the relative position of the perpendicular striæ around the grain of serpentine, assumed to be *cast of a chamber* in the so-called

"*Eozoon canadense*," would be identical with foraminiferous structure. *As it is, it is just the opposite*!

Having recorded the grounds on which I fail to recognize in the so-called "*Eozoon canadense*" the evidence of foraminiferous structure, I have no desire to go further in the matter than to express my satisfaction at having had, after all, the late Prof. Max Schultze's opinion that "the proper wall of Carpenter" is of "inorganic origin" ('Annals,' 1874, vol. xiii. p. 379).

Reply to Criticism.

As an expression used in my observations on the structure called "*Eozoon canadense*" ('Annals,' vol. xiii. p. 377, May 1874) has brought forth a letter from Messrs. Parker, Jones, and Brady, in the last number of this periodical (p. 64), "On Priority in the Discovery of the Canal-system in Foraminifera," I reluctantly notice this, as it is painful to see people so much more concerned in arrogating to themselves directly, or through others, the worldly honour of discovery than contented with the bare announcement of the fact.

Whoever in a subject attempts the *suum cuique* should have read every thing that has been written on that subject, should be judicious in his award, and truthful in his commentary—since he has often to deal with the dead who cannot defend themselves, as well as the living who can. Neither is it necessary only that he should tell the truth, but the "whole truth;" otherwise he has mistaken his avocation. He should avoid the "*suppressio veri.*"

With reference to the letter above mentioned, the following "extracts" may show how far, in the present instance, these points have been fulfilled.

Let us take the last paragraph of this letter first, which runs as follows:—"We may just add that the appeal to Max Schultze's work in confirmation of priority is not very fortunate; for the same three observers are all mentioned in the same paragraph, the opening sentence of which is 'Eine Erwähnung verdient hier das eigenthümliche System von Canälen welches Carter in der Schale von *Operculina arabica* und Williamson an einer *Faujasina* beschrieben haben;' and as the dates 1852 and 1851 respectively are given in the footnote, it cannot be said that the learned German professor assigns priority in discovery specially to Mr. Carter."

On this I would observe, it so happens that in the passage here alluded to, in which I stated that "even Schultze in his book, as well as I can remember (for I have not the work by me to refer to), gives me the credit of having discovered the 'canal-system,'" &c., it was not to Schultze's book of 1854 on "*Polythalamia*" after all, but to a paper by Schultze published many years afterwards, in the 'Archiv für Naturgeschichte,' 1863, p. 99 *, that I referred. The passage is as follows:—" Mir fehlten z. B. die Arten der Carpenter'schen Nummuliniden, so weit sie noch lebend vorkommen, fast ganz, wesshalb ich auch nicht Gelegenheit hatte das von Carter zuerst beschriebene verzweigte Röhrensystem wiederzusehen, wie ich p. 15 meines Buches angeführt habe." [" I lacked almost entirely, for instance, any of the living species of Carpenter's Nummulinida; I therefore had no opportunity of examining the ramified canal-system first described by Carter, as I have stated in my book, page 15."]

If this passage, or the article in which it is contained, has been read by our authors, it is not mentioned in their letter.

The word "zuerst" here, applied to "ramified canal-system," is an emphatic of "first," apparently indicative of the author's intention to show that, although others had previously pointed out the fragments of this system, the *system* itself, but for my having described and figured it in *Operculina arabica*, might have remained undiscovered until the present day; while it also might be added that the specimens were not obtained by others, and "kindly placed in my hands for description," but by myself direct on the south-east coast of Arabia, while I was attached to its Surveying Expedition in 1844-45.

We now come to the middle of the *third* paragraph from the *end*; and here we find it stated that, " It is no part of our present purpose to examine critically what Mr. Carter's paper really added to the facts established by previous observers."

In reply to which, I would state that the "facts of the previous observers" are mentioned, and, as follows from the above quotation, *mine are suppressed*!

But, critically considered, a far greater omission than this occurs in neglecting to mention on this occasion the facts which the following passage from MM. N. Joly et Leymerie's "Mémoire sur les Nummulites," published in the 'Mémoires de l'Académie des Sciences de Toulouse' in 1848, records:—" Sur plusieurs individus [Nummulites] dont les loges étaient vides, et dont la fossilisation n'avait pas confondu les diverses parties en une seule masse compacte, nous avons pu enlever une à une toutes les tables qui entraient dans la composition du test. En examinant avec une forte loupe les parties

* Ann. & Mag. Nat. Hist. 3rd. ser. vol. xii. p. 421.

séparées par cette espèce d'anatomie, nous avons très-distinctement aperçu, tant sur la face interne que sur la face externe des tables, des granulations hémisphériques ou de petits enfoncements circulaires qui correspondaient à ces granulations, et qui n'étaient évidemment rien autre chose que les perforations dont la coquille était criblée durant la vie de l'animal" (Section B, Exposé de nos Recherches, p. 20).

An acquaintance with the contents of this 'Mémoire' (which was also printed separately) is a *sine quâ non* to the study of Foraminifera; and I regret that I did not say more of it in my paper on *Operculina arabica.*

Then in the concluding part of the paragraph last mentioned in Messrs. Parker, Jones, and Brady's letter, we read:—"in a word, we do not desire in any way to detract from the originality of his [Mr. Carter's] work, except so far as in the memoir itself he acknowledges previous investigations; but whatever might be the case then, it cannot be right now, with the opportunity at hand of ascertaining how far his published results really had priority, to ignore the main facts of the papers we have quoted."

To say nothing of the word "detract," that of "ignore" would lead to the inference that I had not acknowledged what others had done on the subject; while, to the best of my belief, I, at the time of writing the paper on the structure of *Operculina arabica* ('Annals,' 1852, vol. x. p. 161), and afterwards in my paper on Foraminifera generally (*ib.* 1861, vol. viii. p. 310), acknowledged every thing that had been previously written on the subject.

In fact, so far from such an acknowledgment *detracting* from what I had stated, I felt that by acknowledging what had already been done in the matter I was only substantiating my own observations. Confirmation of the fact and promulgation of the truth were much dearer to me than the trumpery honour of discovery. I knew which would be most acceptable at the end!

Lastly, was it to be expected that I should go into all the detail of this acknowledgment *again*, at a time when all I wanted for the occasion was Schultze's independent and valuable evidence of my having been very early acquainted with the structure of Foraminifera? I did use the word "system;" but let any one refer to my paper on the structure of *Operculina arabica*, and, contrasting it with what had been previously done by others (which he will also find there), see if the claim was unjustifiable. The illustrations to this paper point out the "system" of foraminiferous structure both in the recent *Operculina* and the fossilized *Nummulites*, especially the tubular formation between the chambers, which Joly and Leymerie demonstrated *before* Dr. Carpenter, as acknowledged by the latter in his book, and about which Dr. Carpenter does not appear to me to have a true conception *yet*, or he would not continue to identify the so-called *Eozoon canadense* with foraminiferous structure. It is a very different thing to describe from the sections and drawings of others and to argue from a knowledge which you have worked out for yourself. The latter requires an amount of time which is quite incompatible with the former, where quantity is the grand object.

I cannot help adding, in conclusion, my astonishment that while blame has been imputed to me from not having burdened my argument against the so-called "foraminiferous structure of *Eozoon canadense*" by the insertion of detail which I had given elsewhere, my able critics should have foregone the opportunity of expressing their opinion on the grand question of my argument for the purpose of delivering themselves on a point in it of the most trivial consequence. That they should have commenced the second paragraph of their letter with, "The question has nothing to do with the *Eozoon* controversy," is therefore, to say the least of it, "most significant"!

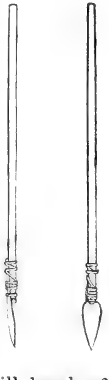
XX.—*On the Invertebrate Marine Fauna and Fishes of St. Andrews.* By W. C. M'Intosh.

[Continued from p. 75.]

Class ANNELIDA.

The marine annelids have sometimes been considered an uninviting group, dimly associated with parasites and earthworms. In regard, however, to beauty of form and colour, wonderful structure and habits, they are not surpassed by any invertebrate class. The splendid bristles of the Aphroditidæ, constantly glistening with all the hues of a permanent rainbow, the brilliant colours of the Phyllodocidæ, Hesionidæ, and Nereidæ, and the gorgeous branchial plumes of the Terebellidæ, the Sabellidæ, and the Serpulidæ can only be compared with the most beautiful types of butterflies and birds. The structures formed by many exhibit an amount of precision and skill equal to that of the most remarkable insects. Thus, at St. Andrews, the common *Pectinaria belgica* fashions a tube like a straight horn of minute pebbles, carefully selected and admirably fixed to each other by a whitish cement. In the placing of these together there is no haphazard, but angle fits angle as in a skilfully built wall, and no profusion of the whitish cement hides slovenly masonry. There is much similarity in the ordinary tubes; dozens may be examined without observing any noteworthy structural difference. All have the same blending of the white or light-coloured grains with the yellow, the brown, and the black. There is no chance grouping, so as to cause the tube to be out of harmony with its surroundings; but the whole tone is such that it can with difficulty be distinguished from the sand. Some annelids, again, secrete transparent tubes of the aspect and toughness of crow-quills; while others cement the mud into caoutchouc-like pipes, fix gravel, stones, and shells by the same means into convenient tunnels, or rely on the parchment-like tenacity of a tube formed solely of one or more layers of their remarkable secretion. The interest in the group is further heightened by the brilliant phosphorescence characteristic of many, and the powers which others have of perforating sand, limestone, shells, aluminous shale, sandstone, and other rocks.

The annelids are not devoid of interest even in an economical point of view. All round the coasts of Britain the *Arenicola marina* (common lobworm) is generally used as bait, and here and there *Nephthys* and *Nereilepas fucata*. On the prolific shores of the Channel Islands the great abundance of the Nereidæ is of considerable importance to the inhabitants, since two of the most plentiful (viz. *Nereis cultrifera*, Grube, and *N. diversicolor*, Müller) are extensively used in fishing. The fishermen constantly search for them with a pointed instrument resembling a spear (see annexed woodcut), and keep them in vessels amongst a little sand and seaweed. They are much employed in catching whiting, the latter, again, being used as bait in conger-fishing. In the same islands one of the most esteemed baits is the large *Marphysa sanguinea*, which reaches the length of two feet. It is termed "varme" by the fishermen, and is highly prized both for the capture of ordinary white fish and dog-fish. The annelids are kept alive in vessels amongst seaweed—or rather the anterior segments only, no more than three or four inches of this region being retained, since experience



has shown that, unless so treated, the animals will break off posterior fragments, which, putrefying, soon cause the death of the whole. The natives of the Fiji group much esteem a form allied to the British *Lysidice ninetta* as an article of diet, and they predict its annual appearance in their seas with unerring precision by observing the phases of the moon, as at Samoa. It is called "Palolo" by the Samoans and Tongese, and "Mbalolo," Dr. Denis Macdonald informs us *, by the Fijians. This annelid occurs in numbers so vast that it is collected by the natives as a dainty and nutritious food; and it is so much prized that formal presents of it are often sent considerable distances from certain chiefs to others, whose small dominions do not happen to be visited by the Palolo. Dr. Macdonald thinks the tendency to transverse fission exhibited by the annelids (since they are seldom got entire) may be connected with the diffusion of the ova, and not with the development of new forms—a conclusion the more likely though by no means necessary. He states that the species had been supposed to exhibit an alliance with *Arenicola*, but that the anatomical characters refer it to the Nereidæ. As already mentioned, it ought rather to be classed with the Eunicidæ. If the Palolo has similar habits to the *Lysidice* of our southern coasts (that is, dwells in fissures and crevices of the rocks at and near low water), it probably leaves its retreats for the purpose of depositing ova. Lastly, *Echiurus* is used as bait by the Belgian fishermen; and a *Sipunculus* is employed as food by the Chinese, whose varied taste ranges from trepangs to edible birds' nests.

If the uses of the majority of the annelids are restricted in the case of man, a very different condition holds with regard to marine animals. An examination of the stomachs of our most valuable fishes shows how acceptable and important a part they play in the supply of nutriment. The large number of species which a few hours' fishing on a rich coast will produce with bait of *Nereis cultrifera* is strongly corroborative; indeed I should be inclined to place them even before crabs and mollusks in respect of the avidity with which fishes devour them. The majority of the annelids of St. Andrews are found in the stomachs of cod, haddock, whiting, flounders, and other common fishes; and it is often puzzling to explain how those which dwell in tubes under stones, in fissures of rocks, and in other remote places have been obtained. To give a satisfactory account of the food furnished by this class to fishes would require an enumeration of every family, and most of the genera and species, found in this country; indeed, I do not know a single form that would be rejected. It will suffice, on the present occasion, to notice a

* Linn. Trans. vol. xxii. p. 237 (1859).

few of the more conspicuous at St. Andrews. The stomachs of cod and haddock are frequently filled with sea-mice and Polynoidæ; and another very common form is *Sigalion Mathildæ*. The Nereidæ (from the gigantic *Alitta virens*, Sars, which often distends the stomachs of large cod, to the smaller *Nereis pelagica* and *N. cultrifera*) are universally eaten. The somewhat uninviting *Trophonia plumosa* sometimes forms the sole food in the stomachs of large haddocks, many hundreds occurring in a single fish. *Owenia filiformis*, with its gravelly tubes, is a favourite diet of the same fish and of cod and flounders. The Terebellidæ and their sandy tubes are also largely devoured; and even Serpulidæ are not passed by. Moreover, in their young or larval forms they constitute an important element in the food of the herring and other fishes that feed near the surface of the water.

Many of the annelids of St. Andrews are common to the whole British area; but some have not yet been found in other parts of our seas: as this, however, is probably due to a larger amount of attention having been directed to the locality, we shall not at present particularize.

The fauna at St. Andrews is distinguished, as far as our present knowledge extends, from the Zetlandic by the absence of such striking forms as *Lætmonice*, *Panthalis*, *Nothria conchylega*, *Terebella nebulosa*, *Pista cristata*, *Trichobranchus glacialis*, and *Ditrypa arietina*; from that of the western regions by the absence of *Spinther*, *Lepidonotus clava*, *Polynoë scolopendrina*, *Ophiodromus vittatus*, *Nereis Dumerilii*, *Gattiola spectabilis*, *Terebella nebulosa*, and *Pista cristata*; and of the southern types we miss *Euphrosyne*, *Hermione*, *Polynoë areolata*, *Nereis Marionii*, *Lysidice ninetta*, the Eunicidæ, the abundance of the Chætopteridæ, *Sabellaria alveolata*, *Lepræa textrix*, *Sabella saxicava*, *Protula*, and *Filigrana* between tide-marks. The great preponderance of *Polynoë floccosa* in the south is also an interesting feature.

Amongst the annelids that, besides other very common forms, abound at St. Andrews, and therefore most characteristic of it, are *Sigalion Mathildæ*, *Sthenelais limicola*, *Phyllodoce laminosa*, *P. grœnlandica*, *Nereis cultrifera*, *Alitta virens*, *Autolytus pictus*, *Aricia Cuvieri*, *Ophelia limacina*, *Trophonia plumosa*, *Nerine foliosa*, *Polydora ciliata*, *Capitella capitata*, *Sabellaria spinulosa*, *Pectinaria belgica*, *Lanice conchilega*, *Sabella pavonia*, and *Branchiomma vesiculosum*.

Some of the phosphorescent forms at St. Andrews have already been noticed *; so that in the mean time the remarks

* Ann. & Mag. Nat. Hist. 4th ser. 1872, vol. ix. pp. 6 & 7.

shall be confined to the Polynoidæ, three common species of which afford ready means of experiment. In *Harmothoë imbricata* irritation causes a series of bluish-green flashes at the points of attachment of the scales, and then a steady light for some time. Very pale specimens seem more irritable than ordinary forms. No pulsations of light are observed on the phosphorescent surface of the detached scales. On the whole the light in this species is characterized by its steadiness. It does not readily emit its phosphorescence when a little sulphuric ether is added to the water; nor does mechanical irritation in these circumstances cause any change in its manifestation. Acetic acid acts as a poison, causing a momentary gleam as the scales are thrown off, which wholly disappears with the death of the animal and the ejection of the proboscis. If strong methylated spirit be gradually added to the sea-water (in a small vessel), there is seldom phosphorescence if no mechanical irritation occurs; the animal perishes with all the scales on its back. The luminous emissions are similar when spirit is applied to the annelid in the air. *Polynoë floccosa* seems to be more irritable, and to emit its phosphorescence more readily than the foregoing at the same points. When one of the scales is detached, the greenish light is given off as if in pulsations from the surface of attachment, somewhat quickly at first, then slower, and finally disappearing. In *Evarne impar*, again, the detached scales give off a flashing light, such as might be caused by a swift series of waves, and which quite differs in character from that in *P. floccosa*.

The Gephyreans are not so abundant as on the muddy flats of the west and south, where swarms of the common forms are found in a single spadeful. The highly characteristic *Echiurus vulgaris*, however, occurs, often in great numbers; and though *Priapulus caudatus* is not met with in the littoral region, nor so large as in the Hebrides, still it is not rare in deep water, and is frequent in the stomachs of fishes.

The Nemerteans, again, are especially abundant between tide-marks, though some range thence to deep water, and a few occur only in the latter. *Amphiporus lactifloreus* is common under stones, and *Lineus gesserensis* and *Cephalothrix linearis* in still greater numbers, especially in muddy places. The great *Lineus marinus* is frequently found under stones, and occasionally in the pools. Near low water the *Tetrastemmæ* (such as *T. melanocephala*, *T. candida*, *T. vermicula*, *T. flavida*, and occasionally *T. dorsalis*) occur in varying numbers, the latter, however, attaining its maximum amongst the red seaweeds in the laminarian region. By splitting the rocks at fissures *Nemertes Neesii*, *Lineus bilineatus*, *Micrura fasciolata*, *M. purpurea*, and *Carinella annulata* are found in great beauty; while the intricacies in the roots of the tangles afford favourite sites for *Nemertes gracilis* and others already mentioned. The débris in the fishing-boats is especially productive of fine examples of *Amphiporus pulcher* and *Micrura fusca* *, both, besides the ordinary method of progression, swimming gracefully through the water like freshwater leeches, by throwing themselves on edge and striking right and left alternately with their flattened tails. The curious *Nemertes carcinophila* is abundant on the ovigerous abdominal hairs of the females of the shore-crab.

Almost all the Nemerteans live well in confinement; and while the development of several is known, that of others (such as *Nemertes Neesii*, *N. gracilis*, *Lineus marinus*, *L. sanguineus*, the *Micruræ*, and *Carinella annulata*) affords a fine field for further research. The Nemerteans approach the Annelids proper very closely.

The Rhabdocœla are generally minute, but tolerably numerous amongst the red ascidians hanging from cavern-roofs, or algous and zoophytic growths on the under surface of stones, in tidal pools and near low-water mark.

The Planarians are fairly represented, the common forms frequently occurring under stones between tide-marks, and gliding over the surface of rock or glass like a living skin, which requires a keen eye for detection. When much disturbed they swim a short distance through the water, with a horizontal stroke that has been compared by some to the motion of a skate; but the undulation in the former is much greater than in the latter, which has a gliding or skimming character. They also progress on the surface of the water. Even more active and irritable than the Nemerteans, they move with ease and swiftness—never avoiding any small obstacle, but spreading their thin mobile bodies over it, and continuing their course uninterruptedly. Occasionally when a projecting point is attained, the anterior part of the body is elevated and waved to and fro till a convenient branch of seaweed or zoophyte is reached. Some are very prettily coloured; and though the large and gaudily striped *Eurylepta vittata*, so characteristic of our southern shores, is not found, yet the pink and yellow hues of *Planaria ellipsis* are scarcely less attractive. The little *Planaria ulvæ*, which abounds in the brackish waters of many of the creeks on the western coasts, is absent. The

* A fine specimen of the large *Cerebratulus angulatus*, O. F. Müller, was sent me from the neighbouring Bay of Montrose by Dr. Howden; but unfortunately no proboscis was present. The two forms closely approach each other.

common *Leptoplana flexilis* may be kept for months in confinement, though it is perhaps less hardy in this respect than the Nemerteans. Even though it perishes, however, it frequently deposits pale brownish masses of agglutinated ova on the side of the vessel; and the development of these can easily be followed.

Subclass TURBELLARIA.

A. **APROCTA**, Max Schultze.

Order I. DENDROCŒLA.

Fam. **Leptoplanidæ.**

Genus LEPTOPLANA, Ehrenberg.

Leptoplana subauriculata, Johnston, Catologue of the Non-parasitical Worms, Brit. Mus. p. 6.

Common between tide-marks.

Leptoplana flexilis, Dalyell; Johnst. Cat. p. 6.

Abundant under stones between tide-marks.

Leptoplana atomata, Müller; Johnst. Cat. p. 6.

Common in the same localities.

Leptoplana ellipsis, Dalyell; Johnst. Cat. p. 7.

Not uncommon between tide-marks.

Order II. RHABDOCŒLA.

Fam. 1. **Proboscidea**, J. V. Carus.

Genus PROSTOMUM, Œrst.

Prostomum lineare, Œrst.; Johnst. Cat. p. 62.

Occasionally found on stones brought from the rocks near low water.

A curious form, having a pointed snout with a globular process posteriorly, and a dull pinkish alimentary canal, was procured from the fishing-boats; but unfortunately I possess only the drawing, upon which, however, every reliance can be placed.

Fam. 2. **Schizostomea**, O. Schm.

Genus CONVOLUTA, Œrst.

Convòluta paradoxa, Abildgaard; Johnst. Cat. p. 16.

Very common amongst seaweeds and *Corallina* in tide-pools.

Convoluta Diesingii, Schmidt (?), Sitzungsb. der k. Akad. 1852.

Occasionally under stones in rock-pools.

Fam. 3. **Mesostomea**, O. Schm.

Genus MESOSTOMUM (Dugès), M. Sch.

Mesostomum bifidum, n. sp.

On the under surface of stones from low-water mark, East Rocks. One tenth of an inch long, and of a very pretty pale orange hue. The body is pointed anteriorly, dilates in the middle, and diminishes posteriorly, terminating in two processes which have a few rather large papillæ on their crenated edge; these papillæ seem to have a slight sucker-action. There are two semilunar eyes, with the concavity external. The cilia are specially distinct a little behind the snout, on each side, at points corresponding to the long ciliary whips of the developing Nemertean. The male organ formed a spirally marked conical process behind the large median sucker; and the testes were loaded with spermatozoa in various stages of development.

Fam. 4. **Derostomea**, Œrst.

Genus VORTEX, Ehrenberg.

Vortex capitata, Œrst. Entwurf Plattwürmer, p. 65, pl. 1. f. 7.

Occasionally under stones between tide-marks. Many diatoms occur in the digestive canal.

Fam. 5. **Opistomea**, O. Schm.

Genus MONOCELIS, Ehrb.

Monocelis unipunctata (Fab.), Œrst. Ent. Plattw. p. 56.

This appears to be the *Planaria flustræ* of Dalyell. It is abundant under stones between tide-marks.

Monocelis rutilans, O. F. Müller, Zool. Danic. iii. p. 49, tab. 109. f. 10 & 11.

Occasionally in the laminarian region.

Order NEMERTINEA.

Suborder **ENOPLA**.

Proboscis furnished with stylets.

Fam. 1. **Amphiporidæ**.

Subfamily *AMPHIPORINÆ*.

Proboscis proportionally large.

Genus 1. AMPHIPORUS, Ehrenberg.

Amphiporus lactifloreus, Johnst. M'Intosh, Brit. Annel. (Ray Society), i. p. 156, pl. 1. f. 1 & 2.

Common under stones between tide-marks.

Amphiporus pulcher (O. F. Müller), Johnst. *Op. cit.* p. 158, pl. 1. f. 3.

Frequent in the coralline ground in crevices of shells. A very large, though fragmentary, specimen appears to be this species. It was found on the West Sands after a severe storm in March. The proboscis is extruded, and the tip of the snout forms a kind of button, which, however, may be due to the condition of the parts; the œsophageal region protrudes as a rugose disk on the ventral surface near the tip. A reddish line along the body is peculiar, and is probably the nerve-cord, since no vivid colouring has been seen in the vessels of ordinary specimens. The dull greyish coloration of the body is also peculiar, and may be partly owing to the brownish-red ova shining through the other tissues, or to alimentary material. The posterior end of the specimen shows the pinkish elements of the digestive chamber and ova.

Genus 2. TETRASTEMMA, Ehrenberg.

Tetrastemma melanocephala, Johnst. *Op. cit.* p. 165, pl. 2. f. 1.

Not rare amongst the roots of seaweeds on stones near low-water mark.

Tetrastemma candida, O. F. Müller. *Op. cit.* p. 167, pl. 2. f. 2 & 3.

Abundant amongst seaweeds on stones in the same localities.

Tetrastemma vermicula, De Quatrefages. *Op. cit.* p. 169, pl. 3. f. 3.

Common amongst the roots of seaweeds on stones between tide-marks.

Tetrastemma flavida, Ehrenberg. *Op. cit.* p. 170, pl. 4. f. 1.

Not uncommon in the same situations.

Tetrastemma dorsalis, Abildgaard. *Op. cit.* p. 172, pl. 1. f. 4, & pl. 3. f. 4.

In swarms on *Ceramium* and other seaweeds in the laminarian region, and occasionally under stones near low-water mark.

Subfamily *NEMERTINÆ.*

Proboscis proportionally small.

Genus 4. NEMERTES, Cuvier.

Nemertes gracilis, Johnst. *Op. cit.* p. 176, pl. 2. f. 5.

Frequent under tangle-roots at low water, and occasionally under stones between tide-marks.

Nemertes Neesii, Œrst. *Op. cit.* p. 178, pl. 3. f. 6, & pl. 7. f. 6.

Common in the same localities, in fissures of the rocks bebetween tide-marks, and often from deep water.

Nemertes carcinophila, Kölliker. *Op. cit.* p. 180, pl. 1. f. 5.

Very frequent on the abdominal hairs of female *Carcini.*

Genus 5. LINEUS, Sowerby.

Lineus marinus, Montagu. *Op. cit.* p. 181, pl. 9.

Common between tide-marks and in deep water.

Lineus gesserensis, O. F. Müller. *Op. cit.* p. 185, pl. 4. f. 2, & pl. 5. f. 1.

Abundant between tide-marks. Green and red varieties are equally common.

Lineus sanguineus, Jens Rathke. *Op. cit.* p. 188, pl. 5. f. 2.
Somewhat less common than the former, in the same sites.

Lineus bilineatus, Delle Chiaje. *Op. cit.* p. 191, pl. 6. f. 1.
Not uncommon between tide-marks, and in deep water.

Genus 8. MICRURA, Ehrenberg.

Micrura fusca, M'Intosh. *Op. cit.* p. 196, pl. 6. f. 3.
Common in the coralline ground amongst old shells.

Micrura fasciolata, Ehrenberg. *Op. cit.* p. 197, pl. 6. f. 2.

Not rare in fissures of the rocks between tide-marks, and occasionally from deep water. The uniformly tinted variety frequents the latter.

Micrura purpurea, Dalyell. *Op. cit.* p. 200, pl. 7. f. 3.
Occasionally in the same localities.

Fam. 3. **Carinellidæ.**

Genus 10. CARINELLA, Johnst.

Carinella annulata, Montagu. *Op. cit.* p. 203, pl. 7. f. 5, & pl. 8.

Common between tide-marks, and in deep water amongst shells.

Fam. 4. **Cephalotrichidæ.**

Genus 12. CEPHALOTHRIX, Œrst.

Cephalothrix linearis, Jens Rathke. *Op. cit.* p. 208, pl. 4. f. 4 & 5.

Abundant under muddy stones between tide-marks.

Subclass CHÆTOGNATHA.

Genus SAGITTA, Slabb.

Sagitta bipunctata, Quoy & Gaimard (?), Krohn.

Vast numbers were found on the West Sands, after a severe storm, in January 1867. They were scattered amidst the foam on the beach along with multitudes of *Pleurobrachia*; and it is curious that very little else was cast ashore at this time. The season is remarkable, as Prof. Busk, who is the author of a most valuable paper * on the structure and relations of the animal, thought it would chiefly be procured in fine and calm weather in the towing-net. They were recognized by the active movements of their bodies, which glistened all along the beach like needles of glass.

Subclass GEPHYREA.

Fam. **Echiuridea**, J. V. Carus.

Genus Echiurus, Cuvier.

Echiurus vulgaris, Sav.; Baird, Proc. Zool. Soc. 1868, p. 109.

Abundant amongst the débris on the West Sands after storms.

Fam. **Sipunculidea**, J. V. Carus.

Genus Phascolosoma, F. S. Leuck.

Phascolosoma Harveii, Forbes; Baird, *loc. cit.* p. 82.

Abundant in the stomachs of cod and haddock.

Phascolosoma Strombi, Montagu; Baird, *loc. cit.* p. 86.

Common in deep water in *Dentalium*, *Turritella*, and *Aporrhais*.

Phascolosoma Johnstoni, Forbes; Baird, *loc. cit.* p. 95.

Frequent amongst the roots of corallines and seaweeds on stones in pools, and in crevices of rocks. Ranges to deep water in shells.

Fam. **Priapulidea**, J. V. Carus.

Genus Priapulus, Lam.

Priapulus caudatus, Lam.; Baird, *loc. cit.* p. 104.

Frequent in the stomachs of cod and haddock, and from deep water.

[To be continued.]

* Journ. of Microscop. Science, 1856, p. 14.

XXI.—*Descriptions of some new Species of Birds.* By ARTHUR, Viscount WALDEN, P.Z.S., F.R.S.

Alcippe collaris, n. sp.

Throat, chin, lores, a broad supercilium extending to behind the eye and down the side of the neck, white; a broad line extending from the nostrils over the eye, then bordering the white superciliary band above, and running down the side of the neck, black; cheeks and ear-coverts black; across the lower throat a broad ferruginous band or collar, separating the white throat from the dingy olive-brown plumage of the breast, flanks, and abdomen; thigh-coverts and under tail-coverts bright ferruginous; forehead, crown of the head, and nape ferruginous brown; back, scapulars, and upper tail-coverts olive-brown, with a ruddy tinge; rectrices above liver-brown; quills brown, edged exteriorly with liver-brown; shoulder-edge albescent dashed with ferruginous, under coverts the same; the median breast-feathers nearly pure white; bill black; legs (in dried skin) yellowish-brown.

Wing 2·3 inches, tail 2·12, bill from nostril 0·36, tarsus 0·85.

Described from a male example obtained by Surgeon-Major F. Day at Sudya, Upper Assam, on the 12th of January, 1874.

This species possesses an especial interest, as it is a representative form of the Formosan *Alcippe brunnea*, Gould, an aberrant member of the genus.

Geocichla andamanensis, n. sp.

Geocichla innotata, Blyth, J. A. S. B. 1858, p. 270 ("Andamans").
Geocichla albogularis, Blyth, *apud nos*, Ibis, 1874, p. 138 ("Andamans").

When writing on Andaman birds (*l. c.*) I had not had the advantage of seeing examples of the Nicobar *Geocichla*, named *G. albogularis* by Mr. Blyth. Lately a considerable series has come under my observation; and a comparison made between them and Andaman examples makes it clear that they belong to a totally distinct species. Having already shown (*l. c.*) that the Andaman species differs from the Malayan *G. innotata*, it remains without a title; and therefore for the Andaman bird I propose the name given above.

Eurycercus cinerascens, n. sp.

Chin, throat, breast, cheeks, and under carpal coverts almost pure white; remainder of lower surface of body white, faintly washed with ashy grey, the flanks being dark ashy grey; a distinct white ring round the eye, formed by the minute feathers of the eyelids; above ashy olive, each feather, except those of the uropygium, boldly centred with brown; upper surface of the rectrices ashy olive like the back, the middle pair with a narrow dark brown central line on each side of the shaft; no striations or terminal marks on the rectrices; upper surface of the wing, when closed, ashy olive like the back, the secondary coverts being centred with brown; inner edges of the basal portion of the quill-webs underneath white, passing into tawny on the tertiaries. The tail consists of very broad feathers much graduated; legs (in dried skin) brown.

Wing 2 inches, tail 3·25, bill from nostril 0·28, tarsus 0·75.

Described from an example of a male obtained by Surgeon-Major Day at Dobri, Lower Bengal, on the 27th of November, 1873.

Ianthœnas nicobarica, n. sp.

Entire head, nape, cheeks, and neck dark French grey, chin and throat albescent grey; breast and abdomen darker grey than the head; feathers of the back and sides of the neck tipped with iridescent colours of changing green and pinkish violet; lower down a broad zone of dark grey feathers with bright green reflections, followed by an interscapular zone of iron-grey feathers with pinkish-violet reflections; lesser wing-coverts iron-grey, with semilunar terminal pinkish-violet edgings. All the iridescent tints described alter from green to violet or violet to green, according to the light in which the individual is held. Back, uropygium, and upper tail-coverts dark ashy grey, many shades darker than the head, and tinted with iridescent hues; quills and rectrices almost black; base of the bill and eyelids bright red.

Wing 9·75 inches, tail 6·50, bill from forehead 1·37, tarsus 1, middle toe with claw 1·87.

Described from examples obtained in Trinkut and Nang-cowry islands, Nicobars, by Captain Wimberley.

Like *Ianthœnas palumboides* (Hume), this species possesses twelve rectrices, and is a true *Ianthœnas*. It is a representative form of the Andaman species, from which it is chiefly distinguished by wanting the pearly-white or greyish-white head, throat, and nape.

Carpophaga pulchella, n. sp.

Head, neck, throat, breast, lower surface, and under wing-coverts delicate pale grey, deeply tinted on the crown, throat, and abdomen with a roseate hue; forehead pure white; a broad triangular patch on the nape rich cupreous chestnut; entire back, and all the wing-coverts and upper tail-coverts, rich copper-colour; first three primaries above dark slate-grey, the remainder washed with green; rectrices above green, with a cupreous tinge; under tail-coverts chocolate.

Wing 8·50 inches, tail 5·50, bill from forehead 1·25, tarsus 1, middle toe with claw 1·90.

Described from a male example obtained in the Tojian islands, Celebes, by Dr. Bernhard Meyer.

It is a representative form of *C. paulina*, but differs by being copper-coloured instead of green; its dimensions are also less.

Alcedo Beavani.

At page 487 of the twelfth volume of this Journal I described as new, under the title of *Alcedo rufigastra*, a species of kingfisher of which examples had been sent to me from the Andaman Islands. A specimen obtained by the late Captain Beavan in Maunbhoom, on comparison, proved to be identical ('Ibis,' 1874, p. 136). But as no such species had been procured on the Indian continent by any other collector, it occurred to me that Captain Beavan's specimen had become separated from his Andaman collection, and had accidentally acquired an erroneous locality. This conclusion subsequent discoveries now convince me was erroneous, and I unwittingly did injustice to my late friend's proverbial accuracy. I have since obtained examples from Assam. It has, I believe, been found at the foot of the Himalayas; and Mr. Ball writes to me that it has occurred in the Rajmehal hills, and he believes that it has also been obtained in Cuttack. Its claim to rank as a species belonging to the Indian continent is therefore established; and I wish, by changing the hybrid title of *rufigastra* to that of *Beavani*, to commemorate the original discoverer of this species.

XXII.—*Description of a new European Species of* Zootoca. By Dr. Albert Günther, F.R.S.

Among the reptiles collected by Lord Lilford during his last cruise in the Mediterranean, and kindly presented by him to the British Museum, there is a remarkable new species of *Zootoca*, which he found inhabiting in great numbers a very small island (Ayre Island) on the south-east of Minorca. I have named it, after its discoverer, *Zootoca Lilfordi*; its distinguishing characters are as follows:—

All the upper parts deep shining black, lower parts of a beautiful sapphire-blue. Back and sides covered with minute, round, granular scales, of which there are between 90 and 100 in one of the transverse series in the middle of the length of the trunk. Ventral shields in six longitudinal and twenty-seven or twenty-eight transverse series. Collar very distinct. Gular scales much larger than those of the body, and slightly larger than those on the temples. Temporal scales uniformly granular, with the exception of a large central scute. Scutellation of the head otherwise similar to that of *Z. muralis*.

The largest of four examples is $5\frac{3}{4}$ inches long, of which the tail takes $3\frac{1}{4}$ inches.

To this species I refer also the lizard which is so common on the Filfola Rock, a very small island south of Malta. Structurally there is no difference between them; but the Filfola race, instead of being uniform black above, has the back and sides ornamented with small bluish-green specks, and the lower parts are bluish black. It appears also to attain to a larger size, viz. $8\frac{1}{2}$ inches, of which the tail takes $5\frac{1}{2}$ inches.

The occurrence on these small islands of a black representative of the continental *Zootoca muralis* is a remarkable fact, which deserves attention inasmuch as it is in accordance with other instances of a race having assumed a deep black coloration when confined to a small island—for example, *Coronella phocarum* from Robben Island.

XXIII.—*On the Identity of* Esox Lewini *with the* Dinolestes Mülleri *of Klunzinger*. By Theodore Gill.

In the tenth volume ("the class Pisces") of the 'Animal Kingdom' of Cuvier, edited by Edward Griffith (1834), are a figure (pl. 60) and a brief notice (p. 465) of a fish which has long been a puzzle to me. It is called *Esox Lewini*, and only noticed as follows:—"Our figure of *Esox Lewini* is from a drawing by Mr. Lewin, made in New Holland, of a species not hitherto noticed." It was very evident that the species thus named belonged neither to the genus *Esox* nor anywhere near it; and (1) the relations of the fins, (2) the position of the ventrals with a spine and five rays each, (3) the form of the head, and (4) the teeth indicated for it affinity to *Chilodipterus* and allied forms; but no first dorsal fin was represented. The question then arose whether that fin had been atrophied (as in *Aspidophoroides*, *Gobiopus*, &c.) or (as was more likely) had been overlooked. After nearly forty years the species has been recovered, and, singularly enough, after having escaped the observation of the numerous collectors in the Australasian seas for so long a time*, has in the same year been obtained and described by three different naturalists under as many names, viz. *Dinolestes Mülleri* by Klunzinger, *Neosphyræna multiradiata* by Castelnau, and *Lanioperca mordax* by Günther. There can be no question about at least the generic identity of the *Esox Lewini* with the fishes described by the three contemporaries; and it now appears that the first dorsal fin exists, but is quite small, and sustained by only four or five spines. Klunzinger and Castelnau refer the type to the family Sphyrænidæ, and Günther (with more justification, I think) to the "Apogonina," *i. e.* Chilodipteridæ. Whether the name *Dinolestes Lewini* should be now given, in view of the absence of a description (although supplied by a figure), is questionable; but in any event the synonymy referable to this type will stand as follows:—

1. *Esox Lewini* (Griffith ?), Cuvier's Animal Kingdom, Griffith ed. x. p. 465, pl. 60 (1834).
2. *Dinolestes Mülleri*, Klunzinger, Archiv für Nat. 38. Jahrg. i. p. 30 (1872). Hobson Bay, South Australia.
3. *Neosphyræna multiradiata*, Castelnau, Proc. Zool. and Acclim. Soc. Victoria, i. p. 96 (1872). Melbourne.
4. *Lanioperca mordax*, Günther, Ann. & Mag. Nat. Hist. ser. 4, x. p. 183 (September 1872). Tasmania.

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* It is said, however, by Castelnau to be "common [at Melbourne] in the months of May, June, and July; it attains 2 feet in length. The fishermen call it 'Skip Jack;' but that name is more particularly applied to *Temnodon saltator*."

MISCELLANEOUS.

Pelomyxa palustris, *a freshwater Amœboid Organism.* By Dr. Richard Greef.

The genus which forms the subject of this memoir was briefly described by the author in 1870, under the name of *Pelobius*; but this denomination has been abandoned by him, on account of its being previously applied to a genus of Coleoptera.

Pelomyxa palustris, the only known species, is found abundantly at all seasons at Bonn and Marburg; but it is in spring and the beginning of summer that it seems especially to develop itself; and it then covers the upper layers of the mud in great masses. It is observed in the form of little greyish bodies averaging 1 millim. in diameter, but sometimes attaining 2 millims., or even more. The smallest individuals are little points, scarcely visible with the simple lens.

Under the microscope the contracted *Pelomyxa* usually appears spherical, ovoid, or lenticular. It is composed of protoplasm, in which two layers of different nature may be distinguished—a cortical layer, and a parenchyma.

The outer layer, which appears to be pure protoplasm, is hyaline, homogeneous, and of a more viscid consistency than the parenchyma. It swells up into rounded vesicles projecting at the surface of the mass, and sometimes lobed or digitate, into which the inner surface penetrates as into a sac. These processes creep or flow by amœboid movements, which cause the advance of the whole *Pelomyxa*.

The inner parenchyma is of a more fluid consistency, and so closely filled with vacuoles that it appears quite reticulated. It seems only to take a passive part in the movements, and is merely carried in one direction or another as mobile contents under the action of the contractions of the outer layer. It is this inner substance that contains all the other parts, both those belonging to the organism itself and those which have penetrated from without. The very dark coloration which it often presents is due to the nature of the ingested food, which consists of animal and vegetable substances, to which a great quantity of grains of sand and fragments of mud is added.

The vacuoles are of different sizes, and more or less closely packed; and they constantly change their positions under the influence of the amœboid movements of the whole body. They are simple cavities, the perfectly clear contents of which rarely contains a few dark granules and is of a totally different nature from the enveloping substance. Dr. Greef believes that they contain nothing but water.

Besides the vacuoles, there are in the inner parenchyma three sorts of distinct bodies—which Dr. Greef names *nuclei* ("Kerne"), *shining bodies* ("Glanzkörper"), and *bacilli* ("feine Stäbchen").

The nuclei, which are always disseminated in great quantities among the vacuoles, are thin-walled, usually spherical bodies, 0·012 millim. in diameter, with hyaline contents, more or less furnished with dark granulations. By the examination of series of specimens, Dr. Greef convinced himself that these granulations become converted into larger rounded bodies, within which a punctiform centre may be recognized. This centre enlarges simultaneously with the body which contains it, and soon leaves nothing more than a thin ring surrounding it. The envelope of the mother nucleus appears finally to burst under the constantly increasing influence of the nucleoles, which are found scattered in great numbers side by side with others still contained in their mother nuclei. The internal cavity of the nucleole constantly enlarges, so that the peripheral layer completely disappears, and there remains a simple, spherical, hyaline brilliant corpuscle with distinct contours.

These bodies, when set free, continue to grow in the interior of the *Pelomyxa*; and it is probably from them that the *shining bodies*, which must be regarded as the zoospores of *Pelomyxa*, originate. These shining bodies, which are easily recognizable by their aspect and size even under a low magnifying power, are disseminated through the inner parenchyma in still greater abundance than the nuclei. Most of them are spherical; but some are oval or pyriform, or even irregular; the smallest are not more than 0·006 millim. in diameter, and correspond to the corpuscles originating from the nuclei; the largest are 0·06 millim. in diameter. They consist of a solid shining capsule, with perfectly hyaline and homogeneous contents. These shining bodies seem to be able to multiply in the interior of the *Pelomyxa* itself, by a constriction which separates them into two often very unequal parts. Otherwise no important change is to be observed in them so long as they are still enclosed in the inner parenchyma. It is outside this that they must continue their transformations.

A *Pelomyxa*, which seemed to be dead and on the point of becoming decomposed, presented to Dr. Greef a totally unexpected spectacle. All round the animal there appeared a considerable number of little Amœbæ, which soon surrounded the body of their parent in close-set bands. All these Amœbæ had the same aspect and the same dimensions, and executed the same movements. With a high power it was easy to detect in their interior a nucleus with its nucleoli, and a contractile vesicle. The constantly increasing circle of the Amœbæ gradually dispersed; and in about half an hour the movements became slower and feebler. Instead of amœboid contractions of the whole body, nothing was to be seen but the extrusion of a few isolated, hyaline, lobed or digitate processes. The little Amœbæ soon contracted, and became spherical or pyriform. Then appeared a long undulating filament, which effected their transformation from the Amœboid to the Flagellate form. Dr. Greef saw them move by means of this flagellum; but he was unable to trace their ultimate destiny. It is consequently impossible to say whether the Flagellate form is developed directly into a *Pelomyxa*, or, as Dr. Greef thinks is more probable, only attains the latter phase after having passed again through the form of an Amœba. The little Amœbæ always issue perfectly formed from the body of the *Pelomyxa*, and they seem to originate from the shining bodies. The latter, therefore, must be regarded as germs or spores, originating in the nuclei.

Besides the nuclei and the shining bodies, there are in the parenchyma of the *Pelomyxa* innumerable fine hyaline bacilli, which are generally not more than from 0·006 to 0·008 millim. in length. They are found free among the vacuoles, and often also adhere in great numbers to the whole surface of the shining bodies. Dr. Greef sometimes thought that he could perceive transverse striæ at their surface and a longitudinal canal in their interior; but he can assert nothing positive upon these points. Reagents prove that they are composed of an organic substance.

Dr. Greef concludes his memoir with some considerations on the affinities of *Pelomyxa*. He remarks that this creature resembles the plasmodium of the Myxomycetes, but that this plasmodium only represents a transitional state due to the coalescence of amœboid spores, from which afterwards originates an organism of a much more complex structure, while the *Pelomyxa* represents the phase of of complete development, having numerous nuclei in its interior. *Pelomyxa* is consequently a multicellular organism which represents a group of amœboid creatures with multiple nuclei, belonging to the class Rhizopoda, and allied in many respects to the Myxomycetes.—*Archiv für mikrosk. Anat.* vol. x. (1873), p. 51; *Bibl. Univ.* Dec. 15, 1873, *Bull. Sci.* p. 358.

On Megapodius trinkutensis, *Sharpe.* By ARTHUR, Viscount WALDEN, P.Z.S.

In the 'Annals' of this year (xiii. p. 448), Mr. Sharpe described a Megapode from Trinkut island (Nicobars) as belonging to a species distinct from *Megapodius nicobariensis*, Blyth.

At least four of the islands composing the Nicobar group are inhabited by a species of Megapode; but as Mr. Blyth did not record the name of the island which furnished him with the type of his species, it is impossible to say which is the habitat of *M. nicobariensis*. A considerable series of individuals has recently reached me—consisting of six males, four females, and one unsexed from Camorta island, nine males, four females, and two unsexed from Nangcowry island, two males, three females, and one unsexed from Katschal island, and seven males, seven females, and one unsexed from Trinkut island; and they all belong to one species. Every phase of plumage is represented; and several of the Trinkut examples exhibit the French-grey tinge on the throat and sides of neck, as do some, but not all, from each of the other islands. *Megapodius trinkutensis* must therefore be regarded as equal to *M. nicobariensis*.

Three of the forty-seven individuals I have received present a feature not hitherto recorded, namely a tendency to assume a naked callosity on the crown, as is observable in *Megacephalon maleo*. One, a female from Katschal island, has the occiput and vertex naked of feathers and covered with a black, hard, thick skin, overlapped in part by the lengthened frontal plumes. Another, a male from Camorta island, is similar; but the frontal plumes being shorter, the naked callosity is more evident. In a third, a female from Nangcowry island, the naked area extends almost from the forehead to low down the nape. At the anterior edge of the naked skin is a large fold, the true nature of which it is difficult to ascertain in the dry specimen.

On the Structure of the Caudal Appendage of some Ascidian Larvæ. By M. A. Giard.

We know, from the brilliant discovery of M. Lacaze-Duthiers, that certain species of the genus *Molgula* issue from the egg in an amœboid form, having no external resemblance to the larvæ of the other Ascidia. Kupffer soon extended this discovery to several other types of the same genus. Hancock, on the other hand, has shown that this exceptional mode of evolution does not occur generally in all the species of the group Molgulidæ. Thus *Molgula complanata* and *M. ampulloides* have a urodelous larva furnished with a well-developed caudal appendage. I have also indicated some analogous cases, and called the attention of zoologists to the interesting fact that the *Molgulæ* with abnormal embryos are free in the adult state, whilst the regularly constructed larvæ belong to species which become permanently fixed.

The investigation of a species of *Molgula* which is very common on the shores of the Boulonnais enables me now to enunciate this law with more certainty, and furnishes a new example of a very singular peculiarity of structure which I had previously observed in the caudal appendage of the larvæ of the genus *Cynthia*.

The rich shores of Wimereux and Portel, to the east and west of Boulogne, are literally carpeted, in the first part of the laminarian zone, by a fine *Molgula* which, instead of living isolated like its congeners, occurs in gregarious masses of individuals adhering firmly to each other, and often even rendered polyhedral by mutual pressure. From this mode of life this species might be supposed to be the one described by J. Alder under the name of *Molgula socialis* (Ann. & Mag. Nat. Hist. March 1863, p. 159); but the anatomical characters given by the English naturalist are not sufficient to establish their identity. He does not mention the length of the siphons, which is very remarkable; the size (half an inch) is less than that of the Wimereux specimens, which average two to three centimetres in height; lastly, the only specimen of the above species examined by Alder was a colony attached to a *Pecten maximus* dredged at twelve miles from Hastings. Now the *Molgula* of the Boulonnais is no longer abundant in deep water, where it is replaced by the twisted masses formed by the tubes of the *Hermellæ*.

The Wimereux *Molgula* often establishes itself on the lower surface of stones, but more frequently on the upper surface of the Jurassic rocks (Portland sandstones) which constitute the sea-bottom. The form varies according to the position which they occupy in the masses: the individuals placed in the centre become elongated, in order that they may not be covered up by their neighbours; frequently there is even developed at the side opposite the siphons a peduncle, which may attain a length of two centimetres.

As might be foreseen, this Ascidian, being fixed, produces a urodelous larva, the caudal appendage of which even attains a considerable development. The terminal portion of the tail presents rays of firmer texture than the rest of the membrane, which I cannot better compare to any thing than the natatory rays of the embryos of fishes.

But this arrangement is not strongly marked in the larva of our *Molgula*; and I have only cited this species in the first place because it seemed to me remarkable to find in the same genus, side by side with anurous larvæ, others presenting a caudal appendage so highly organized.

A much higher degree of complication is observed in the embryos of certain *Cynthiæ*, and especially in the species belonging to the group *Styela* of Savigny. I have more particularly investigated a little Ascidian (4–6 millims. in height), the anatomical structure of which closely approaches that of *Styela*, but which, in accordance with the antiquated and perfectly artificial nomenclature still adopted in recent works on the Ascidia, must be placed in a very different group. In fact this species, which I shall call *Polystyela Lemirri*, is a composite, or at least a social, Ascidian. The individuals (*blastozoïtes*) forming each colony (*cormus*) are arranged upon a common basal lamina, like the coral-polyps of the genus *Sympodium*. *Polystyela* approaches the Synascidia by other morphological and even by physiological characters: the embryos issue fully formed from the maternal organism, within which the incubation has been effected.

The caudal appendage of the embryo of *Polystyela* presents throughout its length perfectly developed and very regularly arranged rays. These rays, which are perpendicular to the dorsal cord in the first part of the tail, become gradually more inclined towards the axis in proportion as they approach the extremity. This extremity itself also surprisingly resembles that of a young fish; a drawing representing it could hardly be distinguished from that which might be made of the embryo of *Macropodus viridis ornatus*, for example.

In the first portion of the tail, and nearly to the posterior third of the dorsal cord, the natatory rays, which are very slightly inclined to this cord, present a cartilaginous base of granular aspect, occupying about one third of the membranous limb of the appendage. We have consequently at this point a structure nearly identical with that which is observed in the caudal appendage of the young salmon about the tenth day of its development, namely cartilaginous supports resting or not resting upon the cord, and terminated by rays sustaining a delicate membrane. I content myself at present by indicating these curious facts, proposing some day to revert to the signification which may be ascribed to them.—*Comptes Rendus*, June 29, 1874, pp. 1860–1863.

Parthenogenesis in Ferns.

An interesting paper by Dr. William G. Farlow, late Assistant in the Botanical Department at Harvard University, and at the time a student in the laboratory of Professor De Bary, of Strasburg, entitled "An asexual growth from the Prothallus of *Pteris serrulata*," was read in January last at a meeting of the American Academy of Arts and Sciences, and is just printed in its 'Proceedings.' A fern, as is well known, comes to fructification and produces spores without any fertilization. The spores in germinating produce a liverwort-like structure, the prothallus, on which the two kinds of sexual organs are developed; the fertilization of a cell in the one by a spermatozoid from the other results in the development and growth of the former into a bud, and so into a fern-plant. Now Dr. Farlow has discovered, in a sowing of the spores of the common *Pteris serrulata*, prothalli which were developing fern-plantlets from their substance quite apart from any archegonium, starting in a different way by a direct outgrowth from the prothallus, beginning with a scalariform duct, but producing plantlets thus far undistinguishable from those which arise from an archegonium through fertilization. The paper is illustrated by figures, which show the earlier stages and the difference between this asexual outgrowth and the ordinary development.

Dr. Farlow, confining himself strictly to the facts of the case and their direct interpretation, does not use the word *parthenogenesis*. But the case seems to be substantially analogous to that of parthenogenesis in phænogamous plants, the few cases of which that have been probably, if not unequivocally, made out are much fortified by the present discovery. If it be demurred that the case is one of bud-growth and therefore not of the nature of parthenogenesis proper, the reply is that it comes from a parthenogenetic spore, which here develops plants without the sexual fertilization of that class of plants. The conclusion, if the facts hold good, is that sexual fertilization, however necessary, is not absolutely necessary in every generation of plants, somewhat as cross-fertilization, however necessary in the long run, is generally unnecessary in every generation; only the rule in the former is far more strict.—Asa Gray *in Silliman's American Journal*, April 1874.

On New-Zealand Whales.

The Museum at Auckland has what Dr. Hector believes to be the fœtus or very young of *Neobalæna marginata*; it is only $2\frac{1}{4}$ feet in length, and has the baleen perfect. All the characters agree exactly with the previous and larger specimen of that whale. It was called a calf of a right whale, the old one being described as of an enormous size!

Dr. Haast has received a fresh and complete animal of *Dolichodon*, perhaps *D. Layardi*; and he has also an *Epiodon*, the skeleton of which agrees with Burmeister's *Epiodon australis* in every part but the sternum; and in that it only differs slightly. Is it different from *E. chathamensis*.—J. E. Gray.

Small Size of the Brain in Tertiary Mammals.
By Prof. O. C. Marsh.

At the last meeting of the Connecticut Academy of Arts and Sciences, June 17th, Prof. Marsh, of Yale College, made a communication on the size of the brain in Tertiary mammals. His researches on this subject have been mainly confined to the larger extinct mammals which he had obtained in the Rocky-Mountain region; and the results are of peculiar interest. The Eocene mammals all appear to have had small brains; and in some of them the brain-cavity was hardly more capacious than in the higher reptiles. The largest Eocene mammals are the Dinocerata, which were but little inferior to the elephant in bulk. In *Dinoceras*, Marsh, the type genus, the brain-cavity is not more than one eighth the average size of that in existing rhinoceroses; in the other genera of this order (*Tinoceras*, Marsh, and *Uintatherium*, Leidy) the smallness of the brain was quite as remarkable. The gigantic mammals of the American Miocene are the Brontotheridæ, which equalled the Dinocerata in size. In *Brontotherium*, Marsh, the only genus of the family in which the skull is known, the brain-cavity is very much larger than in the Eocene *Dinoceras*, being about the size of the brain in the Indian rhinoceros. In the Pliocene strata of the West a species of *Mastodon* is the largest mammal, and although but little superior in absolute size to *Brontotherium*, it had a very much larger brain, but not equal to that of existing Proboscidians. The tapiroid Ungulates of the Eocene had small brain-cavities, much smaller than their allies, the Miocene Rhinocerotidæ. The Pliocene representatives of the latter group had well-developed brains, but proportionally smaller than living species. A similar progression in brain-capacity seems to be well marked in the equine mammals, especially from the Eocene *Orohippus*, through *Miohippus* and *Anchitherium* of the Miocene, *Pliohippus* and *Hipparion* of the Pliocene, to the recent *Equus*. In other groups of mammals likewise, so far as observed, the size of the brain shows a corresponding increase in the successive subdivisions of the Tertiary. These facts have a very important bearing on the evolution of mammals, and open an interesting field for further investigation.

On Euphysetes Pottsii. By Dr. Julius Haast, F.R.S.

This small Catodont whale was stranded amongst the rocks in Governor Bay, near Ohinitahi, and was sent by Mr. T. H. Potts to the Canterbury Museum, New Zealand. It was an adult female, 7 feet 2 inches long, and very like *Euphysetes Grayi*; but that species has 7 cervical, 14 dorsal, 9 lumbar, and 21 caudal vertebræ (of which 13 have chevron bones attached), making 51 altogether. *Euphysetes Pottsii* has only 50 vertebræ; and they are differently arranged. The 7 cervical vertebræ are soldered together; there are only 12 dorsal (instead of 14), 11 lumbar (instead of 9), and 20 caudal with 8 chevron bones attached (instead of 21).

The Australian species has 14 ribs, while the New-Zealand species has only 12, of which the first one is broad and flat, and has, like the second, third, fourth, fifth, and sixth, two articulating surfaces; whilst, according to MacLeay, the Australian species has only one articulating surface on the first rib. The second rib exhibits a considerable breadth, whilst the succeeding ones become gradually narrower. The last six ribs, which assume a rounded shape, possess only one articulating surface.

Even supposing the minor difference in the form of the skull to be due to sex, the number, arrangement, and form of the vertebræ and ribs would prove the distinct specific character of the New-Zealand specimen.

The contents of the stomach consisted of a dark slimy matter, without any beaks of Cephalopods as found in *Berardius Arnuxi.*

There is only a single valve covering the blowholes, the slit being 2 inches long, of which $1\frac{1}{2}$ inch lies on the left and $\frac{1}{2}$ inch on the right side of the top of the head. The skin surrounding the valve is raised in a lunate form rather conspicuously on the left side, open posteriorly. The left side of the valve is far more developed and stronger than the right one.

The skeleton will be figured in the forthcoming volume of the 'Transactions of the New-Zealand Institute,' t. xv.

On a new Genus of Asellidæ. By OSCAR HARGER.

The presence of mandibular palpi has been hitherto regarded as a character of the family of *Asellidæ,* and is thus given by Dana (U. S. Exploring Expedition, Crustacea, p. 714), and by Bate and Westwood, in their late work on British Sessile-eyed Crustacea, vol. ii. p. 313. This organ is present and well developed in *Jæra copiosa, Asellodes alta,* and *Limnoria lignorum,* marine species of this family found on the coast of New England. It has been carefully figured by G. O. Sars (Hist. Nat. des Crustacés d'eau douce de Norvège, 1e livr. pl. viii.) for *Asellus aquaticus,* and occurs in *A. communis,* Say, as well developed as in the European species; but in *A. tenax,* Smith, from Lake Superior, it is wanting. This species seems to be in all other respects closely related to the genus *Asellus,* differing from other species of that genus by characters of specific value only. The most noticeable of these differences are the following:—the antennulæ have the third segment of the peduncle small, short, and similar to those of the flagellum; the ocelli are numerous, as in *A. communis*; the appendages of the first abdominal segment in the females are sub-quadrant-shaped, meeting each other along the median line, much as in *A. communis,* instead of subcircular and overlapping as in *A. aquaticus.* The caudal stylets resemble those of *A. aquaticus,* as do also the feet and the mouth-parts, except in the absence of the mandibular palpi; and on this character I propose for the species the new generic name of *Asellopsis.*—*Silliman's American Journal,* June 1874.

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XXIV.—*On some new Genera and Species of Araneidea.* By the Rev. O. P. Cambridge, M.A., C.M.Z.S.

[Plate XVII.]

The spiders described here belong to widely separated localities: five are from Australia, one from Natal, and one from Brazil. All are of great interest, especially the new genus *Mutusca* (from Australia); the abnormal position of the inferior spinners in this spider is almost unique, occurring only, as far as is known (but in a still more striking way), in one other species, *Liphistius desultor* ?, Schiödte. In *Attus volans*, sp. n., from near Sydney, New South Wales, the wing-like development of the superior epidermis of the abdomen is also, as far as I am aware, hitherto quite unexampled.

Details of these and the remaining species, with all known particulars concerning them, will be found in the descriptions given below.

One other circumstance connected with two of the spiders recorded here is perhaps worth noting in this short introduction; and that is the occurrence in North Australia of two remarkable genera, *Miagrammopes* (Cambr.) and *Amycle* (Cambr.), first discovered not long since in Ceylon. The species representing these genera in Australia are exceedingly closely allied to those found in Ceylon; in fact (as below remarked) it seems doubtful whether one of them, *Amycle albomaculata*, may not eventually prove to be a mere variety of the only as yet known *Ceylon* species. How does this affect the theory of the entire separation of the faunas of

Australia and the Malay archipelago, by which latter alone there would seem to be any existing connexion between Ceylon and Australia? Are there any and what *known insects* common to Ceylon and North Australia?

Family **Colophonides**.

Nov. gen. COLOPHON (nom. propr.).

Characters of the Genus.

Cephalothorax oblong-oval, moderately convex above, with the normal indentations strongly marked. Clypeus long, impressed, and prominent.

Eyes eight, unequal in size, closely grouped in a transverse oblong-oval figure on a slight tubercular elevation, towards the fore part of the caput; the two largest occupy the centre of the group in a transverse line; and three others on either side form a curved row, the curves directed outwards.

Legs moderately long, relatively 4, 1, 2, 3, strong, particularly those of the first and second pairs. Tarsal claws strong, three in number, the two superior ones strongly pectinated.

Falces small and rather projecting; fangs folding down over the inner edge of the falces.

Maxillæ moderate in length, broad and strong near their base, somewhat bluntly tapering from the insertion of the falces to their extremities, strongly inclined to the labium, and broadly and obliquely impressed in a transverse direction on the middle of their outer surface.

Labium long, rather broadest near the middle, where it is broadly compressed, and whence it tapers gradually to the apex, which is drawn out into an obtuse point to the same length as the maxillæ.

Abdomen elongate-oval, joined to the cephalothorax by a strong and distinct pedicle. Spiracular openings four in number, the two extra ones placed immediately in front of the usual pair. Spinners six, those of the superior pair largest and longest; and beneath them the remaining four, of equal length, form a straight transverse row.

Colophon natalensis, n. sp. Plate XVII. fig. 1.

Adult male, length 4 lines.

The whole of the fore part of this spider is of an orange-yellow colour, that of the abdomen being a pale dull straw-yellow.

The *cephalothorax* is very thinly clothed with short hairs; the *legs* are tolerably furnished with hairs, but no spines: the ocular tubercle is strongly suffused with black: the three eyes which form each lateral curved row are nearly equal in size, irregular in form, and separated from each other by about half of an eye's diameter; the two hinder eyes of these rows are further from each other than the two front ones; those of the central pair are the largest of the eight and round, separated from each other by about half a diameter's space, and forming with the middle eye of each of the lateral rows a straight, transverse, equally divided line.

The *palpi* are strong, moderately long, and furnished with short hairs: the cubital and radial joints are very short, the latter devoid of projection or apophysis: the digital joint is oval, bent, and of inordinate size, length, and tumidity, almost equalling in length the whole of the rest of the palpus. The palpal organs are simple, resembling in their character those of the Theraphosides and Dysderides; they consist of a largish oval bulb, produced at its extremity, on the outer side, into a very long, strong, contorted apophysis, with two more slender, spine-like, sharp-pointed projections at its extremity, the larger one being bifid, or rather, perhaps, furnished with another spine towards its termination.

The *falces* are weak, straight, and rather projecting forwards; they have a pale prominence on their inner sides near their extremities; the fangs are not very long nor strong, except near their base, a little way from which they become abruptly weaker.

The *maxillæ* and *labium* have been sufficiently described above among the generic characters.

The *sternum* is large, and short-oval in form, truncate before, pointed behind; its surface appears to be thickly covered with small pock-marks or shallow punctures.

The *abdomen* is of an elongate-oval, somewhat subcylindrical form, and is thinly but uniformly clothed with short dark hairs: the four spiracular openings and six spinners have already been described above.

The genital aperture in the female is scarcely perceptible; but in the male it is of a deep black red-brown colour. In colours and other general respects the female resembles the male; the digital joint of the palpus in the female is long, thickly clothed with hairs, and devoid of any terminal claw; the maxillæ are less impressed transversely than in the male.

Adults of both sexes of this very interesting spider were received in 1873 from Natal. It furnishes the type of a distinct family, which appears to connect the Theraphosides and Dysderides, and has also strong affinities with the Filistatides.

Family **Agelenides**?

Nov. gen. Mutusca (nom. propr.).

Characters of the Genus.

Cephalothorax moderately convex above, nearly round (in fact, broader than long) behind, constricted laterally, but very little produced before; hinder slope short and abrupt, and thence falling gradually to the eyes.

Eyes eight, considerably unequal in size, very similar in position to those of *Enyo* and *Miltia*; six form nearly a circle, with about a third part of its circumference wanting in front; a little way within this point of deficiency are two others, the largest of the eight, round, and almost contiguous to each other, the form of the rest being either oval or irregular.

Maxillæ strong, greatly enlarged, and roundly gibbous at their base, obliquely and transversely impressed near the middle, greatly inclined towards the labium, being, in fact, a little behind that part where they approach it most nearly: the palpi are inserted rather more than halfway towards their fore extremities.

Labium short and nearly quadrate, slightly rounded at its apex.

Sternum short, heart-shaped, and strongly indented between the points opposite to the insertion of the legs.

The *legs* were unfortunately all absent, except the basal joints: these are very strong; and their relative lengths are 4, 1, 2, 3; the difference between 4 and 1 is scarcely perceptible. It does not, however, follow that the relative lengths of the entire legs should agree with those of the basal joints, though they usually follow those of the femoral joints.

The *palpi* are strong, and the digital joint has a strong Ageleniform appearance.

The *abdomen* is of moderate size, and oblong-oval in form. The position and relative size of the spinners (of which only *four* could be detected) is very characteristic and remarkable: two, so short as to be scarcely perceptible, are in the usual position just beneath the anus; the other two, of which one joint each only remained, are of great length, nearly cylindrical in form, and strong, springing from underneath the abdomen not far behind the spiracular plates, and, extending backwards in close contact with the inferior surface of the abdomen, project a little beyond its extremity: I could not ascertain certainly; but I suspect that a second joint, with perhaps a third, had here been broken off.

Mutusca mammosa, n. sp. Plate XVII. fig. 2.

Adult male, length $2\frac{1}{4}$ lines.

The *cephalothorax* has the normal grooves and indentations pretty strongly marked; and the junction of the cephalic and thoracic segments is indicated by a strong and deep indentation or fovea; its colour is a dark yellow-brown, and its surface is glossy: the height of the clypeus, which projects considerably, is rather less than half that of the facial space.

The *eyes* are in the form of two thirds of a circle, the deficient portion being in front; across and within the deficiency are the two largest of the eight, in a transverse line; these are round, dark-coloured, and are separated from each other by less than half of an eye's diameter: the rest do not differ greatly in size; they are, however, of irregular form and pearly white; those of the hinder pair are oval, the others somewhat bluntly subangular; none of the six forming the circumference of the circle are contiguous to each other; the interval is least between those of the lateral pairs respectively: taking the eight eyes as forming two curved rows, those forming the hinder row are equally separated from each other; each fore central eye is very nearly but not quite contiguous to the fore lateral nearest to it.

The *legs*, judging from the basal joints (which were all that remained), are strong, and rather lighter in colour than the cephalothorax, and their relative length probably 4, 1 (or 1, 4), 2, 3.

The *palpi* are moderately long, strong, and of a light yellow-brown colour: the cubital joint is short, bent, and clavate: the radial is longer, slightly bent, and has its upperside towards the fore extremity produced into a strongish, tapering, slightly bent-downwards, pointed apophysis; underneath this joint, towards the outer side, is a group of strongish hairs; there are a few hairs on other parts of the palpi, and a single short, curved spine, directed forwards, near the fore extremity of the humeral joints: the digital joint is long and strong, longer than the radial and cubital joints together, of an oval form, drawn out at its fore extremity, like those of spiders of the genera *Agelena* and *Tegenaria*. The palpal organs are prominent and well developed, but not very complex; they consist of a principal, large, roundish, corneous lobe, rather broken up at its fore part (where there is a small independent corneous projection) and on the outer side.

The *falces* are small, projecting, and cut away towards their inner extremities; their length is just about equal to that of the height of the facial space; and their colour is light yellowish brown.

The *maxillæ* and *labium* (whose form is described in the generic characters above) are of a very pale dirty yellow-brown colour; the *sternum* is rather darker.

The *abdomen* is oblong-oval and of a somewhat cylindrical form; it projects slightly over the base of the cephalothorax; its colour is a dark blackish brown, finely mottled (in spirit of wine) with yellowish points; a largish patch on the upperside just above the anus is of a pale yellowish colour. The peculiarity of the spinners, which are four in number, has been sufficiently described above among the generic characteristics; they are of a yellow-brown colour, the underside of the abdomen being dull whitish yellow-brown.

A single example (minus all the legs and apparently a portion of the longer spinners) was received in the present year (1874) from Mr. H. H. B. Bradley, by whom it was found on Shelley's Flats, Australia.

I have placed it provisionally in the family Agelenides, with which, by its long inferior spinners and the form of the digital joints of the palpi, as well as the position of the eyes, it has considerable affinity. Generically, however, it is very distinct from any hitherto characterized genus. The position of the inferior pair of spinners is, as far as I am aware, only paralleled in one other instance—that of *Liphistius desultor* (Schiödte), in which, from an example in the British Museum, all the four spinners are in a similar position. Schiödte appears to have overlooked these, and describes that curious Theraphosid as without any spinners at all.

Family **Gasteracanthides.**

Nov. gen. Calydna.

Characters of the Genus.

Cephalothorax, from above, quadrate, nearly as broad as long, moderately convex above; upperside of fore part of caput projecting; a deep horizontal transverse cleft or chasm on each side divides the upper part from the lower, the lower being again divided in the middle by a longitudinal cleft; these portions, being thin, flattish, transparent, and angular, hardly appear at first sight to be integral parts of the cephalothorax, having more the appearance of being corneous projections connected with the base of the falces, over which they stretch forwards.

Eyes eight, in three groups; four central eyes close together at the extreme point of the upperside of the caput form a quadrangular figure, whose fore side is shortest; and at the extreme outer point of each of the flat divisions of the lower part of the caput are two eyes contiguous to each other; these correspond to the usual lateral pairs of eyes.

Legs short and not very strong, their relative length being apparently 1, 2, 4, 3; they are furnished only with hairs and bristles.

Palpi short, slender; but the digital joints (with palpal organs) epeiriform and of great size.

Falces long, strong.

Maxillæ strong, moderately long, enlarged and rounded at their extremities; greatly inclined towards and meeting over the *labium*, which is short, broad, pointed at the apex, and with the appearance of a short piece cut off across the base.

Sternum somewhat subtriangular, the apex of the triangle directed backwards; the base, where the labium joins, hollow.

Abdomen short, subtriangular, the three sides curvilinear, broader than long; the upperside covered with a corneous shield, and greatly projecting over the base of the cephalothorax; the underside rugulose; the pedicle connecting the cephalothorax and abdomen projects under and is, to all appearance, articulated or at least joined to the hinder part of the sternum.

Calydna prospiciens, n. sp. Plate XVII. fig. 3.

Adult male, length nearly 2 lines.

The *cephalothorax* is of a uniform yellow-brown colour, with a greenish metallic reflection in some lights, and its surface is finely punctuose: the caput is large, nearly equal in width to the thoracic region, but easily distinguished from it by the ordinary lateral compressions and oblique furrows: the peculiar form of the ocular region has been fully described above among the generic characters.

The *eyes*, placed as described above, are of moderate size; those forming the central square are on black spots and are of equal size; the two hinder ones are separated from each other by rather more than an eye's diameter, the two foremost by rather less; those of each lateral pair (seated at the extreme points of the projecting portions of the caput) are small, obscure, and contiguous to each other.

The *legs* are short, moderately strong; relative length 1, 2, 4, 3; they are furnished with hairs and bristles only, each tarsus terminating with two curved superior, one smaller inferior, and, below the latter, one or two supernumerary opposed claws: the colour of the legs of the third and fourth pairs is pale brownish yellow, the anterior portion of the femora of the fourth pair suffused with sooty brown; those of the first and second pairs have the genual and femoral joints darker yellow-brown, the latter suffused with a deeper hue towards their fore extremities, the tibiæ, tarsi, and metatarsi being of a sooty brown.

The *palpi* are short, and similar to the legs in colour; the humeral, cubital, and radial joints are not strong; the two latter are very short, the radial being rather the longest and of an oval form, but apparently without prominence or apophysis: the digital joint is very large, and oval in form: the palpal organs are directed outwards, very prominent, highly developed and complex, consisting of strong corneous lobes, processes, and spines.

The *falces* are long and strong, well rounded and slightly prominent near their base in front; they are rather directed backwards; looked at from the front their sides are hollow, and they are somewhat depressed near their extremities in front; their colour is similar to that of the cephalothorax, and the fangs are short and strong.

The *maxillæ*, *labium*, and *sternum*, whose form and structure have been described above among the characters of the genus, are of a dark reddish yellow-brown colour.

The *abdomen* is broader than long, of a subtriangular form with the corners rounded; its upper integument is corneous and moderately convex, of a dull suffused yellowish-brown colour, minutely mottled (in spirit of wine) with yellow points, marked also rather obscurely with depressed spots of a darker hue, and some pale brownish-yellow lines; the underside is dusky brownish yellow, suffused on the sides (where it is obliquely rugulose) with greenish black: the spinners are short, six in number, and placed in a compact group beneath the hinder part of the abdomen, but some distance in front of the termination of the corneous epidermis: the pedicle connecting the abdomen and cephalothorax is joined at its fore extremity, by a projecting process, to the hinder part of the sternum.

A single adult male of this spider was received from Minas Geraës, Brazil, where it was found by Mr. Henry Rogers in 1870. It is generically allied to *Cyrtogaster* (Keys.) [changed to *Cyrtarachne*, Thor.], *Eurysoma* (Koch), and *Gasteracantha* (Walck.); but its various peculiarities of structure appear to make it necessary to found a new genus for its reception.

Family **Miagrammopides.**

Genus Miagrammopes (Cambr.).

Miagrammopes Bradleyi, n. sp.

Adult female, length $3\frac{3}{4}$ lines.

In size, form, general colours, and appearance this spider is scarcely distinguishable from *M. Thwaitesii* (Cambr.), described in Linn. Journ., Zool. vol. x. p. 401, pl. xiv. figs. 1–12*a*. It may, however, be at once distinguished by the deep-black-brown tapering band which runs longitudinally through the middle of the upperside of the abdomen from its fore extremity almost to the spinners; the legs are also less strong and shorter.

The whole of the fore part, including the legs and palpi, is of a light yellow-brown colour, clothed with greyish-yellow hairs and pubescence, most of which, however, had been rubbed off in the example described: the *abdomen* is of a uniform pale yellowish buff or dirty cream-white colour, the whole surface as if thickly covered with almost confluent cretaceous spots; and along the middle of the upperside, in a longitudinal direction, is a very distinct deep-black-brown stripe tapering from the fore extremity to its termination, not far from the hinder extremity, where it appears to dilate a little and to be abruptly truncated.

The *legs* are rather shorter and less strong than in *M. Thwaitesii*, those of the fourth pair, when extended backwards, reaching but very slightly beyond the extreme hinder point of the abdomen; the metatarsi of this pair have the calamistrum along their uppersides; and the correlative inframammillary organ likewise exists in front of the six ordinary spinners.

A single adult female was submitted to me by Mr. H. H. Burton Bradley, of Sydney, New South Wales. It was found in Northern Australia; but I have no other information respecting it.

The occurrence of a species of this curious genus so far from the place where the typical species were not long since discovered (Ceylon) is very interesting, more especially because, as above noted, this is so very closely allied to one of them.

It is with great pleasure that I have conferred Mr. Bradley's name upon the present species.

Family **Thomisides.**

Genus Amycle (Cambr.).

Amycle albomoculata, n. sp.

This spider is remarkably similar to *A. forticeps* (Cambr.) (P. Z. S. 1873, p. 122, pl. 13. fig. 6) both in form, general colour, and structure. In the present species, however, the abdomen has none of the dark markings of *A. forticeps*, but has instead on the upperside a tolerably regular pattern of distinct white spots of different sizes; these are most conspicuous in the female; they form two longitudinal lines enclosing a very elongated subdiamond-shaped area, with a few other similar spots on the sides. The two round black blotches so conspicuous on the hinder part of the upperside of the abdomen of *A. forticeps* are also present in *A. albomaculata*. It is possible that the comparison of a lengthened series of examples of both these species might prove them to be merely varieties of each other; but as the only two examples of the present spider that have yet been found differ in the above-mentioned particulars from all the six known examples of *A. forticeps*, and the respective localities of the two are so widely removed from each other, I have thought it best to record the present as a distinct species.

The occurrence of this genus in Northern Australia (whence it was received by Mr. H. H. B. Bradley and kindly submitted to me) so soon after its first discovery in Ceylon, is, like that of *Miagrammopes* (*suprà*, p. 177), exceedingly interesting; one would expect now to find these, as well as other Ceylon genera and species, occurring all along the Sumatran and Javan chain of islands, which form the only present connexion of any kind with Australia.

Two examples, an adult male and female, were received from Mr. Bradley.

Family **Salticides.**

Genus Salticus (Latr.).

Salticus (*Attus*, Sim.) *volans*, n. sp. Plate XVII. fig. 4.

Adult male, length rather above 2 lines.

The *cephalothorax* of this spider is of ordinary form; the thoracic region and sides of the caput are black, with a margin of white hairs; the upper part of the caput between the eyes is banded longitudinally with alternate bands of a soft greyish green and bright scarlet, three of the former to two of the latter; and on the upper part of the thorax are three large spots of white hairs in a transverse row, the lateral spots being considerably the largest: the clypeus, which is retreating, is clothed with numerous fine pale hairs; and the surface of the cephalothorax is furnished with others both pale and dark, and erect.

The *eyes* are in the ordinary position; they form very nearly a square, the fore side being very slightly longer than the hinder one; the small central eye of each lateral row is slightly within the straight line of the other two forming that row, and is also a trifle nearer the hinder than the fore one of these two; the four eyes which form the front row are of a dark shining greenish colour; the two centrals are, like those of most other species of the genus, far the largest; the row is curved, the curve being directed forwards.

The *legs* are moderate in length and strength; their relative length is 3, 4, 2, 1 or 3, 4, 1, 2, the difference between those of the first and second pairs being very slight; they are of a pale yellowish colour, irregularly marked and banded with dark brown, and hairy, numerous short adpressed hairs of a greyish white being mixed with others dark-coloured and erect: the metatarsi of the third pair are furnished with a tuft-like group of bristly black hairs on either side; the tibiæ and metatarsi are also furnished with spines.

The *palpi* are short and similar to the legs in colour. The cubital and radial joints are short, the latter being the longest; they are furnished pretty thickly with greyish-white hairs, especially on the inner sides of the radial and on the digital joints; these latter are oval, and of moderate size: the radial joint has a small tapering pointed projection at the extremity of its outer side. The palpal organs appeared to be of very simple structure, and to consist of a largish oval corneous lobe.

The *falces* are small, conical, placed far back behind the frontal margin, and are of a yellowish-brown colour.

The *abdomen* is of an elongated oval form and rather flattened; its upperside is furnished with an epidermis, which is continued laterally on either side to an extent considerably exceeding the width of the abdomen, and of a semioval or elliptical form; the outer portion of this epidermis on either side is capable of being depressed and folded round beneath the abdomen, or elevated and expanded to its full width, after the manner of wings. The whole of the epidermis is densely covered with short scale-like hairs, which give the different tints and hues to the abdomen; the portion which covers the abdomen itself is striped longitudinally for rather more than two thirds of its length alternately with scarlet and greyish green, the latter reflecting brighter green and blue metallic hues;

the hinder part is striped transversely, but, except the first of the stripes, not so distinctly, with similar colours; the lateral flaps are of a soft yellowish colour, tinged with olive-green, and each is marked with two somewhat oblique, curved, narrow stripes or lines of greyish green, following nearly the curve of the hinder part of the flap, and thickly fringed with greyish hairs. The underside of the abdomen is of a dull brownish-yellow colour, marked longitudinally, but not very regularly, with dark brown; and the underside of the flap is of a uniform, pale, dull yellowish hue: four small black impressed points form a quadrangular figure near the middle of the upperside of the abdomen; and there are numerous upturned, bristly, black hairs just beneath the fore extremity.

It is difficult to describe adequately the great beauty of the colouring of this spider; but the unique lateral flaps or appendages of the abdomen will serve to distinguish it readily from all other at present known *Saltici*. It is probable, from the great development of these flaps, as above described, that they are sexual; but no doubt the female, when discovered, will have some traces of them more or less developed. Mr. H. H. B. Bradley, of Sydney, New South Wales, to whom I am indebted for examples of this exceedingly interesting and remarkable spider, tells me that he has observed them elevating and depressing the flaps, and also actually using them as wings or supporters to sustain the length of their leaps. That this, as with an analogous appendage in the flying squirrel, should be intended for such sustentation, one could have but little doubt after examining it even in the preserved specimens. It appears to be a very rare spider, Mr. Bradley having been able to procure but three examples (all males in the adult state) during many occasions of special hunting for it. The three examples were all found on one spot near Sydney in the month of October, running and jumping on low plants and flowers.

Salticus (*Attus*) *speciosus*, n. sp. Plate XVII. fig. 5.

Adult male, length nearly $2\frac{1}{2}$ lines.

The *cephalothorax* of this beautiful species is of ordinary form; its colour is a dark reddish brown, nearly black on the quadrangular area enclosed by the eyes; this space is clothed with short reddish-yellow hairs, mixed with others fewer and longer, both dark-coloured and of a hoary hue, the latter chiefly round the eyes on the anterior portion: the lower part of the sides all round is thinly clothed with fine hoary hairs; and there is a largish, oblong, longitudinal, central patch of white hairs on and behind the occiput; behind each of the eyes of the hinder row is also a small spot of similar hairs.

The *eyes* are mother-of-pearl-like, those of the first row being of a soft green colour, changing to amethyst and bluish grey; they form a quadrangular figure, whose transverse is considerably longer than its longitudinal diameter; the minute eye between the laterals of the first and third rows on each side is intermediate between and in the same straight line with them; the fore lateral eyes are rather less than half the diameter of the fore centrals, being but very slightly (if at all) larger than those of the third or hinder row: the height of the clypeus, which retreats, is less than half the diameter of the fore central eye.

The *legs* are moderate in length and strength; their relative length is apparently 3, 4, 1, 2 (1 and 2 being almost equal); they are of a brownish-yellow colour, paler in parts, and irregularly, but pretty distinctly and boldly, marked and blotched with blackish brown: the tibiæ and metatarsi of the hinder pair are strongly fringed on each side with black bristly hairs; other ordinary hairs clothe the rest; all are furnished with a few spines, and have a strong claw-tuft at the extremity of each tarsus.

The *palpi* are short and similar to the legs in colour; they are clothed with long hairs, nearly all of which are white. The radial joint is considerably shorter and less strong than the cubital, and has its outer extremity continued in the form of a rather slender, tapering, sharp-pointed, thorn-like apophysis, equal in length to the joint itself, but not easy to be seen among the long hairs by which it is concealed; the digital joint is oblong-oval, not very large, but somewhat truncated at its fore extremity, and darker-coloured than the rest of the palpus. The palpal organs consist apparently of a large oval lobe, most prominent towards the hinder part.

The *falces* are small, inclined backwards, placed a good way back, beneath the ocular region, and of a dark yellow-brown colour.

The *abdomen* is of a broad-oval form and flattish, sloping gradually (when seen in profile) from the fore part to the spinners; the upper surface is densely clothed with short adpressed scale-like hairs, among which are a few erect ordinary ones; the lateral margins, quite round to the spinners, appear to project slightly, and are furnished with a rather dense fringe of long, buff and pale yellowish-white, silky hairs; these fringes are very characteristic; and, from their appearance in the six examples that have come under my notice, I suspect that the living spider has power to raise and depress or expand them as a peacock does its train, and that when so expanded they assist to sustain the spider in its leaps. The slightly projecting lateral margins of the upper epidermis appear also to connect this spider with *Salticus volans* (last described); and there is a general similarity in the colouring of the two species: the upperside of the abdomen in the present spider is broadly and transversely banded with alternate and somewhat wavy bands of scarlet maroon and brilliant emerald-green, changing to blue with the different incidences of the light; there are three bands of the scarlet-maroon colour, and four of emerald, the foremost and hindmost bands being of this latter colour; the underside is of a uniform brownish yellow, marked and spotted with dark brown, and clothed with hoary hairs.

Six examples of this interesting and lovely species were received in 1864 from the Swan River, New South Wales.

List of Spiders described.

Family Colophonides.

Colophon natalensis, n. sp., ♂ & ♀, p. 170, Plate XVII. fig. 1. Natal.

Family Agelenides?

Mutusca mammosa, n. sp., ♂, p. 173, Plate XVII. fig. 2. Sydney, Australia.

Family Gasteracanthides.

Calydna prospiciens, n. sp., ♂, p. 175, Plate XVII. fig. 3. Minas Geraës.

Family Miagrammopides.

Miagrammopes Bradleyi, n. sp., ♀, p. 177. North Australia.

Family Thomisides.

Amycle albomaculata, n. sp., ♂ & ♀, p. 178. North Australia.

Family Salticides.

Salticus volans, n. sp., ♂, p. 178, Plate XVII. fig. 4. Sydney, New South Wales.

Salticus speciosus, n. sp., ♂, p. 180, Plate XVII. fig. 5. Swan River, New South Wales.

EXPLANATION OF PLATE XVII.

Fig. 1. *Colophon natalensis*, ♂ & ♀: *b*, spider, enlarged; *a*, ditto, in profile, with legs truncated; *c*, eyes, from above and behind; *d*, underside, showing maxillæ, labium, and spiracular orifices; *e*, left palpus, from outer side; *f*, portion of digital joint with palpal organs of right palpus, from the front and behind; *g*, palpal organs of left palpus, from beneath and in front; *h*, leg of first pair, ♀; *k*, *m*, portion of tarsus of first pair, showing tarsal claws; *n*, natural length of spider.

Fig. 2. *Mutusca mammosa*, ♂: *a*, spider, in profile, enlarged; *b*, ditto, from above; *c*, eyes and falces; *d*, maxillæ and labium; *e*, underside of abdomen, *f*, right palpus, from outer side; *g*, cubital and radial joints of right palpus, from above and behind; *k*, natural length of spider.

Fig. 3. *Calydna prospiciens*, ♂: *a*, spider, from above, enlarged; *b*, ditto, in profile; *c*, caput and falces, from the front; *d*, maxillæ, labium, and sternum; *e*, *e'*, natural length, and spider in outline, of natural size.

Fig. 4. *Salticus volans*, ♂: *a*, spider, from above, enlarged; *b*, ditto, without legs, showing abdominal flaps folded; *c*, ditto, ditto, with flaps extended; *d*, abdomen, from beneath, showing underside of extended flaps; *e*, natural length of spider.

Fig. 5. *Salticus speciosus*, ♂: *a*, spider from above, enlarged; *b*, ditto, without legs, in profile; *c*, underside of abdomen; *d*, natural length of spider.

XXV.—*On three new Species of Toucans pertaining to the Genus* Aulacorhamphus. By John Gould, F.R.S. &c.

The remarkable South-American family of Rhamphastidæ, or Toucans, of which about six kinds were known to Linnæus, now amount to over fifty very distinct species, each possessing good and tangible specific characters. The entire family has been subdivided into five groups, to which the following generic appellations have been applied—viz. *Rhamphastos*, *Pteroglossus*, *Selenidera*, *Andigena*, and *Aulacorhamphus*.

It is to the genus *Aulacorhamphus* (or little green toucans) that the three new species pertain. They all inhabit the fine countries of Venezuela and Columbia.

Aulacorhamphus calorhynchus.

Entire plumage green, with the following exceptions:—above and surrounding the bare space in which the eye is placed bright blue; throat grey, washed with blue; tail-feathers green, inclining to blue towards the tips. Bill yellow, with the central portions of both mandibles greenish yellow, bounded behind by a narrow line of white; bare skin surrounding the eye reddish brown; legs greenish blue.

Sexes alike in colour; female rather smaller than the male.

Measurements of male—total length 14 inches, wing 5, tail 5, bill $3\frac{1}{2}$, tarsus $1\frac{1}{4}$.

Hab. Merida. Collected by Mr. Goering.

This is by far the finest species of the little section of the Rhamphastidæ to which it belongs—a section differing from the rest of the green toucans by the tail-feathers being uniform in colour. The present species is altogether larger than the old *A. sulcatus*, and very different in the marking of its bill.

Aulacorhamphus erythrognathus.

Base of the upper and hinder half of under mandible clear uniform light chestnut-brown; the remainder of the bill clouded with black, with horny tips to both mandibles. Entire plumage green except the throat, which is light blue-grey; a blue wash also pervades the six middle tail-feathers; over the eye a narrow line of blue, and also a spot of the same colour on the cheeks next the bill and beneath the naked skin round the eye, which is reddish brown; legs green.

Total length 12 inches, wing $4\frac{1}{2}$, tail $4\frac{3}{8}$, tarsus $1\frac{1}{4}$, bill $2\frac{1}{2}$.

Hab. Caripe, Venezuela.

Remark. It is now many years since the late Jules Verreaux presented me with a specimen of this little toucan, which he considered quite distinct from any known species. In the collection of Mr. Salvin there exists another example, sent, I believe, to this country by Mr. Goering. If this bird be compared with its ally *A. sulcatus* it will be found small in size, while the bill is deep, short and robust, and not so deeply channelled on the sides. The tail is perhaps shorter than in other species of the family.

Aulacorhamphus phæolæmus.

General plumage deep grass-green, the green inclining to yellow on the flanks and to blue on the tail; throat deep greyish blue; a narrow stripe of blue surmounts the eye, and there is an almost equally narrow line of blue beneath the bare space at the base of the bill; culmen of the upper mandible yellow, except at the hinder part next the head, which, with the remainder, is black; under mandible black, with a deep-chestnut base; both mandibles, however, have a broad white line next the face; vent and all the tail-feathers tipped with chestnut-red; on the last feather the green runs up to the end on the outer margin, but not so on the rest; a conspicuous narrow yellow line occupies the front of the shoulder—a mark which is observable in other species, but much less conspicuous than in the birds here described; legs greenish.

Total length 13 inches, bill $2\frac{3}{8}$, wing 5, tail $5\frac{1}{4}$, tarsus $1\frac{3}{8}$.

Hab. Concordia, in Columbia, and Merida, in Venezuela, from both of which localities I have examples in my collection—those from Concordia sent by Mr. Salmon, that from Merida by Mr. Goering.

The nearest ally to this bird is the *A. albivitta*, a bird with a white throat.

XXVI.—*Descriptions of four new Species of* Glomeridæ *from Sikkim.* By Arthur Gardiner Butler, F.L.S., F.Z.S., &c.

[Plate XVI.]

The collection of the British Museum has lately been enriched by the addition of the following interesting new species of *Zephronia* and *Sphærotherium.*

Zephronia lævissima, n. sp. Plate XVI. figs. 4, 4 *a*, 4 *b*.

Blackish pitchy, clouded with dark castaneous; head pitchy; antennæ castaneous; nuchal plate black.

Head somewhat coarsely punctured all over, more densely in front, its anterior area clothed with short bristles; antennæ clothed with bristles; nuchal plate with a slight anterior ridge, a few scarcely perceptible punctures along its front margin: dorsal segments highly polished, finely granulated in front; lateral segmental wings rather wide; first dorsal segment with a narrow sloping lamina, having a narrow lateral marginal ridge; last dorsal segment unusually perpendicular, its external edge arched, with a narrow marginal ridge.

Length about 1 inch 4 lines; depth of head 2 lines, width of head (including the eyes) 5 lines.

Hab. Sikkim (*Whitely*). One specimen. B.M.

I find that a second example, apparently, of this species, destitute of head and nuchal plate, was referred by me to my *Z. nigrinota.* It differs from the latter species in its more finely and sharply punctured head, much more highly polished dorsal segments, less pronounced lateral marginal ridge to lamina of first segment, more perpendicular last segment with more arched external edge, and deeper coloration.

Zephronia excavata, n. sp. Plate XVI. figs. 1, 1 *a*.

Testaceous, transversely clouded with olivaceous; the posterior margin of each segment reddish, the external edge being pitchy; occasionally a few rounded testaceous spots and a number of blackish dots scattered here and there over the segments.

Head somewhat coarsely but not densely punctured, slightly hairy; antennæ hairy: dorsal segments perfectly smooth; first dorsal segment with a narrow sloping lamina, having a narrow lateral marginal ridge; last dorsal segment oblique, compressed, arched and distinctly excavated from the centre to near the outer edge.

Length 8 lines; depth of head 1½ line, width of head 3 lines.

Hab. Sikkim (*Whitely*). Four specimens. B.M.

Differs from all the described species in the form of the last dorsal segment.

Sphærotherium politum, n. sp. Plate XVI. figs. 2, 2 *a*, 2 *b*, 2 *c*.

Blackish pitchy, a few rounded orange spots on last two segments; antennæ dull castaneous.

Head somewhat coarsely punctured all over, more densely in front; its anterior area clothed with short bristles; antennæ clothed with bristles; nuchal plate with ill-defined anterior ridge: dorsal segments highly polished, scarcely perceptibly granulated in front; first dorsal segment with a narrow sloping lamina, having a well-defined narrow lateral marginal ridge; last dorsal segment with a narrow marginal ridge.

Length 1 inch 5 lines; depth of head 2⅓ lines, width of head 5½ lines.

Hab. Sikkim (*Whitely*). One specimen. B.M.

Allied to *Zephronia javanica*; but larger, wider, the head less densely punctured, and the colouring entirely different.

Sphærotherium maculatum, n. sp. Plate XVI. figs. 3, 3 *a*, 3 *b*.

Olivaceous, spotted with ochraceous, the hind margins of the segments castaneous; head, nuchal plate, and first segment in young specimens castaneous, spotted with olivaceous; in an old specimen (which is altogether redder in tint) the head, nuchal plate, and front of first segment are pitchy; eyes greenish.

Head coarsely but sparsely punctured, more densely round the mouth, clothed with short, almost imperceptible bristles; antennæ clothed with short bristles; nuchal plate with ill-defined anterior ridge, two or three punctures in front, and a bisinuate depression on its posterior area: dorsal segments smooth; first dorsal segment with a narrow sloping lamina, having a narrow lateral marginal ridge; last dorsal segment oblique, slightly compressed.

Length about 9 lines to 1 inch 2 lines.

Hab. Sikkim (*Hooker & Whitely*). Three specimens. B.M.

Our larger example of this species having come in the same collection with an example of *Zephronia nigrinota*, and being in general appearance very like it, I find that I overlooked its structural distinction from that species. The two young examples recently received are altogether more lively in appearance than the older one, the brighter ochraceous spots being much larger and more numerous.

EXPLANATION OF PLATE XVI.

Fig. 1. *Zephronia excavata*, profile; 1 *a*, curled up.
Fig. 2. *Sphærotherium politum*, profile; 2 *a*, head, nuchal plate, and first four dorsal segments, from above; 2 *b*, head, nuchal plate, and first segment, from below; 2 *c*, last two dorsal segments, from behind.
Fig. 3. *Sphærotherium maculatum*, adult specimen, profile; 3 *a*, young specimen, curled up; 3 *b*, head, nuchal plate, and first segment, viewed in front.
Fig. 4. *Zephronia lævissima*, profile; 4 *a*, head, nuchal plate, and first three dorsal segments, from above; 4 *b*, last two dorsal segments, from behind.

XXVII.—*On a new Genus and Species* (Hylæocarcinus Humei) *of Land-Crabs from the Nicobar Islands.* By JAMES WOOD-MASON, of Queen's College, Oxford *.

MILNE-EDWARDS, in his classical work on the entire class of Crustacea, published in 1837, divides † the four then recognized genera of the small but remarkable group of Gecarcinidæ, or land-crabs properly so-called, into two divisions, according as they have the terminal joints of the external maxillipeds completely exposed or inserted on the internal face of the third joint near its summit and completely hidden beneath it; and Dana in his great work not only adopts these divisions, but gives them subfamily names ‡. "The Gecarcinidæ," he says, "pertain naturally to two groups or subfamilies, one having the termination of the outer maxillipeds *exposed* as usual, the other having this part concealed beneath the second and third segments." The subfamilies and genera are as follows:—

Subfam. I. UCAINÆ. Articulus maxillipedis externi quartus apertus.

1. *Maxillipedes externi non hiantes.*

Gen. 1. UCA, Leach. Articulus maxillipedis externi quartus angulo externo insitus.

Gen. 2. GECARCINUCUS, M.-Edwards. Articulus maxillipedis externi quartus marginis medio apicalis tertii insitus.

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* Communicated by the Author. From the 'Journal of the Asiatic Society of Bengal,' vol. xlii. part 2, 1873, having been read before the Society August 6th, 1873. The original is accompanied by two plates.

† Hist. Nat. des Crust. vol. ii. p. 20.

‡ United States Expl. Exped., Crust. vol. i. pp. 374, 375.

2. *Maxillipedes externi late hiantes.*

Gen. 3. CARDISOMA, Latr. Articulus maxillipedis externi quartus apice tertii externo insitus.

Gen. 4. GECARCOIDEA, M.-Edwards. Articulus maxillipedis externi quartus marginis medio excavato apicalis tertii insitus.

Subfam. II. GECARCININÆ. Articulus maxillipedis externi quartus et sequentes tertio celati.

Gen. 1. GECARCINUS, Latr.

This division is unnatural, as separating the genus *Gecarcoidea* (hodie *Pelocarcinus*) from *Gecarcinus*, to which it is most closely related, and ranging it with others with which its relations are more general; and the classificatory value of the character upon which it is based is moreover much diminished, if not altogether destroyed, by the discovery of a new form presenting an interesting transition from the former to the latter genus in this very character. A more natural result can, however, be attained, and Dana's subfamily names still retained, by the substitution of another maxillipedary character for the one originally selected, and now proposed to be rejected. *Gecarcinus*, *Pelocarcinus*, and *Hylæocarcinus*, in fact, agree with one another, and differ from all other genera of the family, in that the exopodites of their outer foot-jaws are short, without flagella, and completely concealed from view beneath the second joints. The several genera of Gecarcinidæ divided into two groups or subfamilies according as they have the exopodites of their outer foot-jaws provided with a flagellum, and applied to the external margin of the second and third joints so as to be externally visible, or have them short and rudimentary, without flagella, and concealed beneath the second joint, will then be distributed as follows:—

Subfam. I. UCAINÆ.

Genus 1. UCA, Leach.
2. GECARCINUCUS, M.-Edw.
3. CARDISOMA, Latr.

Subfam. II. GECARCININÆ.

Genus 1. GECARCINUS, Latr.
2. PELOCARCINUS, M.-Edw.
3. HYLÆOCARCINUS, Wood-Mason.

A careful study of all the numerous figures and descriptions of species of Gecarcinidæ, and, in the cases of the genera *Cardisoma* and *Gecarcinucus*, of actual specimens, has convinced me that the *Gecarcininæ* further agree with one another in the structure of the *epistoma*, which in them is of great length from before backwards and nearly horizontal, thus differing remarkably from the *Ucainæ*, in which it is short and nearly vertical. This part has in *Pelocarcinus* been described by Milne-Edwards * as "grand, complétement à découvert et confondu en arrière avec le palais;" and it appeared to me to pass insensibly into the *endostoma* or "palate" in *Hylæocarcinus* also until I had removed the thick clothing of coarse hairs that obscured the parts, when I found no difficulty in distinguishing them. It is also a notable fact that the three most closely allied species of the former (viz. *Gecarcinus ruricola*, *Pelocarcinus Lalandei*, and *Hylæocarcinus Humei*) have six rows of strong spines to the terminal joints of the walking-legs; and I would also draw attention to the shallow yellow scars situated in all three on each side of the eye and on other parts of the carapace—tell-tale marks of their descent from a common ancestor!

HYLÆOCARCINUS †, n. gen., Wood-Mason, Proc. As. Soc. Bengal, August 1873, p. 161.

Front not united to the internal suborbital lobes as it is in the genera *Gecarcinus* and *Pelocarcinus*, but separated from them by spaces at least as wide as the deep bold fissures that divide to their bases the internal from the external suborbital lobes; into these interspaces project the flagella of the antennæ, the basal joints of which appendages lie tightly wedged between the internal margins of the internal suborbital lobes and the epistoma. The third joint of the external maxillipeds with an obtuse-angled emargination in its anterior border; the external margins only of the first of the three terminal joints is barely visible externally when the appendages are properly closed, its external surface being flattened for movement upon the inner face of the preceding joint: in *Gecarcinus* these terminal joints are completely hidden from view, the angular process, that projects like a pillar in demi-relief from the inner face of the third joint and supports them, ending abruptly so very far short of the anterior margin of the joint: in *Hylæocarcinus* the similar but stouter pillar-like projection that carries these joints at its summit extending much further towards the extremity of the joint than it does in *Gecarcinus*, but certainly failing to reach it; these joints can consequently be only partially visible; in *Pelocarcinus* they are completely visible, being articulated to the apex of the third joint.

* Arch. du Mus. 1855, vol. vii. pl. xv. fig. 2 *a*.

† ὑλαῖος, sylvester, et καρκίνος, cancer.

Hylæocarcinus Humei, n. sp.

The carapace is at once distinguished from that of *Pelocarcinus Lalandei*, M.-Edw., by its more arched outline in front, and by the two rounded tubercles on the mesogastric lobe, which, as in *Gecarcinus ruricola*, is limited off anterolaterally from the rest of the gastric region by very shallow depressions passing off from the hinder end of the profoundly deep median groove, and joining the branchio-gastric groove on each side; the straight line representing its greatest breadth crosses it just in front of these tubercles; in front of this imaginary line its upper surface is very convex and much swollen everywhere, but behind it flat; it is just perceptibly angulated on each side for a short distance beyond the external margin of the orbits, these angulations corresponding to the lines of spiniform tubercles seen in the same position in *Gecarcinus ruricola*. The outer slopes of the branchial regions both anteriorly and posteriorly, and the floors of the branchial chambers—all the inflected portions of the carapace, in fact, covered with squamiform tuberculated lines, which, fine and delicate above, become shorter and coarser as they approach the bases of the legs and the buccal frame. The anterior is divided by a shallow transverse impression, slightly interrupted in the middle line, from the posterior cardiac lobe, which, just as in the rest of the Gecarcinidæ, is much expanded posteriorly between the bases of the posterior pair of legs.

The interantennulary septum is formed mainly by the subfrontal lobe, but partly by a short triangular process of the epistoma. The flagella of the antennæ are rudimentary. Both divisions of the suborbital lobes have their margins roughened with small tubercles.

The sternal region is much broader than long, its greatest breadth being between the bases of the second pair of legs.

The male appendages are very stout and long, reaching beyond the fifth postabdominal somite, and are connected at their bases with a remarkably stout and highly indurated semicircular plate, which arches over the intestinal canal; a similar plate has been observed in the genus *Cardisoma* by S. I. Smith *, and is doubtless present in all Gecarcinidæ.

Postabdomen of the female broadly oval, about as broad as long, covering all but the margins of the sternal region, broadest across the posterior third of its fifth somite; last segment trefoil-shaped, its sides being slightly emarginate, with its antero-lateral angles slightly covered by the produced postero-lateral angles of the preceding somite.

The chelipedes are equal and very powerful in the male, sub-

* Trans. Connecticut Academy, 1870, vol. ii. p. 142.

equal and slenderer in the female; their meropodites (which in the male, as in *Pelocarcinus Lalandei*, extend much beyond the lateral borders of the carapace, but which in the female hardly reach the level of the branchial regions) have a few obtuse tubercles on their anterior, and some coarse tuberculated squamiform ridges on their posterior angles. The chelæ are granulated and ornamented, especially on the fingers, with minute dark-coloured, smooth tubercles; their toothed prehensile edges meet, in the male, only at the extremities, which are feebly excavated spoon-like; the margin of the spoon-like excavation in the propodite is notched for the reception of the external cutting-edge of the dactylopodite, so as to form scissor-like organs.

The ambulatory legs are also remarkably powerful; their meropodites have their edges and sides much roughened by squamiform tuberculation; the upper crest of their carpopodites is armed with a row of minute spinules; their propodites have a row of stronger spines on each of their four angles; and the dactylopodites are provided with six rows of spine-like teeth.

Colours: upper surface of the carapace and the legs red-violet, the claws whity brown, faintly tinged with reddish violet; the scars at the extraorbital angles, in the middle of the branchio-gastric suture, on each side of the mesogastric region, &c., and the margins of the orbits yellow; the flat posterior portion of the carapace is also much variegated with impure yellow.

	millim.
Breadth of carapace of the male	108
Length ,, ,, ,,	80
therefore B : L : : 1·35 : 1.	
Breadth of carapace of the female	96
Length ,, ,, ,,	73
therefore B : L : : 1·315 &c. : 1.	
Length of left claw of male	88
,, right claw of male	87
Height of left claw of male	38
,, right claw of male	38
Length of left claw of female	55
,, right claw of female	57
Height of left claw of female	21½
,, right claw of female	25
Length of postabdomen of female	55
Breadth ,, ,, ,,	51

Hab. The dark, dense, damp forests of the Nicobar Islands. I captured a male and a female on Treis Island; another specimen, with a much distorted carapace, was subsequently taken on Narkondam Island by Mr. Allan O. Hume, C.B., after whom I have named it.

XXVIII.—*On the Invertebrate Marine Fauna and Fishes of St. Andrews.* By W. C. M'Intosh.

[Continued from p. 155.]

Subclass ANNULATA DISCOPHORA.

Fam. 1. **Hirudinea**, Savigny.

Genus Pontobdella, Leach.

Pontobdella muricata, L.; Johnst. Cat. p. 39.

Abundant on skate, and tossed on the West Sands after storms.

Pontobdella littoralis, Johnst. Cat. p. 42.

Not uncommon on *Cottus bubalis* thrown on the West Sands after storms, and occasionally in the stomach of the haddock. It is curious that an example of *Piscicola geometra* should have been found on the former fish on the sands near the mouth of the Eden.

Fam. 5. **Malacobdellea**, J. V. Carus.

Genus Malacobdella, Blainville.

Malacobdella grossa, O. F. Müller; Johnst. Cat. p. 35.

Occasionally in *Cyprina islandica*. The late Dr. Fraser Thomson procured my specimen.

Subclass ANNULATA OLIGOCHÆTA.

Fam. **Lumbricina**, D'Ud.

Genus Clitellio, Sav.

Clitellio arenarius, O. F. Müller; Johnst. Cat. p. 66.

In swarms under stones on sandy and muddy ground between tide-marks.

Subclass ANNULATA POLYCHÆTA.

Fam. 3. **Aphroditidæ.**

Genus Aphrodita, L.

Aphrodita aculeata, L.; Malmgren, Annulat. Polychæt. &c. p. 3.

Abundant in deep water, and thrown on the West Sands in thousands after some winter storms. It is also a common diet of the cod and haddock.

Fam. 4. **Polynoidæ.**

Genus Lepidonotus, Leach.

Lepidonotus squamatus, L.; Mgrn. *op. cit.* p. 4.

Frequent in deep water, under stones in pools between tide-marks, on the West Sands after storms, and in the stomachs of cod and haddock.

Genus Nychia, Mgrn.

Nychia cirrosa, Pallas; Mgrn. *op. cit.* p. 5.

Occasionally in deep water, and on the West Sands after storms.

Genus Lagisca, Mgrn.

Lagisca propinqua, Mgrn. *op. cit.* p. 9.

Occasionally in débris of the fishing-boats. It is distinguished by its greyish scales mottled with black, by the dark spots at the bases of the feet, the mottling of the dorsum beneath the scales, and by the position of the eyes (the posterior pair only being visible from the dorsum). The dorsal bristles have a short clear portion at the tip; the ventral are long, much tapered and minutely bifid superiorly, while the inferior have shorter and stouter tips, more evidently bifid.

Genus Harmothoë, Kinberg.

Harmothoë imbricata, L.; Mgrn. *op. cit.* p. 9.

Very abundant under stones between tide-marks, and ranging to deep water.

Harmothoë lunulata, Delle Chiaje, Descriz. e Not. pl. 144. f. 5 & 6 (*fide* Claparède).

Occasionally on the West Sands after storms.

Harmothoë Macleodi, M'Intosh.

Stomach of the cod. It is allied to *H. zetlandica* in regard to general appearance and processes. Scales fourteen to fifteen pairs, pale and semitranslucent; dorsal cirri scarcely extend beyond the bristles; serrations of the dorsal bristles continued to the tip; ventral bristles boldly bifid, and with rather broad tips.

Genus POLYNOË, Sav.

Polynoë floccosa, Savigny, Syst. des Annél. p. 23.

Not uncommon on the West Sands after storms, and under stones between tide-marks.

Genus EVARNE, Mgrn.

Evarne impar, Johnst.; Mgrn. *op. cit.* p. 10.

Occasionally under stones in pools between tide-marks, and in littoral sponges.

Genus LÆNILLA, Mgrn.

Lænilla setosissima, Savigny, Syst. des Annél. p. 25; Mgrn. *op. cit.* p. 12.

Polynoë longisetis, Grube; *Lænilla glabra*, Mgrn.; and *Harmothoë Malmgreni*, Lankester.

Tossed on the West Sands after storms, amongst tangle-roots. Not uncommon.

Genus HERMADION, Kinberg.

Hermadion pellucidum, Ehlers, Die Borstenwürmer, i. p. 105, pls. 3 & 4.

Occasionally in deep water amongst corallines and shells.

Hermadion assimile, M'Intosh.

Amongst the débris in the fishing-boats. This species is easily discriminated from the foregoing (in spirit) by the presence of a brownish-black band commencing behind the head, and continuing along the central line to the tail. Dorsal bristles with the rows of spikes much less marked, and with a notch at the tip of each bristle; the ventral bristles have a somewhat blunt tip, with processes or beaks which differ characteristically from those of the foregoing.

Genus HALOSYDNA, Kinberg.

Halosydna gelatinosa, Sars; Mgrn. *op. cit.* p. 14.

Not uncommon under stones in rock-pools and in the stomach of the cod.

Genus Malmgrenia, M'Intosh.

Malmgrenia andreapolis, M'Intosh.

Amongst the débris in the fishing-boats, in the stomachs of cod and haddock, and abundantly on the West Sands after storms. The scales have a persistent brown belt. Dorsal bristles terminated by a peculiar knob; ventral bifid, but the distal process is constituted by a modification of the knob.

Genus Enipo, Mgrn.

Enipo Kinbergi, Mgrn. *op. cit.* p. 15.

Occasionally in the stomachs of cod and haddock.

Fam. 6. **Sigalionidæ.**

Genus Sthenelais, Kinberg.

Sthenelais boa, Johnst. Cat. Brit. Mus. p. 124.

Not uncommon between tide-marks under stones.

Sthenelais limicola, Ehlers, Die Borstenwürmer, i. p. 120, pls. 4 & 5.

Abundant on the West Sands after storms, and in the stomachs of cod, haddock, and flounders.

Genus Sigalion, M.-Edwards.

Sigalion Mathildæ, M.-Ed. Hist. du Litt. de la France, ii. p. 105, pl. 2.

Common on the West Sands after storms, and in the stomachs of cod and haddock.

Genus Pholoë, Johnst.

Pholoë minuta, Fab.; Mgrn. *op. cit.* p. 17.

Frequent under stones between tide-marks, and also in deep water.

Fam. 7. **Nephthydidæ.**

Genus Nephthys, Cuvier.

Nephthys cæca, Fab.; Mgrn. *op. cit.* p. 18.

Common on the beach after storms, in sand under stones between tide-marks, and in the stomachs of cod, haddock, and other fishes.

Nephthys Hombergii, Aud. & Ed. Hist. Litt. *olim cit.* p. 235, pl. 5 B. f. 1–6.

Not uncommon between tide-marks, and in the stomachs of cod and haddock.

Nephthys Johnstoni (*longisetosa*, Johnst.).

Occasionally between tide-marks, and in the stomachs of cod and haddock. This quite differs from the *N. longisetosa* of Œrsted, Malmgren, and others.

Fam. 8. **Phyllodocidæ.**

Genus NOTOPHYLLUM, Œrst.

Notophyllum foliosum, Sars; Mgrn. *op. cit.* p. 19.

Amongst the débris of the fishing-boats. Not common.

Genus GÉNETYLLIS, Mgrn.

Genetyllis lutea, Mgrn. *op. cit.* p. 20.

Occasionally in deep water.

Genus PHYLLODOCE, Savigny.

Phyllodoce grœnlandica, Œrst.; Mgrn. *op. cit.* p. 21.

Thrown in numbers on the West Sands after storms; stomachs of cod and haddock.

Phyllodoce maculata, O. F. Müller; Johnst. Cat. p. 177.

Common under stones between tide-marks.

Phyllodoce laminosa, Savigny; Mgrn. *op. cit.* p. 24.

Frequent between tide-marks, in the laminarian region, on the West Sands after storms, and in the stomachs of cod, haddock, and other fishes.

Genus EUMIDA, Mgrn.

Eumida sanguinea, Œrst., and var.; Mgrn. *op. cit.* p. 25.

Common between tide-marks under stones, and on the West Sands after storms.

Genus EULALIA (Sav.), Mgrn.

Eulalia viridis, O. F. Müller; Mgrn. *op. cit.* p. 25.

Abundant between tide-marks, and ranging to deep water.

Eulalia bilineata, Johnst.; Mgrn. *op. cit.* p. 25.

Under stones in rock-pools. Frequent.

Eulalia tripunctata, n. sp.

Amongst the débris of the fishing-boats. Colour pale yellow, with three rows of black spots on the dorsum.

Genus ETEONE (Sav.), Mgrn.

Eteone picta, De Quatref. Annelés, ii. p. 147.

West Sands after storms, in the stomachs of cod and haddock, and rarely under stones at the East Rocks.

Eteone andreapolis, M'Intosh.

On the West Sands after storms. The species has large eyes, a peculiarly shaped head, and madder-brown or purplish bands on the dorsum.

Eteone arctica, Mgrn. (?); Mgrn. *op. cit.* p. 27.

West Sands after storms.

Genus ETEONELLA, M'Intosh.

Eteonella Robertianæ, M'Intosh.

Found whilst digging for littoral annelids. It appears to be most closely allied to *Eteone longa*, Œrsted. Head conical, with a distinct furrow on each side; and, like Malmgren's *Chætoparia*, the cephalic and buccal segments seem to be united; for two short filiform tentacles proceed from the posterior part of the head; the mouth, moreover, opens in the cephalic segment; no visible eyes in spirit; there is a distinct elevation in the centre of the head posteriorly; the lobes of the feet are lanceolate.

Fam. 9. **Hesionidæ.**

Genus CASTALIA, Savigny.

Castalia punctata, O. F. Müller; Mgrn. *op. cit.* p. 31.

Not uncommon in deep water, and occasionally under stones near low-water mark.

Genus PSAMATHE, Johnst.

Psamathe fusca, Johnst. Cat. Brit. Mus. p. 182, pl. 14 *a.* f. 4.

Frequent under stones in pools and moist places between tide-marks.

Fam. 10. **Syllidæ.**

Genus Autolytus, Grube.

Autolytus prolifer, O. F. Müller; Mgrn. *op. cit.* p. 32.

Not uncommon near low-water mark under stones, and ranging to deep water.

Autolytus (*Procerœa*) *pictus*, Ehlers, Die Borstenwürmer, i. p. 256, pl. 11. f. 8–17.

Occasionally under stones in tide-pools. This form also appears to show alternation of generations.

Genus Eusyllis, Mgrn.

Eusyllis tubifex, Gosse (?); M'Intosh, Trans. Roy. Soc. Edinb. vol. xxv. 2. p. 414.

Abundant on laminarian blades cast ashore by storms.

Genus Exogone, Œrst. (*Sphærosyllis*).

Exogone naidina, Œrst. (?), Archiv f. Naturg. xi. 1845, p. 20, Taf. 2.

Occasionally under stones in rock-pools.

Genus Syllis, Savigny.

Syllis armillaris, O. F. Müller; Mgrn. *op. cit.* p. 42.

Frequent between tide-marks under stones and in the laminarian region.

Genus "Ioida," Johnst.

"*Ioida macrophthalma*," Johnst. Cat. Brit. Mus. p. 197, pl. 14 *a*. f. 5.

Occasionally between tide-marks. This is the sexual bud of a *Syllis*. Four or five of the segments anteriorly are devoid of the long bristles.

Fam. 11. **Nereidæ.**

Genus Nereis, L.

Nereis pelagica, L.; Mgrn. *op. cit.* p. 47.

Everywhere abundant from high-water mark to the coralline ground, and in the stomachs of many fishes.

Nereis cultrifera, Grube; Ehlers, Die Borstenwürmer, ii. p. 461, pls. 18–20.

Frequent between tide-marks under stones on muddy ground, and in the stomachs of various fishes.

Nereis Dumerilii, Aud. & Ed.; Ehlers, *op. cit.* p. 535.

It is curious that only the epitocous form (olim *Iphinereis fucicola*) has yet occurred, viz. in the coralline region and on the West Sands after storms.

Genus Hediste, Mgrn.

Hediste diversicolor, O. F. Müller; Mgrn. *op. cit.* p. 49.

Occasionally between tide-marks, and after storms on the West Sands.

Genus Eunereis, Mgrn.

Eunereis longissima, Johnst.; Mgrn. *op. cit.* p. 57.

Occasionally cast ashore on the West Sands after storms. This is an epitocous form, the relations of which are at present in obscurity; there is no known species with which it may be connected except those mentioned here.

Genus Nereilepas, Blainville.

Nereilepas fucata, Savigny; Mgrn. *op. cit.* p. 53.

Abundant on the coralline ground, chiefly in company with *Pagurus* in *Buccinum*. It also occurs in the stomachs of various fishes.

Genus Alitta, Kinberg.

Alitta virens, Sars; Mgrn. *op. cit.* p. 56.

Sometimes thrown in large numbers on the West Sands after storms, and not uncommon in the stomachs of cod.

Fam. 13. **Lumbriconereidæ.**

Genus Lumbriconereis (Blainv.), M.-Edwards.

Lumbriconereis fragilis, O. F. Müller; Mgrn. *op. cit.* p. 63.

West Sands after storms, and in the stomachs of haddock and flounders. Not rare.

Lumbriconereis Laurentiana, Grube, Archiv f. Naturg. Bd. xxix. 1863, p. 40.

Stomachs of cod and haddock.

Fam. 15. **Onuphididæ.**

Genus ONUPHIS, Sars.

Onuphis tubicola, O. F. Müller; Mgrn. *op. cit.* p. 67.
Fragmentary specimen in the stomach of a haddock.

Fam. 16. **Goniadidæ.**

Genus GONIADA, Aud. & M.-Ed.

Goniada maculata, Œrst.; Mgrn. *op. cit.* p. 68.
Common in the stomachs of cod and haddock.

Fam. 17. **Glyceridæ.**

Genus GLYCERA, Savigny.

Glycera dubia, Blainv. (vel *Rouxii*, Aud. & M.-Ed.?).
West Sands after storms and in fissures of rocks.

Glycera capitata, Œrst.; Mgrn. *op. cit.* p. 70.
Occasionally in the stomachs of cod and haddock.

Glycera Goësi, Mgrn. *op. cit.* p. 71.
Stomachs of cod, haddock, and flounders. Not uncommon.

Fam. 18. **Ariciidæ.**

Genus ARICIA, Savigny.

Aricia Cuvieri, Aud. & M.-Ed.; Mgrn. *op. cit.* p. 71.
Common between tide-marks in sand, and thrown on the West Sands after storms.

Genus SCOLOPLOS (Blainv.), Œrst.

Scoloplos armiger, O. F. Müller; Mgrn. *op. cit.* p. 72.
Frequent between tide-marks under stones on sandy ground.

Fam. 19. **Opheliidæ.**

Genus AMMOTRYPANE, H. Rathke.

Ammotrypane aulogaster, H. Rathke; Mgrn. *op. cit.* p. 73.
Occasionally in the stomachs of haddocks.

Genus Ophelia (Sav.), M.-Edwards.

Ophelia limacina, H. Rathke; Mgrn. *op. cit.* p. 74.

Very abundant on the West Sands after storms, and often in the stomachs of cod and haddock.

Genus Travisia, Johnst.

Travisia Forbesii, Johnst.; Mgrn. *op. cit.* p. 75.

Occasionally under stones on gravel at East Rocks, and in the stomachs of flounders.

Fam. 20. **Scalibregmidæ.**

Genus Eumenia, Œrst.

Eumenia crassa, Œrst.; Mgrn. *op. cit.* p. 76.

In the stomach of the haddock. Not uncommon.

Genus Scalibregma, H. Rathke.

Scalibregma inflata, H. Rathke; Mgrn. *op. cit.* p. 77.

In the stomach of a flounder. Rare.

Fam. 21. **Telethusidæ.**

Genus Arenicola, Lamarck.

Arenicola marina, L.; Mgrn. *op. cit.* p. 78.

Everywhere abundant in sandy ground.

Fam. 22. **Sphærodoridæ.**

Genus Ephesia, H. Rathke.

Ephesia gracilis, H. Rathke; Mgrn. *op. cit.* p. 79.

Occasionally between tide-marks, and frequently in the coralline region.

Fam. 23. **Chloræmidæ.**

Genus Trophonia, M.-Edwards.

Trophonia plumosa, O. F. Müller; Mgrn. *op. cit.* p. 82.

Common on the beach after storms, in muddy fissures of the rocks between tide-marks, and ranging to deep water, as well as in the stomachs of various fishes.

Genus Flabelligera, Sars.

Flabelligera affinis, Sars; Mgrn. *op. cit.* p. 83.

Frequent in deep water, and sometimes between tide-marks.

Fam. 25. **Chætopteridæ.**

Genus Chætopterus, Cuvier.

Chætopterus norvegicus, Sars; Mgrn. *op. cit.* p. 88.

Occasionally in the stomachs of haddock.

Genus Mæa, Johnst.

Mæa mirabilis, Johnst. Cat. Brit. Mus. p. 278.

Not uncommon amongst gravelly sand off the East Rocks. The position of this remarkable form may be regarded as provisional (between the Chætopteridæ and Spionidæ).

Fam. 26. **Spionidæ.**

Genus Nerine, Johnst.

Nerine foliosa, Sars; Mgrn. *op. cit.* p. 89.

Common in sandy ground or in muddy sand.

Genus Scolecolepis, Blainv.

Scolecolepis vulgaris, Johnst.; Mgrn. *op. cit.* p. 90.

Not uncommon in muddy sand.

Genus Spio, Œrst.

Spio seticornis, Fab.; Mgrn. *op. cit.* p. 92.

In fine sand tubes under stones at the East Rocks.

Genus Polydora, Bosc.

Polydora ciliata, Johnst.; Mgrn. *op. cit.* p. 95.

Very abundant in soft sandstone and shale.

Fam. 27. **Cirratulidæ.**

Genus CIRRATULUS, Lamarck.

Cirratulus cirratus, O. F. Müller; Mgrn. *op. cit.* p. 95.

Common in mud and muddy sand under stones between tide-marks, and ranging to deep water.

Genus DODECACERIA, Œrst.

Dodecaceria concharum, Œrst.; Mgrn. *op. cit.* p. 96.

Not unfrequent in tangle-roots and old shells from low-water mark to the coralline ground.

Fam. 28. **Capitellidæ.**

Genus CAPITELLA, Blainville.

Capitella capitata, Fab.; Mgrn. *op. cit.* p. 97.

Common on the West Sands after storms and in fissures of rocks in mud.

Fam. 29. **Maldanidæ.**

Genus MALDANE, Grube.

Maldane biceps, Sars; Mgrn. *op. cit.* p. 98.

A fragmentary specimen in the stomach of a haddock.

Genus NICHOMACHE, Mgrn.

Nichomache lumbricalis, Fabr.; Mgrn. *op. cit.* p. 99.

Common between tide-marks under stones, and thence to deep water; it is especially abundant in vertical fissures of the soft sandstone at the East Rocks.

Genus PRAXILLA, Mgrn.

Praxilla prætermissa, Mgrn. *op. cit.* p. 100.

In the stomach of a haddock. Not common.

Fam. 30. **Ammocharidæ.**

Genus OWENIA, Delle Chiaje.

Owenia filiformis, Delle Chiaje; Claparède, Chæt. Naples, p. 446, pl. 26. f. 5.

Common in the stomachs of haddock.

Fam. 31. **Hermellidæ.**

Genus Sabellaria, Lamarck.

Sabellaria spinulosa, R. Leuckart; Mgrn. *op. cit.* p. 102.

Abundant between tide-marks, and thence to deep water.

Fam. 32. **Amphictenidæ.**

Genus Pectinaria, Lamarck.

Pectinaria belgica, Pallas; Mgrn. *op. cit.* p. 103.

Very abundant off the West Sands, and tossed ashore in vast numbers after storms. Common in the stomachs of cod and haddock.

Genus Amphictene, Sav.

Amphictene auricoma, O. F. Müller; Mgrn. *op. cit.* p. 103.

Occasionally off the East Rocks in sandy ground, and in the stomachs of cod, haddock, and flounders.

Fam. 33. **Ampharetidæ.**

Genus Ampharete, Mgrn.

Ampharete arctica, Mgrn. *op. cit.* p. 104.

Occasionally in deep water and in the stomachs of haddock.

Genus Amphicteis (Gr.), Mgrn.

Amphicteis Gunneri, Sars; Mgrn. *op. cit.* p. 105.

Not uncommon in the stomachs of haddock.

Genus Melinna, Mgrn.

Melinna cristata, Sars; Mgrn. *op. cit.* p. 106.

Frequent in the stomachs of cod.

Fam. 34. **Terebellidæ.**

Subfam. 1. *Amphitritea*, Mgrn.

Genus Amphitrite, O. F. Müller.

Amphitrite figulus, Dalyell; Mgrn. *op. cit.* p. 107 (as *A. Johnstoni*).

Not uncommon between tide-marks, and ranging to deep water.

Genus LANICE, Mgrn.

Lanice conchilega, Pallas; Mgrn. *op. cit.* p. 108.

Abundant between tide-marks and off the West Sands, and multitudes are thrown on the beach after storms. A common food of many fishes.

Genus NICOLEA, Mgrn.

Nicolea zostericola, Œrst. & Gr.; Mgrn. *op. cit.* p. 109.

Common between tide-marks amongst tangle-roots, and ranging to deep water.

Genus THELEPUS, Leuckart.

Thelepus circinatus, Fab.; Mgrn. *op. cit.* p. 110.

Frequent in the laminarian and coralline regions, in the stomachs of various fishes, and on the West Sands after storms.

Subfam. 2. *POLYCIRRIDEA*, Mgrn.

Genus POLYCIRRUS, Grube.

Polycirrus (*Ereutho*) *Smitti*, Mgrn. *op. cit.* p. 111.

Not uncommon between tide-marks.

Subfam. 5. *CANEPHORIDEA*, Mgrn.

Genus TEREBELLIDES, Sars.

Terebellides Strœmii, Sars; Mgrn. *op. cit.* p. 112.

Large specimens occur in the stomachs of cod and haddock.

Fam. 35. **Sabellidæ.**

Genus SABELLA, L.

Sabella pavonia, Sav.; Mgrn. *op. cit.* p. 112.

Abundant in the coralline ground, on the West Sands after storms, and in the stomach of the cod.

Sabella (*Branchiomma*, Kölliker) *vesiculosa*, Mont.; Johnst. Cat. Brit. Mus. p. 259.

Frequently thrown on the West Sands after storms.

Sabella viridis, M.-Edwards, Règ. An. Illust. pl. 1 *e* (*fide* De Quatref.).

Amongst mud in the insterstices of *Filigrana implexa* from the coralline region.

Genus DASYCHONE, Sars.

Dasychone Dalyelli, Kölliker; Mgrn. *op. cit.* p. 115.

Occasionally from the coralline ground in the débris of fishing-boats.

Genus AMPHICORA, Ehrenberg.

Amphicora Fabricia, O. F. Müller; Mgrn. *op. cit.* p. 117.

Abundant under stones on muddy ground between tide-marks and amongst tangle-roots.

Fam. 36. **Serpulidæ.**

Genus PROTULA, Risso.

Protula tubularia, Mont. (=*protensa*, Johnst.); Johnst. Cat. Brit. Mus. p. 264.

Occasionally in deep water.

Genus FILIGRANA, Oken.

Filigrana implexa, Berkeley; Mgrn. *op. cit.* p. 119.

Fine masses are common in the coralline region.

Genus HYDROIDES, Gunner.

Hydroides norvegica, Gunner; Mgrn. *op. cit.* p. 120.

Abundant in deep water, attached to shells, stones, &c.

Genus SERPULA, L.

Serpula vermicularis, L.; Mgrn. *op. cit.* p. 120.

Common in deep water.

Genus POMATOCERUS, Phil.

Pomatocerus triqueter, L.; Mgrn. *op. cit.* p. 121.

Very common from the littoral to the coralline region.

Genus SPIRORBIS, Daud.

Spirorbis borealis, Daud.; Mgrn. *op. cit.* p. 122.

Abundant on seaweeds and stones between tide-marks.

Spirorbis lucidus, Mont.; Mgrn. *op. cit.* p. 123.

Common on zoophytes from deep water.

[To be continued.]

XXIX.—*Descriptions and Figures of Deep-sea Sponges and their Spicules from the Atlantic Ocean, dredged up on board H.M.S. 'Porcupine,' chiefly in* 1869*; with Figures and Descriptions of some remarkable Spicules from the Agulhas Shoal and Colon, Panama.* By H. J. CARTER, F.R.S. &c.

[Plates XIII., XIV., & XV.]

I NOW propose to describe and illustrate for publication a few more of the deep-sea sponges dredged up on board H.M.S. 'Porcupine,' from the bed of the Atlantic Ocean, off the coast of Ireland, or between the north of Scotland and the Faroe Islands—every fragment of which that came into my hands was immediately sketched and preliminarily recorded in my MS. journal, with all the information as regards "soundings &c." that accompanied them, in order that I might possess the means of referring to any particular specimen directly, and, in case of accident, thus endeavour to provide against total loss.

The greater part of these specimens represent sponges which have already been described; and the rest will be considerably reduced by those which I am now about to add. Among the latter, however, will be found such extraordinary forms of the flesh-spicule that, unless I first describe a well-known one for reference, they will probably not be understood.

As regards nomenclature, it is not desirable to give new names if we wish to *speed* knowledge; and hence it is better, if possible, to retain an old one, although inappropriate, rather than oppress the mind at the outset by introducing that to which it is unaccustomed. Much that is valuable is never read because it is accompanied by new names.

Again, if we can find familiar types in our British sponges for reference, when engaged in the study of foreign species, it is better to adopt these than to refer to specimens which are less accessible.

Thus, in the present instance, I shall have recourse to Johnston's *Halichondria incrustans*, whose description, including Col. Montagu's observations (Johnst. Brit. Sponges, 1842, p. 122, pl. xi. fig. 3, and pl. xii. fig. 3), leaves no doubt in my mind that the species grows plentifully about this place (Budleigh-Salterton, Devon); while Johnston's figures of *H. incrustans* and *H. saburata*, together with his specimens now in the Johnstonian Collection of the British Museum, have led me, as well as Dr. Bowerbank (B. S. vol. ii. p. 248) to the conclusion that they all represent one and the same sponge, viz. *Halichondria incrustans*.

The reason that I have not yet published descriptions of more of the sponges that were dredged up on board H.M.S. 'Porcupine,' which were handed over to me for this purpose, is that the system under which I have arranged the collection of sponges in the British Museum is not yet sufficiently matured for publication; and until I have this for reference, there is no other arrangement of the sponges that appears to me to offer any thing so practicable. "Why then," it may be asked, "do you still publish descriptions of these specimens?" My reply is, that "the examination and arrangement of the collection of sponges in the British Museum has already taken up so much time that it seems to me better that I should at once do a little more to the deep-sea ones, and thus partly anticipate my arrangement, than leave them all for description until this is completed."

Returning, then, to *Halichondria incrustans*, it will be remembered by those acquainted with the elements of this sponge that one of the minute or "flesh-spicules" is an anchorate, somewhat like that illustrated in my last communication to the 'Annals' (vol. xiv. p. 105, pl. x. fig. 12); and before proceeding to the description and illustration of the deep-sea sponges, it is desirable that I should notice this spicule in detail in *H. incrustans*, which, perhaps, affords the best typical form of it that can be obtained for this purpose, at the same time that the sponge producing it is common on our shores.

The term "anchorate," first used by Dr. Bowerbank (*Haken*, Schmidt), answers very well generically; but as one end of this spicule is occasionally much more developed than the other, Dr. Bowerbank has found it necessary to add the specific terms "equianchorate" and "inequianchorate," which, respectively, are equally appropriate.

It is the "equianchorate" form, as it exists in *Halichondria incrustans*, that, being the most typical of the two, I am now about to describe *in detail*, in order that the same kind of flesh-spicule, which will hereafter be found to be so extraordinarily modified in form in the deep-sea sponges, may be understood.

The equianchorate, then, of *Halichondria incrustans* consists of a shaft and three arms or hooks of *equal* size at each end, whence its specific designation (Plate XIII. fig. 1, *a*, *b*, *c*). The shaft is curved bow-like equally (fig. 1, *a*, *d*), and the three arms recurved towards the concavity of the shaft (fig. 1, *b*, *e*, *f*). Two of these arms are lateral (fig. 1, *b*, *f*), and the other anterior or in front (fig. 1, *b e*, *a e*); hence the back of the shaft forms a continuous and uninterrupted curve (fig. 1, *d*). All three of these arms are attached to the shaft by falciform expansions, extending between the shaft and the arms respectively (fig. 1, *a g*, *c h*), which expansions will be termed in the singular number the "falx," and in the plural "falces;" and while the two lateral arms, being opposite to each other, thus present a wing-like appearance (fig. 1, *c h*), the anterior one being single, median, and in front, presents a linear form; but in all the falx is more or less retracted and web-like towards the end of the shaft (fig. 1, *a g*).

As the anterior arm of the anchorate in other sponges frequently presents a petaloid or tongue-shaped form of extreme thinness, while the linear element, when it remains in this form, represents the midrib of a leaf, but as often is retracted into an elliptical or circular body, which, at the base of the petaloid expansion, is joined through the intervention of the falx to the shaft, we shall call this the "tubercle" (fig. 1, *b i*, and fig. 4, *e*).

Thus we have to remember the "shaft," the "lateral" and "anterior arms" respectively, the "falx," and the "tubercle" for this complicated little spicule.

I should also here add that, in the anchorate of *Halichondria incrustans*, there are four lateral convex aliform expansions of the shaft itself, viz. one on each side towards the ends, thus causing the shaft to present a constricted form in the centre when viewed anteriorly or posteriorly (fig. 1, *b* & *c*). These aliform expansions will also be seen, by-and-by, in the anchorate of *Chondrocladia virgata* and other deep-sea sponges.

In my last communication to the 'Annals' (*l. c.*) it will be observed that I have figured three forms of flesh-spicules as common to *Halichondria ægagropila*, Johnston (*Esperia ægagropila*, Carter); and it will also be found that the two additional ones (viz. the "tricurvate" and the "bihamate") are as frequent in their occurrence in many other sponges as the "anchorate" itself, but, being very simple in construction, they do not require a detailed description like the anchorate. In the communication to which I have just alluded it will further be seen that the anchorate presents the form specifically termed "*in*equianchorate," and thus affords, with that under description, the two principal varieties, viz. the "equi-" and "inequi-" anchorates respectively of this spicule.

Halichondria incrustans differs from *Esperia* (Carter) in possessing *two* forms of skeleton-spicules, viz. an acuate or club-shaped spicule, spined or not, and an acerate (smooth, curved, fusiform, and pointed at each end), sometimes inflated round, hastate, or even minutely spined, at the ends; while *Esperia* only possesses *one* form of skeleton-spicule, viz. smooth, sub-pinlike, fusiform, with the body frequently thicker than the head, which is the reverse of the acuate in *H. incrustans.* The anchorate among the flesh-spicules, too, in *H. incrustans* is equi-ended (equianchorate), while in *Esperia* it is for the most part *in*equi-ended (inequianchorate).

I shall retain the term "*Halichondria*" for the group of sponges whose type is that of *H. incrustans* and its modifications, as it is necessary to adopt one for this purpose, and this, which appears to have been first introduced by Fleming in 1828 (Hist. Brit. Animals, p. 520), has since been most generally used.

With this short introduction, let us proceed to the description of the deep-sea sponges, which respectively will appear under the names :—*Guitarra fimbriata*, n. gen. et sp.; *Melonanchora elliptica*, n. gen. et sp.; *Esperia villosa*, n. gen. et sp.; *Esperia cupressiformis*, n. gen. et sp.; *Chondrocladia virgata*, Wyv. Thomson; *Histoderma appendiculatum*, n. gen. et sp.; *Halichondria abyssi*, n. gen. et sp.; *Halichondria forcipis*, Bk.; *Cliona abyssorum*, n. gen. et sp.; *Desmacella pumilio*, Schmidt; *Reniera fibulata*, Sdt.; and *Dictyocylindrus anchorata*, n. gen. et sp.,—to which will be added descriptions and figures of three remarkable spicules obtained from arenaceous deposits, respectively dredged up on the Agulhas Shoal, Cape of Good Hope, by Dr. G. C. Wallich, in 1857, and obtained just now by Mr. F. Kitton from Colon, Panama; to the former of which the name *Gummina Wallichii*, and to the two latter respectively *Forcepia colonensis* and *Corticium Kittonii*, will be given.

Guitarra fimbriata, n. gen. et sp. Pl. XIII. figs. 2–5, and Pl. XV. fig. 34.

General form conical (figs. 2 & 3); surface villous, even; villi formed by the projecting ends of the skeleton-spicules, arranged in tufts close together (fig. 3, *d*), and somewhat spirally over the body, lengthened into a tubular fringe around the apex (fig. 3, *a*). Sessile. Colour grey. Vent chiefly apical (fig. 3, *a*), where it is surrounded by the fringe of long spicules just mentioned, while smaller vents (fig. 3, *c*) are scattered over the surface generally. Pores not seen. Internal structure massive, permeated by the excretory system of canals, which has its chief vent at the apex; charged with skeleton- and flesh-spicules, and surrounded by a cortical layer chiefly composed of the former, whose projecting ends give the villous surface (fig. 3, *d*).

Spicules of two kinds, viz. skeleton- and flesh-spicules. Form of skeleton-spicule, of which there is only one, smooth, acerate, fusiform, finely pointed, and nearly straight; average largest size 27 by ½-1800th of an inch in its greatest diameters (Pl. XV. fig. 34), that of the fringe round the apex much longer, viz. 1-24th inch. Flesh-spicule equianchorate, in which the lateral arms are so blended with the shaft as to convert the whole into a flattened plate, of an hourglass- or guitar-shape, constricted in the centre and round at the ends (Pl. XIII. fig. 4, *a b c*), bordered inside throughout by a fringe directed inwards towards the shaft (fig. 4, *d*), leaving a trapezoidal, clear area opposite the constriction, and a narrow, obovate one at each end (fig. 4, *b c*): anterior arm at each end flat, expanded into a circular or obtuse, thin, elliptical plate, presenting the same kind of fringe round its margin, directed inwards, and leaving, as in the shaft, a transparent ovate area in the centre (fig. 4, *b*); anterior arm equal in width to the end of the shaft &c., to which it is parallel transversely, but longitudinally inclined from it at an acute angle beginning at the end (fig. 4, *a*), where it is united to the shaft by a short falx (fig. 4, *f*), opposite to which is a large, clear, circular tubercle (fig. 4, *e*): average length of largest form 16-6000ths inch; widest part 6-6000ths; constricted part 3-6000ths. Size of entire specimen about 6 by 4-12ths of an inch in its largest diameters. Fringe of spicules round the apex 1-24th inch broad.

Hab. Deep sea.

Loc. Atlantic Ocean, off the N.W. coasts of the British Isles.

Obs. The jar containing this, with a specimen of *Podospongia Lovenii*, Bocage, one of *Desmacella pumilio*, Schmidt, and a fragment of an Hexactinellid sponge (*Askonema*?) bears *no* label. It is remarkable for the form of the anchorate spicule, which, but for reference to that of *Halichondria incrustans*, above given, is so modified in form that it could hardly be otherwise understood. Although the average largest size of this spicule is figured, it is present of all intermediate sizes down to an embryonic form not more than 2-5000ths inch long, in which the outlines alone of the hourglass-shape can be distinguished (fig. 5). Further, it is remarkable for having only *one* form of skeleton-spicule, and that acerate, and only one form of flesh-spicule, which, so far as is known, is unique; also for the length of the skeleton-spicules at the apex of the body, where they present a tubular fringe round an apical vent, like that seen in some of the Calcispongiæ, ex. gr. *Grantia ciliata* &c. I think, from the villous even surface and general composition of this sponge, it might be necessary to place it among the Suberites, in which case it would come into my 5th division, viz. Rayneriæ.

Melonanchora elliptica, n. gen. et sp. Pl. XIII. figs. 6–12, and Pl. XV. fig. 35, *a*, *b*.

General form globular, corrugated, studded with projecting tubercles over the upper two thirds, smooth below this, where it partly encloses a small stone (figs. 6 & 7, *b b*). Free. Colour grey. Composed of a stiff, glistening, bladder-like dermis, enclosing a soft fibreless parenchyma. Dermis formed of a wove-like texture, composed of linear spicules, intercrossing each other on the same plane, and held together by tough horny sarcode (fig. 8, *a*), corrugated, and presenting rounded tubercles (figs. 6 & 7, *a a*), whose heads respectively are cribriform (fig. 8). Pores and vents respectively situated in the cribriform tubercles (fig. 8). Internal structure massive, fibreless, permeated by the excretory canal-systems, which have their vents respectively in the tubercles; charged with skeleton- and flesh-spicules, together with ova sufficiently large to be seen with the unassisted eye. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of two forms, viz.:—one, the largest, which is chiefly confined to the parenchyma, smooth, acuate, curved, and abruptly pointed, averaging, in its largest size, 53 by 1-1800th inch in its greatest diameters (Pl. XV. fig. 35, *b*); and the other, which is the smallest, and chiefly confined to the dermal texture, smooth, slightly curved, fusiform, and inflated at the ends, averaging, in its largest size, 35 by 1-1800th of an inch in its greatest diameters (fig. 35, *a*). Flesh-spicule of one form only, viz. equianchorate (Pl. XIII. fig. 9), in which the three arms, growing towards each other (fig. 11), at length unite, and, with the shaft, ultimately form two ellipses, which, cutting each other longitudinally and at right angles (fig. 10), give a melon-shaped appearance to the anchorate (fig. 9), which, but for the gradation of all its stages of development being present, from the simple embryonic *equi*anchorate form (fig. 12, *a b*), like that of *Halichondria incrustans*, to the fully developed melon-shaped one, would hardly have been thought to have come from an ordinary form of the anchorate. Arms, as they approach each other, becoming compressed, widened, and knife-shaped, with the thin edge inwards, and presenting, in their fully developed state, fine parallel striæ close together on the blade, which are perpendicular to its curved outer margin (fig. 9,*b*); also presenting, before the union of the arms is completed, a *notch* on the inner edge (fig. 9,*a*), which is filled up at maturity, at which time the shaft becomes undistinguishable from the arms: average largest size of melon-shaped form 12 by 7-6000ths of an inch in its greatest diameters (fig. 9); that of the embryonic form 6-6000ths inch long (fig. 12). Size of entire specimen about $1\frac{1}{4}$ inch in diameter in all directions; that of the tubercle about 1 to 2-6000ths inch in diameter.

Hab. Deep sea.

Loc. Atlantic Ocean, between the north coast of Scotland and the Faroe Islands.

Obs. This specimen is alone; and the label on the jar only bears "Porcupine, 1869," which refers to the "voyage." It is remarkable for the form of the full-grown anchorate, which here also, but for the presence of all minor grades of development leading up to the matured one, could hardly have been understood. It is further remarkable for the general form and structure of the body, although the presence of a stiff, bladder-like envelope or dermis, similarly composed and filled with a soft, parenchymatous, fibreless mass does not, as we shall see hereafter in *Histoderma appendiculatum*, appear to be so much confined to any particular species as to be a peculiarity of some of the deep-sea sponges. It had grown on, and subsequently partly round, the pebble at its base (Pl. XIII. figs. 6 & 7, *b b*), which, in the otherwise unattached state of the sponge, must at once have served to keep it more or less stationary, with the same side always uppermost. Hence, probably, the restricted position of the pore-areæ.

The alliance of the double form of skeleton-spicules here, as well as their shape respectively, with those of *Halichondria incrustans*, would seem to indicate that this sponge should be placed under the heading "*Halichondriæ*" in my 5th division of sponges, viz. RAYNERIÆ.

Esperia villosa, n. gen. et sp. Pl. XIII. figs. 13-15, and Pl. XV. fig. 36.

General form massive, lobular, erect (fig. 13), growing from a contracted portion of stout, naked fibre (fig. 13,*a*), whose main filaments, being expanded at the ends, appear to have been torn from some submarine object to which the sponge was thus attached. Sessile. Colour grey. Dermal surface villous, even, consisting of the ends of linear spicules that project in small tufts a little beyond the sarcode, which thus holds them in position (fig. 13, *b*). Pores in the interstices between the tufts (fig. 13, *c*). Vents scattered here and there irregularly. Internal structure parenchymatous and fibrous, surrounded by a spicular crust, which forms the villous surface (fig. 13, *b*), charged with spicules, and permeated by the excretory canal-systems, which respectively end in the vents mentioned. Parenchyma hung on the fibrous structure, which is stout, stiff, reticulate, anastomosing, and chiefly composed of the skeleton-spicules, united together by a small portion of horny sarcode. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. sub-pinlike, stout, smooth, slightly curved, abruptly pointed, head less in diameter than the shaft; average largest size 43 by $\frac{1}{3}$-1800th inch in its greatest diameters (Pl. XV. fig. 36). Flesh-spicules of two forms, viz. bihamate and equianchorate. Bihamate very large, C-shaped, in which the central canal is visible (Pl. XIII. fig. 15, *a*), more or less contorted and sigmoid; average largest size 40 by $2\frac{1}{2}$-6000ths inch in its greatest diameters (fig. 15). Equianchorate very long and narrow (fig. 14, *a*); anterior arm spatuloid, terminated at the fixed end by a short, elliptical tubercle, and attached by an equally short falx to the shaft; the free end, *en profile*, curved forwards and inwards, claw-like (fig. 14, *b*); lateral arms united to the shaft throughout by their falces respectively, and so long as to leave nothing of the shaft visible beyond a constricted portion in the centre (fig. 14, *e*), thus contrasting strongly with the half-grown individual (fig. 14, *c*); average largest size 24 by 3-6000ths inch in its greatest diameters; distance of the free end of the anterior arm from the shaft, when viewed laterally, greater than its width. Size of entire specimen $2\frac{1}{2}$ inches high by $1\frac{1}{4} \times 1$.

Hab. Deep sea.

Loc. Atlantic Ocean, between the north coast of Scotland and the Faroe Islands.

Obs. The No. on this jar is "51," whose "station" (for that is what the No. refers to in the "Reports") would give a depth of 440 fathoms. It is in company with *Hymedesmia Johnsoni*, Bowerbank (B. S. vol. i. p. 276), and *Axinella mastophora*, Schmidt. The specimen is very much injured; but enough of it remains to enable me to give the above description and figure in the plate. It is remarkable for the large size of the bihamate (fig. 15) and this particular weaver's-shuttle-like or navicular form of anchorate, which is by far the largest I have yet seen (fig. 14). The bihamate presents the central canal; and the equianchorate differs so much in form between the half- and fully-developed states (fig. 14, *c* & *a b*), that, but for such gradations, they would hardly be recognized as belonging to each other. In the half-grown and embryonic form (fig. 14, *c d*) the shaft is much less covered in the middle, and the arms much wider than in the matured form, where the shaft is hardly seen from the close approach of the lateral arms to each other; while all the arms in the matured form appear to be more curved inwards than in the half-grown specimen, where their *expanded* state chiefly leads to their appearing to be so much wider. But for there being only one kind of skeleton-spicule, and this in singleness and form being evidently allied to *Esperia*, the presence of the anchorate in an equi-ended form would have led me to reject it from the Esperiadæ (Carter), whose most prevalent character is the *in*equianchorate; while the villous condition of the dermis, arising from the projecting ends of the skeleton-spicules, equally differs from the beautiful, subhexagonal, or polygonal, structure presented by the surface of *Esperia ægagropila* and the like, in which the spicules do not project, but are on a level with the dermal sarcode. The naked, stiff, rigid, coarse, reticulate fibre at the base, composed almost entirely of spicules, is very characteristic of *Esperia*, whose parenchyma appears to leave and return to the old spiculo-fibrous structure as required; or, at all events, the latter when once produced is more durable than the parenchyma, which often, in the newly formed state, returns to and partly overspreads an old skeleton. Hence with the Esperiadæ a naked portion of this peculiarly rigid spiculous fibre is as common as it is characteristic.

Esperia cupressiformis, n. gen. et sp. Pl. XIV. figs. 16–19, and Pl. XV. fig. 37.

General form long, narrow, pyramidal, echinated all round with short, linear processes, diminishing in length, becoming thicker as they are inclined upwards towards the summit, and disappearing altogether towards the base, which is somewhat inflated (Pl. XIV. fig. 16). Matured form club-shaped. Processes at first pointed, and afterwards inflated at the ends respectively, becoming more or less united together by a continuous dermal layer of sarcode (fig. 16, *g*). Free or fixed. Colour whitish grey. (Or, in another form (fig. 19), capitate, head pyriform, compressed (fig. 19, *b*), supported on a slender stem, terminating in an expanded discoid root at the base (fig. 19, *c*.) Hispid over the lower half of the compressed head, and also over the root at the base (fig. 19, *c*). Capitate portion divided into two lip-like parts, halfway down from the summit, parallel with the compression (fig. 19, *a*).) Dermal surface even, consisting of sarcode densely charged with minute inequianchorates, whose large ends just project above the level of the structure in which they are otherwise imbedded (fig. 16, *f*). Pores not seen, but probably in the dermal sarcode. Vents not seen. Internal structure dense, consisting of bundles of long linear spicules, partly erect and parallel and partly transverse, the former supplying the axial support of the body of the sponge, and the latter that of the echinating processes (fig. 16, *f*). Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. long, smooth, acuate or sub-pin-like, fusiform; average largest size 65 by 1-1800th of an inch in its greatest diameters; head narrower than the shaft (Pl. XV. fig. 37). Flesh-spicules of two forms, viz. inequianchorate and tricurvate. Inequianchorate (Pl. XIV. fig. 17 *a*, *b*) almost without appearance of shaft in the front view, as the lateral arms of the larger end reach down to those of the smaller one (fig. 17, *b*); anterior arm petaloid, much shorter than the lateral ones (fig. 17, *b*), presenting an elliptical tubercle where it is united to the end of the shaft by the falx, which is extended halfway down the petaloid arm; lower end of spicule much aborted; shaft much curved: average largest size $5\frac{1}{2}$ by 3-6000ths of an inch in its greatest diameters. Tricurvate (fig. 18), smooth, in the form of a minute hair-pin or pair of forceps—that is, as it were, consisting of a smooth, linear spicule, bent into a very acute angle, with attenuated arms, here terminated respectively by a bulbous inflation (fig. 18, *a*); round at the bend, and in its average largest size 9-6000ths of an inch long, with a distance of 2-6000ths inch between the extremities (fig. 18). Size of largest entire specimen $3\frac{1}{4}$ inches long by 2-12ths in transverse diameter; that in which the echinating processes are most developed, 4-12ths inch in diameter.

Hab. Deep sea.

Loc. Atlantic Ocean, between the north coast of Scotland and the Faroe Islands.

Obs. This sponge appears in jars with the Nos. 52, 54, 57, and 27 on them respectively, also in a little bottle with no number. The three former numbers represent stations at which the depth was 384, 363, and 632 fathoms respectively. No. 27 is "Rockall Bank" (lat. 57° 35′ N. and long. 13° 41′ E.)—that is, rocks in the Atlantic, west of the Hebrides and "200 miles from the nearest land," with only 54 fathoms on them. With the latter is a small *Holtenia*, but nothing else in either of the other jars. The capitate variety (fig. 19) is in jar No. 54 by itself. Besides the general form of this sponge—which becomes club-shaped at maturity, and the echinating processes overrun and united together by the dermal sarcode into broken ridges or rows (fig. 16, *h*), the surface being formed of a layer of myriads of the little inequianchorates and forceps-like tricurvates (fig. 16, *f*), through which the ends of the skeleton-spicules project, especially towards the ends of the echinating processes—the peculiar form of the inequianchorate, which here and there is in groups like the well-known rosettes of *Esperia ægagropila* &c., and the minute little spicule with bulbous ends which so much resembles a pair of forceps, and must be regarded as a tricurvate, all, together with the single and characteristic form of the skeleton-spicule, point out the alliance of this sponge with *Esperia*, while the echinating processes in form and composition are very much like those of *Cladorhiza abyssicola*, which will be found to be another Esperian sponge. The Esperiadæ come into my 5th division, viz. Raynerlæ.

Chondrocladia virgata, Wyv. Thomson. Pl. XIV. figs. 20 & 21, and Pl. XV. fig. 38.

General form a tall, narrow stem, branching scantily and dichotomously, rendered more or less angular by the projection of conical processes arranged alternately round it in a confused spiral manner; each process inflated or jointed in the centre, and surmounted by an attenuated spine-like termination, equal in length to and of the same structure as the conical process. Conical processes and their attenuated spine-like portions diminishing in length towards the ends of the branches, whose stems, thus becoming finally divested of them, present a rounded, naked, *Esperia*-like appearance. Fixed by a spreading root. Colour greenish grey. Surface even, reticulate, composed of dermal sarcode, charged with the flesh-spicules of the species, and pierced by the pointed ends of small linear skeleton-spicules. Pores and vents not seen; probably the former are situated, as usual, in the interstices of the reticular surface of the dermis, and the vents scattered here and there. Internal structure, composed of an axis formed of long skeleton-spicules, arranged parallelly and perpendicularly together, from which radiate transversely bundles of the same kind of spicules to form the "conical processes" &c., imbedded in a parenchymatous sarcode charged with the flesh-spicules of the species, together with the smaller skeleton ones, which project through the surface. Axis and its spicules diminishing in size upwards from the base, where it forms, with the exception of a thin cortical portion, the whole of the stem, intermixed with parenchymatous structure; permeated by the excretory canal-system, and presenting a distinct spiral arrangement of the spicules. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. smooth, long, linear, slightly curved, fusiform, acuate or sub-pinlike, fine-pointed; average largest size 110 by 2-1800ths inch in its greatest diameters (Pl. XV. fig. 38); head narrower than the shaft. Flesh-spicules of two forms, viz. equianchorate and bihamate:—1st. Equianchorate (Pl. XIV. fig. 20): shaft curved, expanded or alate at each end (fig. 20, *a e*), which end is circular (fig. 20, *c e*), and from which rises the falx (fig. 20, *f*), supporting an umbrella-shaped head of seven arms or claws, of which the falx supplies the eighth (fig. 20, *d*), webbed together for half their length, and recurved obliquely towards the centre of the shaft; average largest size 16 by 5-6000ths inch in its greatest diameters, viz. in its total length and breadth of head respectively. 2nd. Bihamate: C-shaped, smooth, more or less contort and sigmoid, rather small; average largest size 6 by ½-6000th inch in its greatest diameters (fig. 21). Size of entire specimen about 3-12ths inch in diameter at the base, gradually diminishing upwards to a height of 8 to 16 inches (20 to 40 centimetres, Wyv. Thomson, 'Depths of the Sea'). Transverse processes about an inch long, and about 2-12ths inch in diameter at the base.

Hab. Deep sea.

Loc. Atlantic Ocean, between the north coast of Scotland and the Faroe Islands.

Obs. Although there is no number on the jar containing this sponge, the allusion to it in the Report of the 'Porcupine' Expedition for 1869 (Proceed. Roy. Soc. vol. xviii. no. 121, p. 443) shows, by the station ("52") therein mentioned, that it was dredged up here (between the north coast of Scotland and the Faroe Islands) in 384 fathoms. Dr. Wyville Thomson has inserted an excellent figure of it in his 'Depths of the Sea,' p. 188, to which I must refer the reader for an illustration of its general form; but the detail having been left for me to supply, it alone, with illustrations, is herewith given. There were four sponges dredged up on board the 'Porcupine' possessing allied forms of this anchorate, viz.:—that above described; that figured and described by Sars as *Cladorhiza abyssicola* ('Remarkable Forms of Animal Life from the Great Depths of the Norwegian Coast' (Eng.). Published by G. O. Sars. Christiania, 1872, p. 65, pl. vi. figs. 16–34); and another, which I shall hereafter describe and illustrate under the name of *Halichondria abyssi*, as far as the two very small fragments that have been preserved of it will permit.

In *Cladorhiza abyssicola*, Sars, the general form is a branched, shrub-like sponge, rising from a thick, solid, *Esperia*-like stem of spicules (that is, a stem very like in appearance to a glass rope, covered by a cortical layer of sarcode in its natural state), in which the branches are very numerous, often anastomosing by contact, and passing into a massive structure; branches echinated with short filamentous processes, and covered generally with a parenchymatous sarcode charged with the flesh-spicules of the species, viz. a small inequianchorate and a very large bihamate, more or less contort, with everted, fine, whip-like ends. Although the skeleton-spicule is similar to that of *Chondrocladia virgata*, Wyv. Thomson, and the anchorate presents one end like the anchorate of this sponge, with alate appendages on the shaft, fully developed (fig. 22), the whole at the other end is aborted, so as to demand for it the term "*in*-equianchorate" (fig. 22, *c*); while the bihamate, on the other hand, far exceeds in size that of *Chondrocladia*, being 37 by 1-6000th inch in its greatest diameters. I have figured the inequianchorate (Pl. XIV. fig. 22) for comparison, on the same scale, with the equianchorate of *Chondrocladia* (fig. 20) and that of *Halichondria abyssi* (fig. 27), to be described hereafter; but the bihamate is so large that I have not room for the figure of this spicule in this plate. (It seems to me that, in sponges possessing both the anchorate and bihamate flesh-spicules, the larger size of one is always accompanied by a lesser size of the other.) Besides these differences, the opaque cream-yellow colour of *Cladorhiza abyssicola* contrasts strongly with the translucent, greenish-grey one of *Chondrocladia virgata*.

The branched sponge named by Dr. Gray "*Axos Cliftonii*" ("Notes on Arrangement of Sponges," Proc. Zool. Soc. 1867, p. 546), from Nichol Bay, West Australia, must be very like *Chondrocladia virgata*, as the following extract from a note, with rough sketch, kindly handed over to me by Dr. Gray, shows, wherein it is stated to have been "found growing on a piece of rock about a foot square, in 27 branches, 2 feet long." In *Axos Cliftonii* the short, triangular, compressed processes on the stem, whose bases respectively rest longitudinally on the latter, are arranged in an aliform manner spirally round the stem—the skeleton-spicule, of which there is only one form, being acuate, and not fusiform, and the flesh-spicule, of which also there is only one form, being like a *Maltese cross*, with *six* arms, two of which are in a line perpendicular to the plane of the "cross," but so densely charging the parenchymatous sarcode which imbeds the bundles of skeleton-spicules forming the axis, that, altogether, we cannot help seeing in *Axos Clif-*

tonii a great resemblance in every way to *Chondrocladia virgata*.

The single and peculiar form of the skeleton-spicule in *Cladorhiza* and *Chondrocladia*, with the anchorate and bihamate, point to a strong alliance with *Esperia*, Carter, at the same time that their rigid stems, composed of closely united parallel spicules (in *Cladorhiza* anastomosing also) present a strong resemblance to the characteristic fibre-skeleton of *Esperia*.

Histoderma appendiculatum, n. gen. et sp. Pl. XIV. figs. 23–25 and Pl. XV. fig. 39, *a*, *b*.

General form subglobular, smooth, furnished with several narrow tubular prolongations of different lengths, some of which are longer than the diameter of the body (Pl. XIV. fig. 23). Free. Colour light grey. Composed of a stiff glistening bladder-like dermis (fig. 23, *a*), which also forms the walls of the tubuli (fig. 23, *b*), and encloses throughout a soft fibreless parenchyma. Dermis a woven-like texture, consisting of a dense layer of linear spicules intercrossing each other on the same plane, and held together by tough horny sarcode extending into the tubular prolongations, whose cylindrical walls respectively are similarly constructed, and, like the body, retain their form when dry and emptied of their contents. Tubuli terminating abruptly, each followed by a small conical eminence (fig. 23, *c*) which appears to have had the power of opening and closing itself as required. Pores and vents not distinctly seen, but probably situated at the extremities of the tubuli respectively, which, with the exception of one instance (fig. 23, *c*), from which the above description is taken, are all broken off. Internal structure massive, fibreless, charged with the spicules of the species and permeated by the excretory canal-systems, which appear to have had their vents respectively at the ends of the tubuli. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of two forms, viz.:—one, the largest, smooth, slightly curved, acuate, abruptly pointed, average largest size 64 by 1-1800th of an inch in its greatest diameters (Pl. XV. fig. 39, *a*); the smaller one smooth, slightly curved, fusiform, terminating at each extremity in a constricted neck, followed by a remarkably large elliptical pointed inflation, average largest size about 40 by $\frac{1}{2}$-1800th inch, inflated ends wider than the shaft (fig. 39, *b*). Flesh-spicules also of two forms, viz. bihamate and equianchorate. Bihamate (Pl. XIV.

fig. 25) smooth, C-shaped, more or less contort and sigmoid; average largest size about 21 by $1\frac{3}{4}$-6000th inch. Equianchorate (fig. 24, *a*, *b*) consisting of a simple shaft with three linear arms at each end, united to the former respectively by a short falx. Size of entire specimen about $\frac{1}{2}$ inch in diameter. Longest tube 1-12th inch in diameter and 9-12ths of an inch in length.

Hab. Deep sea.

Loc. Atlantic Ocean off the west coast of Ireland.

Obs. There are specimens of this sponge in two jars, numbered respectively "2" and "24" (*i. e.* Stations), which would give respectively the depths of 808 and 109 fathoms. In jar No. "2" it is in company with *Tisiphonia agariciformis*, Wy. Thomson, *Pachastrella abyssi*, Schmidt, *Tethya cranium*, *Hymedesmia Johnsoni*, Bk., *Halichondria ventilabrum*, *Geodia*, and deciduous fragments of a *Corallistes*; while in jar No. "24" it is in company only with *Hyalonema longissimum*, Sars (*op. cit.*), and *Tisiphonia agariciformis.*

There is a great resemblance in form and structure between this sponge and *Melonanchora elliptica*, inasmuch as both have the same silvery resilient dermal covering filled internally with soft, pulpy, fibreless parenchyma; but while in the latter the dermal structure is only extended to the base of the short tubercles with cribriform heads respectively, in the former, or *Histoderma*, it is extended into the walls of the tubes throughout, terminating abruptly, and followed by the cone of spicules above mentioned, of which unfortunately there is only one example left, the rest of the tubes having been broken off towards their ends.

With, therefore, no fibrous structure internally, it is evident that the bladder-like dermis is the skeleton or organ of support in these sponges.

In some specimens the tubes are shorter than in others; while in others there is nothing but a slight elevation of the surface surrounding a flat or sunken pore-area, but not formed of cribriform sarcode like that of the tubercles in *Melonanchora.*

When dried the specimens present an asbestine appearance from the densely packed spicules of the dermis, which, together with the stiff, horny sarcode that holds them together, forms a textile fabric that retains its form whether wet or dry.

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

March 26, 1874.—Joseph Dalton Hooker, C.B., President, in the Chair.

"On the Organization of the Fossil Plants of the Coal-measures. —Part VI. Ferns." By W. C. Williamson, F.R.S., Professor of Natural History in Owens College, Manchester.

The author called attention to the various methods of classifying the fern-stems and petioles of the Coal-measures adopted by Cotta, Corda, Brongniart, and others, and to the difficulties which attend those methods. Some of those difficulties had been already felt and partially removed by M. Brongniart. All the generic distinctions hitherto adopted were based upon variations in the form, number, and arrangement of the vascular bundles. These elements vary so much, not only in different species of the same genus, but in different parts of the same petiole, as to make them most untrustworthy guides to generic distinctions. The consequence has been an enormous multiplication of genera; but, notwithstanding their number, the author found that if he adopted the methods of his predecessors he would have to establish additional ones for the reception of his new forms. Under these circumstances he decides that it will be better to include the entire series of these petioles, provisionally, under the common generic term of *Rachiopteris*. This plan dispenses with a number of meaningless genera, and is rendered additionally desirable by the circumstance that all the petioles to which these numerous generic names have been applied belong to fronds which have already received other names, such as *Pecopteris*, *Sphenopteris*, &c.; only the structure of fronds found in the shales, and their respective petioles of which we have ascertained the structure, have not yet been correlated.

As a preparation for the present investigation, the author made an extensive series of researches amongst recent British and foreign fern-stems and petioles, with the object of ascertaining not only the modifications in their arrangements in different parts of the same plant, but especially of studying the modes in which secondary and tertiary vascular bundles were derived from the primary ones. This inquiry led him over the ground previously traversed by M. Trécul and, so far as British ferns were concerned, by Mr. Church.

The most common general forms exhibited by transverse sections of these bundles in recent petioles may be represented by the letters H, T, U, and X. As a general rule, the secondary bundles are given off from that part of the primary one which happens to be nearest to the secondary rachis to be supplied. Thus in some cases the upper arms of the X will merely be prolonged and their *ends* detached; in other cases a loop projects from the *side* of one or both arms of the U, and becomes detached as a ring.

The first petiole, described under the name of *Rachiopteris aspera*, is one in which transverse sections of the central vascular bundle exhibit modifications of the H form at its base, separating into two contiguous bundles higher up, and ultimately reverting to the V form—the gutter-shaped bundle (*en gouttière*) of M. Trécul. This is the plant to which, on a previous occasion, the author proposed to assign the generic name of *Edraxylon* (Proc. Roy. Soc. vol. xx. p. 438). The vessels are chiefly reticulate, with some of the barred and spiral types. The bark consists of a delicate inner parenchyma, the cubical cells of which are arranged vertically. This is enclosed in a coarser middle parenchyma; and the whole is surrounded by an outer layer, composed of intermingled parenchyma and prosenchyma, the latter being disposed in vertical fibrous bands, having wedge-shaped transverse sections, and being modifications of the sclerenchyma of authors. The outer surface of the bark is covered with innumerable little, obtuse, projecting cellular appendages, which are obviously abortive hairs. These appendages are relatively larger in the smaller rachis than in the larger petioles. In very young petioles transverse bands of small consolidated cells traverse the bark at numerous points, reminding us of the similar conditions seen in the *Heterangium Grievii*, described in a previous memoir. In the larger petioles these cellular bands have disappeared, and left in their places large intercellular lacunæ. Numerous fragments of the terminal rachis of the above plant have been obtained with the leaflets attached. For a long time the author believed that he could identify these with the detached leaflets of a *Pecopteris* which are very abundant in the Oldham nodules; but later researches have led to the conclusion that the plant has been a *Sphenopteris*, closely allied to, if not identical with, the *S. Hoeninghausi* of Brongniart. The author proposes the provisional name of *Rachiopteris aspera* for the above plant.

The next petiole described is one to which Mr. Binney proposed ('Proceedings of the Literary and Philosophical Society of Manchester,' Jan. 9, 1872) to give the name of *Stauropteris Oldhamia*. This is one of the plants of which the vascular bundle, when seen in transverse section, exhibits the appearance of the letter X. The vessels composing this bundle are barred ones; they are sometimes grouped in four slightly coherent clusters, with some delicate, vertically elongated cells in or near their central point of conjunction. The same kind of cellular tissue surrounds the bundle, forming a thin layer, which passes rapidly into a very thick layer of coarse prosenchyma, and which has evidently been hard and woody, as in many of the recent Adiantums. Towards the upper part of the petiole the vascular bundle becomes distinctly consolidated into a single cluster of crucial form; it then passes into a somewhat trifid form, and ultimately into a small cylindrical one. This petiole has branched much more freely than any of the others described. Two of the extremities of the crucial arms of the vascular bundle become first enlarged and then detached as two secondary bundles, which generally have an irregularly triangular transverse section, with long arms to the triangle. These triangular bundles are altogether different from the central axis of *Asterophyllites* described in a preceding memoir. The ultimate subdivisions of these secondary branches look more like the terminations of cylindrical rootlets than of petioles—which fact, combined with the circumstance that no traces of leaflets have been found associated with any of these ultimate twigs, renders the petiolar nature of this plant open to question, though the arguments in favour of its being a branching fern-petiole preponderate over those which militate against that conclusion. The author designates this plant *Rachiopteris Oldhamia.*

The next plant described is an exquisitely beautiful petiole from Burntisland, to two detached portions of which the author has already assigned the names of *Arpexylon duplex* and *A. simplex**, but which two forms he now proves to belong to the same plant. In the matured petiole the vascular bundle is always a double one. There is a central bundle, exhibiting a transverse section shaped like an hour-glass, one side of which is truncated and the other rounded, with a free, narrow, crescentic band at the more truncate of its enlarged extremities. At each of these extremities of the central bundle there is a longitudinal groove, which is shallow on the truncated side nearest to the crescentic bundle, but so surrounded by small vessels at the opposite convex side as often to become converted into a longitudinal canal. The hour-glass bundle always reappears in various specimens under the same aspect; but the crescentic one divides into two lateral halves, and the ends of each of these two subdivided parts curl under their more central portions. We thus obtain two of the crescentic structures previously designated *Arpexylon simplex.* These crescents are traced outwards through the bark to lateral secondary raches. The vessels thus detached from the truncated side of the central hour-glass bundle now reappear at its opposite and more convex side, whence, in turn, they again become detached; so that the truncate surface with its crescentic appendage, and the more oblate one with its almost closed canal, have alternately reversed their positions in the petiole as each secondary rachis was given off. Alternating distichous tertiary raches spring from these secondary ones.

Two plants which appear to be identical with those described by M. Renault, under the names of *Zygopteris Lacattii* and *Z. bibractiensis*, are next examined †. In these plants the section of the central bundle exhibits a form of the letter H. The vessels of the large central transverse bar are all reticulated ones: the greater part of those of the terminal vertical bars are of the same character; but the outermost vessels of those latter structures are

* Proceedings of the Royal Society, vol. xx. p. 438.

† Annales des Sciences Naturelles, 5e série, Bot. tome xii.

barred or quasi-scalariform. As in the case of *R. duplex*, already described, these outermost layers of barred vessels, accompanied by a few reticulated ones, become detached alternately from opposite sides of the H-shaped central bundle. Passing quickly through a thin delicate cellular inner bark, they enter the coarser parenchyma of a middle one, as two irregular clusters of vessels with one common investment prolonged from the innermost bark. On reaching the outer bark they become two distinct cylindrical bundles, each with its own delicate cortical investing layer; and thus invested, they emerge from the primary petiole to supply the secondary rachis.

The Oldham specimens of *Rachiopteris bibractiensis* agree with those described by M. Renault in having all their vessels of the barred type. The outer bark projects at numerous points in large conical abortive hairs, which almost assume a spinous aspect.

The author further figures and describes the section of a vascular axis, with a central cellular medulla surrounded by five contiguous crescentic masses of vascular tissue, whose concavities are directed outwards. This plant appears identical with the *Anarchopteris Decaisnii* of Renault.

May 21, 1874.—William Spottiswoode, M.A., Treasurer and Vice-President, followed by Dr. Sharpey, Vice-President, in the Chair.

"On the Structure and Development of *Peripatus capensis*." By H. N. Moseley, M.A., Naturalist to the 'Challenger' Expedition.

The author commences by expressing his obligations to Professor Thomson, who gave him assistance in some parts of his work, and every encouragement in the further prosecution of it.

Specimens of *Peripatus* were collected at the Cape of Good Hope during the stay of H.M.S. 'Challenger' at Simon's Bay, with a view to the investigation of the development of the animal. A specimen was dissected and at once seen to be provided with tracheæ, and to contain far developed young. This led to as careful an examination being made as time would permit, and hence the present paper. The most modern paper on *Peripatus* is that of Grube*. Grube, after examining the anatomy of the animal, came to the conclusion that it was hermaphrodite, and placed it among the "Bristle-Worms" in a separate order, Onychophora. Grube has been followed in most text-books, such as those of Claus and Schmarda; but uncertainty on the matter has been generally felt. De Quatrefages† follows Gervais in placing *Peripatus* in affinity with the Myriopods; and the result of the present investigation is to show that he is not far wrong.

The species made use of appears to be *Peripatus capensis*, described by Grube in the Zoological Series of the 'Novara' expe-

* Müller's Archiv, 1853. † Hist. des Annelés.

dition. The animal has invariably seventeen pairs of ambulatory members, a pair of oral papillæ, and two pairs of horny hooked jaws, shut in by tumid lips. The specimens found varied in length from 1·6 to 7 centims. (in the contracted condition). About thirty specimens were found, all of them but one at Wynberg, between Simon's Bay and Cape Town. The animals appear to be somewhat local and not very abundant; they live in damp places under trees, and especially frequent rotten willow-wood. They feed on rotten wood. They are nocturnal in their habits. They coil themselves up spirally like *Iulus* when injured. They have a remarkable power of extension of the body, and when walking stretch to nearly twice the length they have when at rest. They can move with considerable rapidity. They walk with the body entirely supported on their feet. Their gait is not in the least like that of worms, but more like that of caterpillars. When irritated they shoot out with great suddenness from the oral papillæ a peculiarly viscid tenacious fluid, which forms a meshwork of fine threads, with viscid globules on them at intervals, the whole resembling a spider's web with the dew upon it. The fluid is ejected at any injuring body, and is probably used in defence against enemies, such as insects, which would be held powerless for some time if enveloped in its meshes. The fluid is not irritant when placed on the tongue, but slightly bitter and astringent; it is as sticky as birdlime: flies, when they alight in it, are held fast at once. The fluid is structureless, but presents an appearance of fine fibrillation when dry. The animal is best obtained dead in an extended condition by drowning it in water, which operation takes four or five hours.

Only those points in anatomy are touched on which appear to have hitherto been wrongly or imperfectly described.

The intestinal tract is not straight, as described by Grube, but longer than the body, and usually presents one vertical fold; it presents numerous irregular sinuous lateral folds, but is not enlarged in every segment, as stated by Grube. Special regions, a muscular pharynx, short œsophagus, long stomach, and short rectum, are distinguished in the tract. The viscid fluid ejected from the oral papillæ is secreted by a pair of ramified tubular glands lying at the sides of the stomach and stretching nearly the whole length of the body. These glands are those described by Grube as testes; they show a common glandular structure, but no trace of testicular matter. A pair of enlargements on the ducts of the glands, provided with spirally arranged muscles, serve as ejaculatory reservoirs. The lateral elongate bodies lying outside the nerve-cords, considered by Grube to be vessels, show a fatty structure, vary much in extent, and are probably to be regarded as representing the fatty bodies of Tracheata.

No structure like that of the heart of Myriopods was found in the dorsal vessel.

The tracheal system consists of long fine tracheal tubes, which very rarely branch: these arise, in densely packed bunches, from short common tubes, which open all over the body by small outlets in the epidermis; these outlets have no regular structure, and are difficult to see. The whole of the tracheal system, very conspicuous in the fresh condition, becomes almost invisible when the animal examined has been a short time in spirit and the air has been thus removed from the tracheæ. Hence the failure of Grube to see them. The tracheæ are distributed in meshworks to all the viscera. The spiral filament is very imperfectly developed. A row of larger oval spiracles exists along the middle line of the under surface, the spiracles being placed opposite the interspaces of the feet, but not quite regularly. Other large spiracles exist on the inner sides of the bases of the feet. A large supply of tracheæ goes to the rectum and muscular pharynx. In many points the structure of the tracheal system resembles that in *Iulus*.

Peripatus is not hermaphrodite. Out of thirty specimens about ten were males. No outward distinction of the sexes could be discovered. The female organs consist of a small oblong ovary situate behind the stomach, about one sixth of the length from the end of the body; from this lead a pair of oviducts, which, at their terminations, become enlarged and perform a uterine function, appearing, when filled with embryos, like a string of sausages. In nearly all cases, even when the embryos were far advanced, two large masses of spermatozoa were found in the ovary, and others attached to the ovisacs externally. A long loop, formed by the oviducts on each side, being quite loose in the body, becomes often thrown into a knot through the constant protraction and retraction of the body-wall. The knot is known to sailors as an overhand knot on a bight. The knot sometimes becomes drawn very tight, and then prevents the passage of the embryos above it. A case was met with in which this had occurred. The upper parts of the oviducts were mortified off at the knot, and remained attached only to the ovary. The ducts were dilated into large single sacs, the usual constrictions between the embryos having disappeared, and were full of decomposed embryos and fatty tissue. The knot was met with in many specimens—in some cases on both sides of the body, in others on only one. The oviducts unite in a short common tube to open at the simple vulva. The male organs consist of a pair of large ovoid testes, surmounted by short tubular prostates. The vasa deferentia are long and tortuous, forming, near the testes, spiral coils in which the ducts are enlarged, and which may be called vesiculæ seminales. A muscular ejaculatory tube, or penis, lies on one side of the body—sometimes on one, sometimes on the other. One vas deferens passes across, at the end of the body, under both nerve-cords to join the penis; the other takes a more direct course, not passing under the cords at all. In the original condition both ducts probably passed one under each nerve-cord, to join the centrally placed common terminal tube, homologous with that of the female organs.

The spermatozoa are filamentary, as in insects and in *Scolopendra*, but not in *Iulus*. Their development is described. They are very long; and their tails have a spiral movement as well as an undulatory one. They twist into all sorts of loops.

The muscular tissue of *Peripatus* is unstriated.

The development of *Peripatus* was only partially followed. As a rule, all the embryos found in one mother are of the same age. In some cases slight differences were found, which were very valuable for determining the development of the parts of the mouth. The embryos lie coiled up in simple hyaline envelopes, enclosing an ovoid cavity, within the enlargements of the uterine tubes. In the earliest stage observed the embryo had large round cephalic lobes and was without members, but showed distinct segmentation about its middle; it was coiled up spirally, the head being free, the tail in the axis of the coil. Later on the embryo becomes bent round in an oval, with the tip of the tail resting between the antennæ.

The front members are formed first: they arise as undulations of the lateral wall of the body, which become pushed further and further outwards, and are at first hollow, formed of two layers of cells, the inner of which is reflected over the intestine. The members form one after another, from the head downwards. A line of segmentation is formed across the body before the pair of members swells out, but disappears as they develop. The wall of the digestive tract is, in the early condition, drawn out laterally at each interspace between the pairs of members, to become attached there to the body-wall. The cephalic lobes early show traces of a separation into two segments, anterior and posterior; from them, anteriorly, bud out the antennæ, which gradually become more and more jointed. The mouth forms before the anus.

The full number of body-members is very early attained. The second pair are the largest at first, but subsequently become the small oral papillæ. The first pair turn inwards towards the primitive mouth-opening, and, developing their claws greatly, form the pair of horny jaws; these are covered by processes which grow down from the lower part of the head, and which eventually unite with the tissues at the bases of the oral tentacles and form the tumid lips, which, eventually closing in, hide all the parts of the mouth in the adult. The head-processes are probably homologous with the mandibles of higher Tracheata, the horny jaws with the maxillæ and the oral papillæ with the foot-jaws of *Scolopendra*; a regular labrum is formed by a downward growth from the front of the head, but is eventually shut in by the tumid lips.

It is uncertain whether a corresponding structure beneath the mouth represents the second underlip of *Scolopendra* or a true labium. The foot-claws are developed in invaginations of the tips of the ambulacral members. The young members develop five joints each, the typical number in insects, and one which seems to be retained in the adult.

In the present state of our knowledge concerning the structure of *Peripatus*, the most remarkable fact in its structure is the wide divarication of the ventral nerve-cords. The fact was considered remarkable and dwelt upon in all accounts of *Peripatus* before the existence of tracheæ in the animal was known, and when it was thought to be hermaphrodite; but it is doubly remarkable now. The fact shuts off at once all idea of *Peripatus* being a degenerate Myriopod, the evidence against which possibility is overwhelming. The bilateral symmetry and duplicity of the organs of the body, the absence of striation in the muscles, of periodical moults of the larval skin in development, and of any trace of a primitive three-legged condition, taken in conjunction with the divarication of the nerve-cords, are conclusive. The parts of the mouth are not to be regarded as degraded to any great degree; and homologies for some of them, at least, may perhaps be found amongst the higher Annelids. The structure of the skin is not at all unlike that in some worms, especially in its chitinous epidermic layer, which occasionally strips off in large pieces as a thin transparent pellicle. The many points of resemblance of *Peripatus* to Annelids need not be dwelt upon; they led to its former placing in classification; but it is difficult to understand how the very unannelid-like structure of the foot-claws did not lead others beside De Quatrefages to draw a line between *Peripatus* and the Annelids. In being unisexual, *Peripatus* is like the higher Annelids, as well as the whole of the higher Tracheata. To Insects *Peripatus* shows affinities in the form of the spermatozoa, and the elaboration, structure, and bilateral symmetry of the generative organs, though there is a very slight tendency towards the unilaterality of Myriopods in the male organs.

To Insects, again, it is allied by the five-jointing of the feet and oral papillæ and the form and number of its claws. It should be remembered that spiders' feet are two-clawed, as are those of some Tardigrades, and that some of these latter forms have two-clawed feet in the early condition even when they possess more claws in the adult state. In Newport's well-known figure of the young *Iulus* with three pairs of limbs, the tips of these latter are drawn with *two* hair-like claws; these are not mentioned in the text. To the ordinary lepidopterous larva the resemblances of *Peripatus* are striking—as, for example, the gait, the glands (so like in their function and position to silk-glands), the form of the intestine, and the less perfect concentration of the nervous organs, as in larval insects. To Myriopods *Peripatus* is allied by the great variety in number of segments in the various species, in its habits, and in these especially to *Iulus*. The parts of the mouth perhaps show a form out of which those of *Scolopendra* were derived by modification; but the resemblance may be superficial. Our knowledge is not yet sufficient to determine such points. The usual difficulties occur in the matter. Segments may have dropped out or fused; and their original condition may not be represented at all in the process of development. In structure *Peripatus* is more like *Scolopendra* than *Iulus*, viz. in the many joints to the antennæ (in Chilognaths never more than fourteen), in the form of the spermatozoa, and in being viviparous, as are some *Scolopendræ*; further, in the position of the orifices of the generative glands and in the less perfect concentration mesially of the nerve-cords in *Scolopendra*.

Peripatus thus shows affinities, in some points, to all the main branches of the family tree of Tracheata; but a gulf is fixed between it and them by the divarication of the nerve-cords. Tending in the same direction are such facts as the non-striation of the muscles, the great power of extension of the body, the arrangement of the digestive tract in the early stage, the persistence of metamorphosis, and the nature of the parts of the mouth—the full history of the manner of origin of these being reserved.

There are many speculations as to the mode of origin of the tracheæ themselves in the Tracheata. Professer Häckel (' Biologische Studien,' p. 491) follows Gegenbaur, whose opinion is expressed in his ' Grundzüge der vergleichenden Anatomie,' p. 441. Gegenbaur concludes that tracheæ were developed from originally closed tracheal systems, through the intervention of the tracheal gills of primæval aquatic insects now represented as larvæ. If *Peripatus* be as ancient in origin as is here supposed, the condition of the tracheal system in it throws a very different light on the matter. *Peripatus* is the only Tracheate with tracheal stems opening diffusely all over the body. The Protracheata probably had their tracheæ thus diffused, and the separate small systems afterwards became concentrated along especial lines and formed into wide main branching trunks. In some forms the spiracular openings concentrated towards a more ventral line (*Iulus*); in others they took a more lateral position (Lepidopterous larvæ, &c.). A concentration along two lines of the body, ventral and lateral, has already commenced in *Peripatus*. The original Protracheate being supposed to have had numerous small tracheæ diffused all over its body, the question as to their mode of origin again presents itself. The peculiar form of the tracheal bundles in *Peripatus*, which consist of a number of fine tubes opening into the extremity of a single short common duct leading to the exterior of the body, seems to give a clue. The tracheæ are, very probably, modified cutaneous glands, the homologues of those so abundant all over the body in such forms as *Bipalium* or *Hirudo*. The pumping extension and contraction of the body may well have drawn a very little air, to begin with, into the mouths of the ducts; and this having been found beneficial by the ancestor of the Protracheate, further development is easy to imagine. The exact mode of development of the tracheæ in the present form must be carefully studied; there was no trace of these organs in the most perfect state of *Peripatus* which I obtained.

Professor Gegenbaur's opinion on the position of *Peripatus* (' Grundzüge der vergleichenden Anatomie,' p. 199) is, that its place among the worms is not certain, but that, at any rate, it connects ringed worms with Arthropods and flat worms. The general result of the present inquiry is to bear out Professor

Gegenbaur's opinion; but it points to the connexion of the ringed and flat worms, by means of this intermediate step, with three classes only of the Arthropods—the Myriopods, Spiders, and Insects, *i. e.* the Tracheata. From the primitive condition of the tracheæ in *Iulus*, and the many relations between *Peripatus* and *Scolopendra*, it would seem that the Myriopods may be most nearly allied to *Peripatus*, and form a distinct branch arising from it and not passing through Insects. The early three-legged stage may turn out as of not so much significance as supposed. If these speculations be correct, the Crustacea have a different origin from the Tracheata. *Peripatus* itself may well be placed amongst Professor Häckel's Protracheata; Grube's term Onychophora becomes no more significant than De Blainville's Malacopoda. Some notions of the actual history of the origin of *Peripatus* itself may be gathered from its development.

In conclusion I would beg indulgence for the many defects in this paper, due to the hurry with which it was written (all available time, almost up to the last moment of our sailing for the Antarctic regions, having been consumed in actual examination of the structure of *Peripatus*), and due, further, to the impossibility of referring to original papers in any scientific library. At all events it is hoped that *Peripatus* has been shown to be of very great zoological interest, as lying near one of the main stems of the great zoological family tree, and that further examination of the most minute character into the structure of this animal will be well repaid.

H.M.S. 'Challenger,' Simon's Bay, Cape of Good Hope,
December 17, 1873.

June 18, 1874.—Joseph Dalton Hooker, C.B., President, in the Chair.

"On Dredgings and Deep-sea Soundings in the South Atlantic, in a Letter to Admiral Richards, C.B., F.R.S." By Prof. Wyville Thomson, LL.D., F.R.S., Director of the Civilian Staff on board H.M.S. 'Challenger.'

Melbourne, March 17, 1874.

Dear Admiral Richards,—I have the pleasure of informing you that, during our voyage from the Cape of Good Hope to Australia, all the necessary observations in matters bearing upon my department have been made most successfully at nineteen principal stations, suitably distributed over the track, and including Marion Island, the neighbourhood of the Crozets, Kerguelen Island, and the Heard group.

After leaving the Cape several dredgings were taken a little to the southward, at depths from 100 to 150 fathoms. Animal life was very abundant; and the result was remarkable in this respect, that the general character of the fauna was very similar to that of the North Atlantic, many of the *species* even being identical with those on the coasts of Great Britain and Norway. The first day's dredging was in 1900 fathoms, 125 miles to the south-westward of Cape Agulhas; it was not very successful.

Marion Island was visited for a few hours, and a considerable collection of plants, including nine flowering species, was made by Mr. Moseley. These, along with collections from Kerguelen Island and from Yong Island, of the Heard group, are sent home with Mr. Moseley's notes, for Dr. Hooker's information.

A shallow-water dredging near Marion Island gave a large number of species, again representing many of the northern types, but with a mixture of southern forms, such as many of the characteristic southern Bryozoa and the curious genus *Serolis* among Crustaceans. Off Prince Edward's Island, the dredge brought up many large and striking specimens of one or two species of Alcyonarian zoophytes, allied to *Mopsea* and *Isis*.

The trawl was put down in 1375 fathoms on the 29th December, and in 1600 fathoms on the 30th, between Prince Edward's Island and the Crozets. The number of species taken in these two hauls was very large; many of them belonged to especially interesting genera; and many were new to science. I may mention that there occurred, with others, the well-known genera *Euplectella*, *Hyalonema*, *Umbellularia*, and *Flabellum*, two entirely new genera of stalked Crinoids belonging to the Apiocrinidæ, *Pourtalesia*, several Spatangoids new to science (allied to the extinct genus *Ananchytes*), *Salenia*, several remarkable Crustaceans, and a few fish.

We were unfortunately unable to land on Possession Island on account of the weather; but we dredged in 210 fathoms and 550 fathoms, about 18 miles to the S.W. of the island, with a satisfactory result. We reached Kerguelen Island on the 7th of January, and remained there until the 1st of February. During that time Dr. v. Willemöes-Suhm was chiefly occupied in working out the land-fauna, Mr. Moseley collected the plants, Mr. Buchanan made observations on the geology of those parts of the island which we visited, and Mr. Murray and I carried on the shallow-water dredging in the steam-pinnace. Many observations were made, and large collections were stored in the different departments. We detected at Kerguelen Island some peculiarities in the reproduction of several groups of marine invertebrates, and particularly in the Echinodermata, which I have briefly described in a separate paper.

Two days before leaving Kerguelen Island, we trawled off the entrance of Christmas Harbour; and the trawl-net came up, on one occasion, nearly filled with large cup-sponges belonging to the genus *Rossella* of Carter, and probably the species dredged by Sir James Clark Ross near the ice-barrier, *Rossella antarctica*.

On the 2nd of February we dredged in 150 fathoms, 140 miles south of Kerguelen, and on the 7th of February off Yong Island, in both cases with success.

We reached Corinthian Bay, in Yong Island, on the evening of the 6th, and had made all arrangements for examining it, as far as possible, on the following day; but, to our great disappointment, a sudden change of weather obliged us to put to sea. Fortunately

Mr. Moseley and Mr. Buchanan accompanied Captain Nares on shore for an hour or two on the evening of our arrival, and took the opportunity of collecting the plants and minerals within their reach. A cast of the trawl taken in lat. 60° 52′ S., long. 80° 20′ E., at 1260 fathoms, was not very productive, only a few of the ordinary deep-sea forms having been procured.

Our most southerly station was on the 14th of February, lat. 65° 42′ S., long. 79° 49′ E. The trawl brought up, from a depth of 1675 fathoms, a considerable number of animals, including Sponges, Alcyonarians, Echinids, Bryozoa, and Crustacea, all much of the usual deep-sea character, although some of the species had not been previously observed. On February 26th, in 1975 fathoms, *Umbellulariæ*, *Holothuriæ*, and many examples of several species of the *Ananchytidæ* were procured; and we found very much the same group of forms at 1900 fathoms on the 3rd of March. On the 7th of March, in 1800 fathoms, there were many animal forms, particularly some remarkable starfishes, of a large size, of the genus *Hymenaster*; and on the 13th of March, at a depth of 2600 fathoms, with a bottom-temperature of 0°·2 C., *Holothuriæ* were abundant, there were several starfishes and *Actiniæ*, and a very elegant little Brachiopod occurred attached to peculiar concretions of manganese which came up in numbers in the trawl.

In nine successful dredgings, at depths beyond 1000 fathoms, between the Cape and Australia:—

Sponges were met with on	6	occasions.
Anthozoa Octactinia	7	,,
—— Polyactinia	6	,,
Crinoidea	4	,,
Asteroidea	8	,,
Ophiuridea	9	,,
Echinidea		
Holothuridea	8	,,
Bryozoa	6	,,
Tunicata	5	,,
Sipunculacea	3	,,
Nematodes	1	,,
Annelida	8	,,
(*Myzostomum*)	2	,,
Balanoglossus	1	,,
Cirripedia	4	,,
Ostracoda	1	,,
Isopoda	7	,,
Amphipoda	3	,,
Schizopoda	5	,,
Decapoda Macrura	6	,,
—— Brachyura	2	,,
Pycnogonida	2	,,
Lamellibranchiata	5	,,
Brachiopoda	2	,,

Gasteropoda	4	occasions.
Cephalopoda	3	,,
Teleostei	6	,,

It is of course impossible to determine the species with the books of reference at our command; but many of them are new to science, and some are of great interest from their relation to groups supposed to be extinct. This is particularly the case with the Echinodermata, which are here, as in the deep water in the north, a very prominent group.

During the present cruise special attention has been paid to the nature of the bottom, and to any facts which might throw light upon the source of its materials.

This department has been chiefly in the hands of Mr. Murray; and I have pleasure in referring to the constant industry and care which he has devoted to the preparation, examination, and storing of samples. I extract from Mr. Murray's notes:—

"In the soundings about the Agulhas bank, in 100 to 150 fathoms, the bottom was of a greenish colour, and contained many crystalline particles (some dark-coloured and some clear) of Foraminifera, species of *Orbulina*, *Globigerina*, and *Pulvinulina*, a pretty species of *Uvigerina*, *Planorbulina*, *Miliolina*, *Bulimina*, and *Nummulina*. There were very few Diatoms.

"In the deep soundings and dredgings before reaching the Crozets, in 1900, 1570, and 1375 fathoms, the bottom was composed entirely of *Orbulina*, *Globigerina*, and *Pulvinulina*, the same species which we get on the surface, but all of a white colour and dead. Of Foraminifera which we have not got on the surface I noticed one *Rotalia* and one *Polystomella*, both dead. Some Coccoliths and Rhabdoliths were also found in the samples from these soundings. On the whole, these bottoms were, I think, the purest carbonate of lime we have ever obtained. When the soundings were placed in a bottle and shaken up with water, the whole looked like a quantity of sago. The *Pulvinulinæ* were smaller than in the dredgings in the Atlantic. We had no soundings between the Crozets and Kerguelen.

"The specimens of the bottom about Kerguelen were all from depths from 120 to 20 fathoms, and consisted usually of dark mud, with an offensive sulphurous smell. Those obtained furthest from land were made up almost entirely of matted sponge-spicules. In these soundings one species of *Rotalina* and one other Foraminifer occurred.

"At 150 fathoms, between Kerguelen and Heard Island, the bottom was composed of basaltic pebbles. The bottom at Heard Island was much the same as at Kerguelen.

"The sample obtained from a depth of 1260 fathoms, south of Heard Island, was quite different from any thing we had previously obtained. It was one mass of Diatoms, of many species, and, mixed with these, a few small *Globigerinæ* and Radiolarians and a very few crystalline particles.

"The soundings and dredgings while we were among the ice in 1675, 1800, 1300, and 1975 fathoms, gave another totally distinct deposit of yellowish clay, with pebbles and small stones, and a considerable admixture of Diatoms, Radiolarians, and *Globigerinæ*. The clay and pebbles were evidently a sediment from the melting icebergs; and the Diatoms, Radiolarians, and Foraminifera were from the surface-waters.

"The bottom from 1950 fathoms, on our way to Australia from the Antarctic, was again exactly similar to that obtained in the 1260-fathoms sounding south of Heard Island. The bottom at 1800 fathoms, a little further to the north (lat. 50° 1′ S., long. 123° 4′ E.), was again pure '*Globigerina*-ooze,' composed of *Orbulinæ*, *Globigerinæ*, and *Pulvinulinæ*.

"The bottom at 2150 fathoms (lat. 47° 25′ S., long. 130° 32′ E.) was similar to the last, with a reddish tinge; and that at 2600 fathoms (lat. 42° 42′ S., long 134° 10′ E.) was reddish clay, the same which we got at like depths in the Atlantic, and contained manganese nodules and much-decomposed Foraminifera."

Mr. Murray has been induced, by the observations which have been made in the Atlantic, to combine the use of the towing-net, at various depths from the surface to 150 fathoms, with the examination of the samples from the soundings. And this double work has led him to a conclusion in which I am now forced entirely to concur, although it is certainly contrary to my former opinion—that the bulk of the material of the bottom in deep water is, in all cases, derived from the surface.

Mr. Murray has demonstrated the presence of *Globigerinæ*, *Pulvinulinæ*, and *Orbulinæ* throughout all the upper layers of the sea over the whole of the area where the bottom consists of "*Globigerina*-ooze" or of the red clay produced by the decomposition of the shells of Foraminifera; and their appearance when living on the surface is so totally different from that of the shells at the bottom, that it is impossible to doubt that the latter, even although they frequently contain organic matter, are all dead. I mean this to refer only to the genera mentioned above, which practically form the ooze. Many other Foraminifera undoubtedly live, in comparatively small numbers, along with animals of higher groups, on the bottom.

In the extreme south the conditions were so severe as greatly to interfere with all work. We had no arrangement for heating the work-rooms; and at a temperature which averaged for some days 25° F., the instruments became so cold that it was unpleasant to handle them, and the vapour of the breath condensed and froze at once upon glass and brass work. Dredging at the considerable depths which we found near the Antarctic Circle became a severe and somewhat critical operation, the gear being stiffened and otherwise affected by the cold; and we could not repeat it often.

The evening of the 23rd of February was remarkably fine and calm; and it was arranged to dredge on the following morning. The weather changed somewhat during the night, and the wind rose. Captain Nares was most anxious, however, to carry out our object, and the dredge was put over at 5 A.M. We were surrounded by icebergs; the wind continued to rise, and a thick snow-storm came on from the south-east. After a time of some anxiety the dredge was got in all right; but, to our great disappointment, it was empty: probably the drift of the ship and the motion had prevented its reaching the bottom. In the mean time the wind had risen to a whole gale (force=10 in the squalls), the thermometer fell to 21°·5 F., the snow drove in a dry blinding cloud of exquisite star-like crystals, which burned the skin as if they had been red-hot; and we were not sorry to be able to retire from the dredging-bridge.

Careful observations on temperature are already in your hands, reported by Captain Nares. The specific gravity of the water has been taken daily by Mr. Buchanan; and, during the trip, Mr. Buchanan has determined the amount of carbonic acid in 24 different samples—15 from the surface, 7 from the bottom, and 2 from intermediate depths. The smallest amount of carbonic acid was found in surface-water on the 27th January, near Kerguelen; it amounted to 0·0373 gramme per litre. The largest amount, 0·0829 gramme per litre, was found in bottom-water on the 14th February, when close to the Artarctic ice. About the same latitude the amount of carbonic acid in surface-water rose to the unusual amount of 0·0656 gramme per litre; in all other latitudes it ranged between 0·044 and 0·054 gramme per litre. From the greater number of these samples the oxygen and nitrogen were extracted, and sealed up in tubes.

The considerations connected with the distribution of temperature and specific gravity in these southern waters are so very complicated, that I prefer postponing any general *résumé* of the results until there has been time for full consideration.

While we were among the ice all possible observations were made on the structure and composition of icebergs. We only regretted greatly that we had no opportunity of watching their birth, or of observing the continuous ice-barrier from which most of them have the appearance of having been detached. The berg- and floe-ice was examined with the microscope, and found to contain the usual Diatoms. Careful drawings of the different forms of icebergs, of the positions which they assume in melting, and of their intimate structure were made by Mr. Wild; and instantaneous photographs of several were taken from the ship.

Upwards of 15,000 observations in meteorology have been recorded during the trip to the south. Most of these have already been tabulated and reduced to curves, and otherwise arranged for reference in considering the questions of climate on which they bear.

Many specimens in natural history have been stored in about seventy packing-cases and casks, containing, besides dried specimens, upwards of 500 store-bottles and jars of specimens in spirit.

I need only further add that, so far as I am able to judge, the expedition is fulfilling the object for which it was sent out. The naval and the civilian staff seem actuated by one wish to do the utmost in their power, and certainly a large amount of material is being accumulated.

The experiences of the last three months have of course been somewhat trying to those of us who were not accustomed to a sea-life; but the health of the whole party has been excellent. There has been so much to do that there has been little time for weariness; and the arrangements continue to work in a pleasant and satisfactory way.

(Signed) Charles Wyville Thomson.

MISCELLANEOUS.

A new Order of Hydrozoa. By George J. Allman, F.R.S. &c.

On the southern shores of France, at a slight depth below the surface of the sea, there may be found attached to stones small patches of one of the horny sponges which will probably arrest the attention of the zoologist by what will appear to him as an unusually obvious and well-defined condition of their efferent orifices or oscula.

If one of these patches be transferred to a phial of sea-water, the observer will soon be astonished by seeing that from every one of the apparent oscula a beautiful plume of hydroid tentacles will have become developed, and he will naturally believe that the form has at last been found which will remove all doubt as to the zoological position of the sponges, and decide in favour of the hydroid affinities recently assigned to them *.

A more careful examination, however, will show that the orifices on the surface have been incorrectly regarded as oscula, and that the tentacles form no part of the sponge, but proceed from an entirely different organism which is imbedded in its substance.

It will be further seen that the organism with which the sponge is thus associated is contained in a congeries of chitinous tubes which permeate the sponge-tissue, and open on its surface in the manner of genuine oscula; and it will be still further apparent that this organism, while undoubtedly a hydrozoon, and even presenting quite the aspect of a hydroid trophosome, is no hydroid at all, and cannot indeed be referred to any of the hitherto recognized orders of the Hydrozoa, but must take its place in an entirely new and as yet undefined order of this class.

The chitinous tubes and their contents are united by a common tubular plexus which lies towards the base of the sponge, and they thus constitute a composite colony of zooids. The tubes, towards their free extremities, where they open on the surface of the sponge,

* See Haeckel's "Kalkschwämme."

become much increased in width; and here their contents become developed into a very remarkable body, which has the power of extending itself beyond the orifice of the tube, and of again withdrawing itself far into the interior, exactly like the hydranth or polypite of a campanularian hydroid in its hydrotheca. When extended, it displays from around the margin of a wide terminal orifice its beautiful crown of tentacles; but when withdrawn into the interior of the cup-like receptacle, the tentacles are greatly contracted and thrown back into the cavity of its body. Its general appearance, indeed, is very like that of a campanularian hydranth; and a careful examination is needed in order to show that it possesses all the essential characters, not of a hydranth, but of a medusa. It has a circular canal surrounding the terminal orifice and supporting the tentacular crown, and it has four symmetrically disposed longitudinal canals extending from the circular canal backwards in the walls of the body. No manubrium could be detected, though this was carefully sought for at the point where it might be expected to be found—namely, where the medusiform zooid passes into the common cœnosarc which occupies the narrower portion of the tube; neither was there any appearance of a velum, nor of lithocysts or ocelli; but these are comparatively unessential modifications.

The reproductive system is probably developed in the walls of the longitudinal canals; but in none of the specimens examined was this part of the organization sufficiently mature to admit of a satisfactory demonstration.

For the little animal thus constructed I propose the name of *Stephanoscyphus mirabilis*. Whether it is to be regarded as parasitically connected with the sponge, or whether the two are only accidentally associated, it is at present impossible to say. At all events, in no instance did I find the *Stephanoscyphus* unaccompanied by the sponge.

Stephanoscyphus may then be regarded as a compound hydrozoon whose zooids are included in cup-like receptacles resembling the hydrothecæ of the calyptoblastic hydroids; but these zooids, instead of being constructed like the hydranths of a hydroid, are formed on the plan of a medusa. It has plainly very decided affinities with the Hydroida, but is nevertheless removed from these by a distance at least as great as that which separates from them the Siphonophora. It thus becomes the type of a new hydrozoal order, for which I propose the name of THECOMEDUSÆ.—*Nature*, July 30, 1874.

Description of the Skull of a new Species of Dolphin (Feresa attenuata). By Dr. J. E. GRAY, F.R.S. &c.

The British Museum has lately received from M. Godeffroy, of Hamburg, a skull of a dolphin (but, unfortunately, it is without any habitat) which proves to be an unrecorded species of the genus *Feresa*.

The only other species of the genus, *Feresa intermedia*, has a broad muscle, dilated and rounded in front: the teeth are large and thick, the upper hinder one being smaller and more slender; three teeth on the side of the jaw occupy $1\frac{5}{12}$ inch; there are eleven teeth on each side above, and twelve below.

The skull of the new species (*Feresa attenuata*) is very like that of the former; but the beak, instead of being dilated in front, becomes gradually narrower and is rather acute in front. Its teeth are considerably smaller and further apart. The three teeth in the middle of the sides of the jaw occupy $1\frac{1}{6}$ inch of the margin; the two or three hinder teeth on each side of the upper jaw are much smaller and more slender than the others. The total length of the skull from the condyle to the front of the beak is $13\frac{1}{2}$ inches; the width of the skull over the front of the eyebrows is 8 inches; width of the beak at the front of notch $4\frac{1}{3}$ inches, and at two thirds its length $2\frac{3}{4}$ inches; length of tooth-line 5 inches.

The genus *Feresa* is known from the other Lagorhynchina by having only ten or twelve teeth on each side of the jaw; whereas all the other genera have much more numerous teeth, from twenty to thirty, and the teeth in all the other genera are slender. *Feresa intermedia* has such large teeth that it was first described as an *Orca*, and was thought by Mr. Flower to be the young of that genus. In *Feresa attenuata* the teeth are much more slender and further apart, and in this respect resemble the teeth of the other genera of the tribe; but it is at once known by the limited number. It also agrees with the genus *Electra* in the attenuated form of the beak.

Note on Iphiclides Ajax. By RAPHAEL MELDOLA.

In a communication made by Mr. S. H. Scudder to the Natural History Society of Boston in October last, and reprinted in the pages of this Magazine*, the author has done me the favour of making some remarks on a paper published by me in the 'Annals and Magazine of Natural History' for October last †. Having waited in vain up to the present time for the arrival of the Society's 'Proceedings,' I think it advisable to publish these remarks without further delay.

I am indebted to Mr. Scudder for pointing out the true signification of Mr. Edwards's tabulated results—a signification which it is difficult to gather from the text. It is to be regretted that Mr. Edwards did not affix an explanatory note to the numerical results given in his Table in the 'Butterflies of North America.' As this table now stands, it is apt to be taken for a general summary giving results that are to be considered true for each of the polymorphic forms of the insect, under all conditions. With regard to the issue of Mr. Scudder's remarks, however, I may state that these do not in any way affect the main conclusion arrived at by me in the

* Ser. 4, vol. xiii. p. 186. † Vol. xii. p. 301 *et seqq.*

paper referred to. *The polymorphic forms of* I. Ajax *do not conform to the law of substance-waste.* Perhaps Mr. Scudder, who has ample opportunities of studying this interesting species, may be induced to turn his attention to the subject and attack it experimentally.

August 3, 1874.

Tube-building Amphipoda. By S. I. Smith.

In examining recently an alcoholic specimen of a species of *Xenoclea*, I noticed a peculiar opaque glandular structure filling a large portion of the third and fourth pairs of thoracic legs, which in most, if not all, the non-tubebuilding Amphipoda are wholly occupied by muscles. A further examination shows that the terminal segment (dactylus) in these legs is not acute and claw-like, but truncated at the tip and apparently tubular. In this species, a large cylindrical portion of the gland lies along each side of the long basal segment, and these two portions uniting at the distal end pass through the ischial and along the posterior side of the meral and carpal segments and doubtless connect with the tubular dactylus. There can be no doubt that these are the glands which secrete the cement with which the tubes are built, and that these two pairs of legs are specialized for that purpose.

A hasty examination revealed a similar structure of the corresponding legs in *Amphithoë maculata, Ptilocheirus pinguis, Cerapus rubricornis, Byblis Gaimardi*, and a species of *Ampelisca*. In all these except the last two a very large proportion of the gland is in the basal segment. In the *Amphithoë* this segment is thickened and the gland is in the middle. In the *Cerapus* it is very broad and almost entirely filled by the gland, with only very slender muscles through the middle, and the orifice in the dactylus is not at the very tip, but subterminal on the posterior side. In the *Ptilocheirus* the gland forms three longitudinal masses in the basal segment and is also largely developed in the meral and carpal segments. The dactylus is long and slender, and the orifice subterminal. In *Ampelisca* and *Byblis* (which, like *Haploöps*, are tube-building genera) the meral segments of the specialized legs are nearly as large as the basal, and contain a proportionally large part of the gland. In these genera the remarkable elongation of the two distal segments in the third and fourth pairs of legs is perhaps a special adaptation to enable them to reach back over the deep epimera.

The examination of fresh specimens will doubtless show these structures much more fully.—*Silliman's American Journal*, June 1874.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

No. 82. OCTOBER 1874.

XXX.—*On the Genera* Paradoxurus, Platyschista, *and* Paguma; *and Notes on some Species lately received in the British Museum.* By Dr. J. E. Gray, F.R.S. &c.

The Musk-Weasel of Pennant and its congeners are peculiar among the Viverridæ, and indeed among the Carnivora, for having an elongate naked glandular fold of skin, the secretion of which emits a musky odour, situated on the hinder part of the abdomen, between the thighs. In the males it occupies the whole underside of the sheath of the penis, between the front of the scrotum (which is well developed and placed close to the anus) and the exit of that organ; in the females it is elongate, situated just in front of the opening of the female organ, which is placed close to the vent. This glandular structure is probably similar to the glands of the civets at the sides of the anus, but is very differently situated.

Pallas described this animal under the name *Viverra hermaphrodita*, on account of the glandular fold. Frédéric Cuvier, who had a living specimen of this animal, does not notice this peculiarity of the glandular structure of the abdomen, but establishes a genus for it; and, as the specimen which he described had the tail abnormally twisted, he called it *Paradoxurus*. Temminck truly observes that in form the tails of these genera are "nullement caractéristiques, pas même spécifiquement pour son Pougouné." But as these animals have generally the habit of curling up the tip of the tail as they lie on the ground, the tip of the tail, of those at least in confinement, has the hair more or less worn off on one of its sides. Otto some years afterwards described and figured the glandular organ on the abdomen, and formed a genus for the animal, under the name *Platyschista*.

Ogilby, Temminck, and others have described a series of semiplantigrade *Viverræ* as species of the genus *Paradoxurus*. I have formed, from differences in their dentition and the form of the skull, the genera *Paguma*, *Arctogale*, and *Nandinia* for some of the species so described; and in describing *Arctogale* I observed that the hinder part of the abdomen was like that of the other *Viverrinæ*, and without the glandular development; and lately examining the well-preserved skin of *Paradoxurus stigmaticus* of Temminck, I found that it had the hinder part of the abdomen similarly covered with hair; and on examining with care the stuffed specimens and the skins in the Museum I found that all the species of *Paguma* and *Nandinia* were equally deficient of this glandular structure. I have seen but one or two species of these animals alive, and do not recollect to have observed their tails curled at the end; nor do any of the skins show the hair partly worn off on one side of the tip, which is common in *Paradoxurus*.

The species of *Paradoxurinæ* in the British Museum will therefore, after careful examination, be arranged thus:—

I. *The hinder part of the abdomen with an elongated naked glandular fold.*

PARADOXURUS.

* *Back spotted.*

1. *Paradoxurus hermaphroditus*. India.
2. *P. nigrifrons*. India.
3. *P. fasciatus*. Java and Sumatra.
4. *P. dubius*. Java and Sumatra.

** *Back streaked.*

5. *P. philippensis*. Philippines.

*** *Back uniform grizzled.*

6. *P. bondar*. India.

II. *The hinder part of the abdomen between the thighs covered with hair, without any glandular fold.*

PAGUMA. Back uniform grizzled.

1. *Paguma zeylanica.* Ceylon.
2. *P. Crossii.* India.
3. *P. Grayii.* India, Nepal.
4. *P. Tytleri.* Andaman Islands.
5. *P. stigmatica.* Borneo.
6. *P. leucomystax.* Sumatra and Borneo.
7. *P. larvata.* China.

ARCTOGALE. Back streaked.

8. *Arctogale trivirgata.* Java and Sumatra.

NANDINIA. Back spotted.

9. *Nandinia binotata.* West Africa.

The British Museum has lately received, since the publication of the 'Catalogue,' two additional species of the genus.

In the year 1871 the Museum received from Edward Gerrard, jun., an adult specimen with its skull of a *Paradoxurus* from North Borneo, which is quite distinct from any other in the British Museum.

This species is probably the *Paradoxurus stigmaticus* of Temminck's 'Esquisses Zoologiques,' p. 120, described from a single old male specimen in the Museum of Leyden.

This species is very peculiar for its nearly uniform brown colour, with blacker head and extremities, black whiskers, and a narrow white stripe or, rather, elongated spot on the nose. The colour of the whiskers and the stripe on the nose at once distinguish it from *P. leucomystax* and *P. Tytleri*, which agree with it in being of a nearly uniform colour, but have nearly white whiskers and a dark spotless nose.

1. *Paguma stigmatica.* Black-whiskered Paguma.

Paradoxurus stigmaticus, Temminck, Esq. Zool. p. 120; Cat. Carniv. Brit. Mus. p. 76.

Fur nearly uniform rather ashy brown; whiskers elongate, black; the face, the lower lip, fore and hind feet, and the hinder half of the tail blackish or black; the middle of the nose, in front of the eyes, with an indistinct short white streak, from the pale tips to the hairs; the hair at the top of the head and of the fore and hind legs darker, with small white tips; the middle of the throat, the chest, and underside of the body ashy; the hairs on the underside of the middle of the tail with long silver ends. Length of head and body 21 inches: tail about the same length; but it is probably lengthened, as it is very slender and has a stick inside it.

Hab. North Borneo. B.M.

The white spot, from which Temminck named the species, is very small and indistinct in the British-Museum specimen; but I suppose it is the same as his species, which comes from Borneo, and which he describes as having a "pure white longitudinal band extending from the forehead to the origin of the muffle, covering the ridge of the nose."

It is to be observed that all the plain *Paradoxuri* have a more or less distinct indication of a streak down the nose. The other parts of Temminck's description agree with what a brighter and more adult specimen of this animal would be. This species is at once known from the other *Pagumæ* by its black whiskers, whereas in almost all the other species they are white. The whiskers differ in strength in the species, being strongest in *P. leucomystax* and most slender and weakest in *P. zeylanica.* It is to be observed that though this is so characteristic, it is not mentioned in Temminck's description.

The British Museum received in 1870 the specimen of *Paradoxurus* from the Andaman Islands presented to the Zoological Society by Mr. Arthur Grote in May 1865, and said to be *Paradoxurus Tytleri* of Blyth (see P. Z. S. 1865, p. 466). As I do not know where this very distinct species is described, I send the following short note of it, as it is perfectly distinct from all the other species in the British Museum.

2. *Paguma Tytleri.*

Paradoxurus Tytleri, Blyth: P. Z. S. 1865, p. 466.

Fur rather long, not dense, pale greyish brown, with long white tips; the sides of the neck, the throat and upper parts of the body, and the insides of the limbs ashy white; the face, the sides of the lower jaw, and the fore and especially the hind feet darkish brown; the cheeks under the eye, the forehead, and a narrow line down the centre of the nose paler, with paler tips to the hairs; whiskers white, scarcely as strong as in *P. leucomystax.*

Hab. Andaman Islands. B.M.

XXXI.—*Descriptions and Figures of Deep-sea Sponges and their Spicules from the Atlantic Ocean, dredged up on board H.M.S. 'Porcupine,' chiefly in* 1869*; with Figures and Descriptions of some remarkable Spicules from the Agulhas Shoal and Colon, Panama.* By H. J. CARTER, F.R.S. &c.

[Concluded from p. 221.]

Halichondria abyssi, n. sp. Pl. XIV. figs. 26–28, and Pl. XV. fig. 40, *a*, *b*, *c*.

General form unknown. Sessile, spreading horizontally. Colour grey or brown. Internal structure massive, consisting of an areolar skeleton formed of polygonally arranged bundles of spicules covered with sarcode (Pl. XIV. fig. 26). Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of three forms, viz.:—the longest, smooth, curved, fusiform acerate, fine-pointed, average largest size 45 by $\frac{2}{3}$-1800th inch in its greatest diameters (Pl. XV. fig. 40, *a*); shorter spicule, stout, smooth, acuate, curved, rather abruptly pointed, averaging in its largest size 35 by 1-1800th inch in its greatest diameters (fig. 40, *b*); smallest form smooth, curved, fusiform, inflated equally at each extremity, average largest size 22 by $\frac{1}{2}$-1800th inch in its greatest diameters (fig. 40, *c*). Flesh-spicules of two forms, viz. equianchorate and tricurvate. Equianchorate (Pl. XIV. fig. 27, *a*, *b*): shaft round, much curved, almost bent, expanded but not alate at the ends, where the expansion extends into a claw- or clam-shaped umbrella-like head, composed of six linear recurved arms webbed together nearly to the extremities; average largest size 16 by 3-6000ths inch in its greatest diameters, viz. length of shaft and width of head respectively. Tricurvate (fig. 28) stout, 18 by 1-6000th inch in its greatest diameters. Size of entire fragments each about $\frac{1}{2}$ inch in diameter and 1-12th inch thick.

Hab. Deep sea, on deciduous shells.

Loc. Atlantic Ocean. Between the north coast of Scotland and the Faroe Islands.

Obs. The jars containing these two fragments respectively bear the No. "65," which station gives a depth of 345 fathoms. That in the smaller jar is of the least consequence, being a mere unconnected formless fragment of a brown colour; while the other (which is figured) has grown over the concavity of a small ostraceous bivalve shell (fig. 26, *b*), and is of a lighter colour, but at once reveals the structure and habitat of the sponge, although, from being only a fragment with none of the surface left, it fails to afford its general form. The unconnected brown fragment is in company with specimens of *Tisiphonia agariciformis* only; while that on the shell has with it *Tisiphonia*, *Hymedesmia Johnstoni*, Bk., *Hymedesmia verticillata*, Bk., and *Desmacella pumilio*, Sdt., also a branched Suberite with pin-like spicule only, *Tethya cranium*, and *Halichondria ventilabrum*.

In the brown fragment there is *no tricurvate* (fig. 28); but it is abundant in the fragment growing over the shell. I also observe that, in the figure of *Hymedesmia Johnstoni* given by Dr. Bowerbank (B. S. vol. i. pl. 18. fig. 293) from a Madeira specimen, there is *no* tricurvate, while the tricurvate is a prominent object in a specimen of the same sponge from Madeira in the British Museum. Still as it was the habit of *Halichondria abyssi* to take in grains of sand and foreign spicules into its structure, I am still doubtful, as the tricurvate is not in both specimens, whether it also may not have belonged to a different sponge.

Thus we have here another or third sponge whose anchorates have the clam-shaped or umbrella-like ends similar to those of *Cladorhiza* and *Chondrocladia*, while there are three forms of skeleton-spicules instead of one, hence resembling, but for the absence of spines, some of the varieties of *Halichondria incrustans*; so that, unless these clam-shaped ends are to be considered the chief grouping characters, the presence of the three forms of skeleton-spicule, together with the massive areolar structure, the sessile incrusting habit, and the "crumb-of-bread"-like structural appearance of this sponge, must ally it more to *H. incrustans* than to *Cladorhiza* or *Chondrocladia*, where the general form is branched stem-like, and there is only one form of spicule, like that of *Esperia*.

Lastly, I would observe that there is in both specimens a minute equianchorate spicule (fig. 27, *c*), about 4-6000ths inch long, in great abundance, which, although with straight shaft and anchor-like head, seems to me to be no more than the embryonic form of the great equianchorate flesh-spicule with bent shaft and deeply dentate clam-shaped heads.

Halichondria forcipis, Bk. Pl. XIV. figs. 29–32, and Pl. XV. fig. 41, *a*, *b*.

General form massive, lobed, sessile, stiff, areolar, like "crumb of bread." Sessile. Colour light grey (Pl. XIV. fig. 29). Surface irregularly areolar, owing to the form of the subjacent skeleton-structure; covered with a dermal sarcode, which, adhering to the projecting points of the former, presents a cribriform structure over the rounded cavities beneath (fig. 29, *a*). Pores making up the cribriform area just mentioned (fig. 29, *a*). Vents scattered. Internal structure becoming cavernous towards the base (fig. 30), charged with the spicules of the species, and permeated by the excretory canals, of which the dilated cavernous structure is chiefly composed. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of two forms, viz.:—1st, the largest, smooth, stout, slightly curved, acuate, rather abruptly pointed, average largest size 40 by $1\frac{1}{3}$-1800th inch in its greatest diameters (Pl. XV. fig. 41, *b*); 2nd, smooth, nearly straight, slightly fusiform, constricted and slightly inflated at the extremities, average largest size 20 by $\frac{1}{3}$-1800th in its greatest dimensions (fig. 41, *a*). Flesh-spicules of two forms, viz. tricurvate and equianchorate. Tricurvate long, bent upon itself so as to assume the form of a pair of forceps (Pl. XIV. fig. 32, *a*) (whence its designation): arms separate at the point of bending (which is round), but in contact a little further on, and then spreading out again for a short distance towards their terminations, which are *unequal*, one arm being a little longer than the other; arms incipiently spined throughout, spines recurved or inclined *towards* the bend on each arm, becoming almost obsolete at the bend itself; extremities much attenuated and finely pointed; average largest size 30 by $\frac{1}{2}$-1800th of an inch in its greatest diameters. Equianchorate (fig. 31, *a*, *b*) stout, consisting of a curved shaft and three linear arms at each end; the tubercle evident, and the falces respectively extending to about half the length of the arm; average largest size 13 by 4-6000ths of an inch in its greatest diameters, viz. the length of the shaft and width of the head respectively. Size of entire specimen $1\frac{3}{4}$ long, $1\frac{1}{2}$ wide, and $\frac{1}{2}$ inch high or thick, vertically.

Hab. Deep sea.

Loc. Atlantic Ocean. Between the north of Scotland and the Faroe Islands.

Obs. This specimen is alone in a jar with the No. "54" on it, which gives a depth of 363 fathoms. It has already been described among the British sponges by Dr. Bowerbank under the name above given (vol. ii. p. 244), but *not* illustrated. The "bidentate spicules" mentioned by Dr. Bowerbank appear to me to be merely early forms of the equianchorate, and the "minute bihamates" embryonic forms of the tricurvate or large forcipiform spicules, which, in the deep-sea specimen are not more than 2-1800ths inch long, very faintly displayed, very abundant, and with arms in *all* of *unequal* length, the short one being not more than one third of the length of the other (Pl. XIV. fig. 32, *b*); so that this, being a constant occurrence and making its appearance in the embryonic form, must be considered a normal condition of the spicule. Dr. Bowerbank's specimen was dredged up "at Shetland."

In *Esperia cupressiformis* there is a very minute form of the same kind of tricurvate (Pl. XIV. fig. 18), but with a bulbous inflation at the extremity of each arm and other differences which will be learnt by reference to its description. I have also just found a minute sponge on the "rocks" here (Budleigh-Salterton), not more than 2 lines long, containing a similar spicule, but without bulbous ends, hairpin-like. It is *very* minute, not being more than 2-6000ths inch long, but in company with the same kind of equianchorate and double form of skeleton-spicule as those in *Halichondria forcipis*, though not the same species.

All, however, are eclipsed by the beautiful form which I have figured of a much stouter forcipiform spicule that came from an arenaceous deposit in the neighbourhood of Colon or Aspinwall, Panama, five specimens of which, having been mounted, were sent to me by Mr. F. Kitton of Norwich. Here the arms in all are *equal* in length and the extremities abruptly pointed, indeed, may be termed conical; this, together with the great development of the spines, points out a different species from that of *Halichondria forcipis*, for which I propose the name of *Forcepia colonensis* (Pl. XV. fig. 47). Size of specimens 19 by $\frac{3}{4}$-1800th inch in its greatest diameters; width of bend 2-1800ths inch, distance of ends 3-1800ths inch. In Schmidt's *Suberites arciger*, from the coast of Greenland (Atlantisch. Spongienfaun. p. 47, Taf. v. fig. 6), we appear to have another example of this form of spicule, in which the body is smooth and the ends, which are strongly though scantily spined, so far separated from each other that the spicule forms two sides of an almost equilateral triangle, the distance between the free ends being about 53-6000ths inch. This, too, Schmidt calls a tricurvate (*Bogen*).

The forceps-form of the tricurvate spicule in *Halichondria forcipis* is therefore not confined to this sponge, or kind of sponge, since it appears, as before stated, in *Esperia cupressiformis*, in the Budleigh-Salterton specimen, in *Suberites arciger* (if I am right in identifying the tricurvate in Schmidt's sponge with it), as well as free in this arenaceous deposit about Colon. At the same time it should be remembered that this spicule is subject to great variety in form, since I have lately found it here (in a new species of *Esperia*) straight (that is, without any bend), and even longer than the skeleton-spicule of the species; while throughout it was enclosed by a delicate nucleated mother-cell, shaped like a bolster.

The mounted specimen of *Suberites arciger* which Schmidt sent to the British Museum, besides the tricurvate, presents the true pin-like skeleton-spicule of a Suberite.

In *Halichondria forcipis* both the skeleton-spicules and equianchorates are very much allied, in general form, to those of *Halichondria incrustans*; but in place of the bihamate of the latter we have the forcipiform tricurvate in the former, while the "crumb-of-bread"-like appearance of the structure, in the general form, is very much like that of *Halichondria incrustans*, which used to be designated "*H. panicea.*"

Cliona abyssorum, n. sp. Pl. XIV. fig. 33, and Pl. XV. fig. 45, *a*, *b*, *c*.

Sponge retiform, permeating the branches of *Lophohelia prolifera*, and appearing here and there in small heads through corresponding holes in this coral. Pores and vents respectively in these heads. Internal structure areolar, charged with the spicules of the species, and permeated by the excretory system, which is more areolar than tubular. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of two forms, viz.:—1st, the largest, smooth, pin-like, fusiform, curved, fine-pointed, chiefly confined to the "heads," average largest size 57 by $\frac{2}{3}$-1800th inch in its greatest diameters, head oval and as wide as the shaft (Pl. XV. fig. 45, *a*); 2nd, the small skeleton-spicule, smooth, curved, fusiform, acerate, fine-pointed, chiefly confined to the body, average largest size 25 by $\frac{2}{3}$-1800th inch in its greatest diameters (fig. 45, *b*). Flesh-spicule of one form only (fig. 45, *c*), smooth, spiral, sinuous, straight, abruptly terminated at each end, and presenting four bends on each side in its course, densely charging the sarcode throughout; average largest size 20 by 1-6000th inch in its greatest diameters. Size of entire specimen undefinable from its fungus-like permeating growth.

Hab. Deep sea, permeating the branches of *Lophohelia prolifera*.

Loc. Atlantic Ocean, "chops" of English Channel.

Obs. The specimen of *Lophohelia prolifera* in which this sponge was found is partly enveloped in *Corticium abyssi*, which having already been figured and described in the 'Annals' of 1873 (vol. xii. p. 17, pl. i. figs. 1 & 2), I must refer the reader to that for all particulars concerning this part of its history, merely observing that it was dredged up from a depth of 500 fathoms at the entrance of the English Channel.

The sponge itself, being very minute, while its concealment, according to the habit of the so-called "boring sponges," being, with the exception of the small apertures through which the heads respectively are protruded, completely within the branches of the coral, it is impossible without breaking up the *Lophohelia* to ascertain its exact form, though this may be anticipated from our acquaintance with that of *Cliona corallinoides*, so common on the British coasts ('Annals,' vol. viii. 1871, p. 14, pl. ii. figs. 33–37), since all these "boring sponges" have the same kind of half-reticulated, half-lobulated form in the interior of the bodies which they inhabit.

This species, however, is especially beautiful on account of the dense mass of large, spiral, sinuous spicules (fig. 33) with which the sarcode is charged, presenting, when torn to pieces under the microscope, the appearance of tresses of curled hair. It is figured by Dr. Bowerbank in his B. S. (vol. i. p. 239, pl. iii. fig. 71) as it "occurs in the interstitial membranes of *Geodia carinata*, Bk. MS."!

Cliona abyssorum being, according to my arrangement, a Suberite, will come under my fifth group of sponges, viz. RAYNERIÆ.

Desmacella pumilio, Schmidt (Atlantisch. Spongienfaun. p. 53, Taf. 5. fig. 14, and mounted specimen in British Museum). Pl. XV. fig. 42, *a*, *b*, *c*.

Amorphous fragments of this sponge occur about the specimen of *Corticium abyssi* which envelops the *Lophohelia* just mentioned (Annals, *l. c.*). Its skeleton-spicule is pin-like (fig. 42, *a*); and flesh-spicules a bihamate (fig. 42, *c*) and a very much flattened tricurvate (fig. 42, *b*), which latter, however, does not appear in Schmidt's illustrations of this sponge. But as yet I do not know what value to attach to these flesh-spicules in many instances as special characteristics. At the Cape of Good Hope (Natal) the same kind of small equi-anchorate navicular form is present in several sponges, many of which are even more than generically different.

In *my* arrangement *Desmacella pumilio* would come among the Suberites in my 5th division, viz. RAYNERIÆ.

Reniera fibulata, Schmidt (Spong. adriatisch. Meeres, p. 73, Taf. vii. fig. 9). Pl. XV. fig. 44, *a*, *b*.

Fragments of this sponge occur about this specimen (in the same amorphous condition as the preceding one), possessing a smooth, curved, pointed, fusiform, acerate skeleton-spicule (fig. 44, *a*), and a bihamate flesh-spicule (fig. 44, *b*). But I do not see any difference, in this respect, between Schmidt's *Reniera fibulata* (*l. c.*) and his *R. bullata* from the coast of Portugal (British Museum, mounted specimen; and Atlantisch. Spongienf. p. 40). In the mounted specimen at the British Museum, too, of *R. accommodata* from Cette in the south of France (Spong. Küste Algier. p. 30) there are with the same form of skeleton-spicule tricurvates as well as bihamates. But this is a world-wide sponge, presenting several slight varieties in its spicular complement, yet, I think, only one general form, to which I hope to return for more lengthy consideration on a future occasion, as the subject is thus well worthy of a separate treatise.

Reniera fibulata and its like will come into a Group as yet unnamed in my fifth division of sponges, viz. Rayneriæ.

Dictyocylindrus anchorata, n. sp. Plate XV. fig. 43, *a*, *b*, *c*.

This is another sponge which, in small amorphous masses, occurs about the *Corticium* just mentioned, and presents three kinds of spicules, viz. a skeleton, an echinating, and a flesh-spicule. Skeleton-spicule stout, smooth, curved, gradually pointed; but the curve sudden and *between the centre and the large end*, which is very characteristic of the sponges bearing this form of spicule; average largest size 60 by 2-1800ths inch in its greatest diameters (fig. 43, *a*). Echinating spicule nearly straight, acuate, or club-shaped and short-spined throughout; average largest size 34 by ½-1800th of an inch in its greatest diameters (fig. 43, *b*). By the term "echinating" is meant a spicule that has its head fixed in the fibre which sustains the skeleton-spicules, while the rest of its body is free. Flesh-spicule a minute anchorate, of the navicular or weaver's-shuttle-like form, much bent upon itself; average largest size 1½-1800th of an inch long (fig. 43, *c*).

This sponge would of course come among my fourth division of sponges, viz. Armatæ.

Hence about the specimen of *Corticium abyssi* which envelops the *Lophohelia* (see fig. of spec. Annals, *l. c.*) there are seven kinds of sponges, viz.:—*Farrea occa* and *Aphrocallistes Bocagei*, which grew on the branches of the dead coral; *Cliona abyssorum*, the boring sponge, which inhabited their interior; *Corticium abyssi*, which enveloped the whole; and *Desmacella pumilio*, *Reniera fibulata*, and *Dictyocylindrus* *anchorata*, which, in amorphous fragments, exist inside the tubes of the *Farrea* and on the surface of the *Corticium* respectively.

Lastly, we come to two beautiful forms of sponge-spicules which were found *free* in an arenaceous deposit of the Agulhas Shoal at the Cape of Good Hope, and in the neighbourhood of Colon, Panama, respectively:—the former dredged up by Dr. G. C. Wallich himself in 1857; and the latter from Colon, together with the forcipiform spicule above mentioned, just mounted and forwarded to me by Mr. F. Kitton, of Norwich.

For the sponge bearing the spicule from the Agulhas Shoal I propose the name of "*Gummina Wallichii*," and for that from Colon "*Corticium Kittonii*."

To some it may seem strange to give a name to a sponge from a single form of spicule; but when it is considered that there is no kind of sponges but the Gummineæ of Schmidt in which such-like spicules are to be found, and that the spicules themselves respectively are sufficiently remarkable to characterize any sponge, the difficulty will probably disappear. Let us now proceed to their description, beginning with

Gummina Wallichii, n. sp. Pl. XV. fig. 46, *a*, *b*, *c*.

Spicule acerate, curved, fusiform, covered with twelve (?) rows of prominent tubercles, alternately placed in longitudinal lines extending from one end of the spicule to the other (fig. 46, *b*). Tubercle (fig. 46, *c*) consisting of a short cylindrical process somewhat expanded at the base, constricted in the centre, and again slightly expanded at the summit, which is round (fig. 46, *c*). Central canal (fig. 46, *a*) bent angularly in the centre, from which it proceeds towards each extremity in a slightly undulating form, straightening towards the end. Size of specimen 58 by 4½-1800ths inch in its greatest diameters.

Obs. Of the arenaceous deposit in which this exquisitely beautiful spicule was found, Dr. G. C. Wallich, who kindly sent it to me in February 1871, states, "I have a considerable quantity of a green sand-like deposit which I dredged up in 80 to 100 fathoms water on the Agulhas Shoal so long ago as 1857."

It is interesting to find that the arenaceous deposit from which Mr. Kitton obtained his spicules was of a like nature, inasmuch as, after boiling a portion of it in nitric acid, he states that the casts of the internal cavities of Foraminifera, minute corals, and boring sponges, which were also present, came out of a "dark green colour like the greensand fossils."

It is further interesting to find a figure of this spicule in Dr. Bowerbank's 'British Spongiadæ' (vol. i. p. 270, pl. xi. fig. 244), which is stated to have been "repeatedly found in the matter obtained by washing the roots of *Oculina rosea* and other corals from the South Sea by my friends Messrs. Mathew Marshall, Legg and Ingall; but the sponge from whence it is most probably derived has never yet been determined," &c. With this Dr. Bowerbank gives two other figures of similar kinds of spicules, and considers that they "indicate the existence of a peculiar tribe of sponges with which we are at present entirely unacquainted." That "tribe," as I have above stated, is probably Schmidt's Gummineæ.

Corticium Kittonii, n. sp. Pl. XV. fig. 48, *a*, *b*, *c*.

Spicule stout, consisting of a short shaft from one end of which 2, 3, or 4 arms spread upwards and outwards *en fleur-de-lis* (fig. 48, *a*, *b*, *c*). Arms about twice the length of the shaft, and all parts, with the exception of that about the junction of the arms with the shaft, thickly covered by stout vertical short spines. Size of specimens—total length 19-1800ths inch; shaft 11 by 2-1800ths inch in its greatest diameters.

Obs. The arenaceous deposit from which these beautiful spicules were obtained came from the neighbourhood of Colon, Panama, and was sent to Mr. Kitton, of Norwich, chiefly for its richness in Diatomaceæ. They are so exquisitely mounted, and so perfect, that nothing further in this respect could be desired; while they are so characteristically like those of *Corticium abyssi* which I have described and figured in the 'Annals' (vol. xii. July 1873, p. 19, pl. i. figs. 3–5), that I do not think I can be wrong in giving the name above mentioned to the sponge from which these were originally derived.

To the likeness in nature of the arenaceous deposit from which these spicules were obtained to that of the Agulhas Shoal dredged up by Dr. Wallich, and of both to the "greensand" of the Chalk Formation, I have above alluded.

Nor should I omit to add here, respecting the probable existence of the Gummineæ themselves in the "greensand deposit," that the fossil spicules termed "*Monilites*" (Annals, vol. vii. 1871, p. 132, pl. ix. figs. 44–47, now that I am better acquainted with the existing species) seem to me to have belonged to sponges of this kind; while I have lately found acerate and short-shafted, three-armed, *beaded* forms of this spicule in some powder from the interior of a flint from

Warborough, Berkshire, forwarded to me by the Rev. R. St. Pattrick, in company with a full spicular complement of the fossil *Geodia* termed (*l. c.*) *Geodites haldonensis*, in great abundance, which appears to have been the specimen in particular enclosed in this flint.

Thus the *Gummina* would seem to have grown about the *Geodia* before the latter became imbedded for fossilization; while it is curious that among the deposits of heterogeneous sponge-spicules in the Upper Greensand of Haldon Hill, I should have happened to select the very spicules for the representative of *Geodites haldonensis* that are, with the exception of those of the supposed *Gummina*, exclusively present in the powder of the Warborough flint.

Thus it would *à priori* appear that, by going to the interior of flints, we may be able to find out the exact spicular complement of each species whose spicules are heterogeneously mixed up in the spiculiferous deposits of the Greensand.

But, on the other hand, the presence of seven existing species together, as found in the deep-sea specimen to which I have above alluded, shows how we may be defeated in this inquiry.

EXPLANATION OF THE PLATES.

Plate XIII.

All the spicules in Plates XIII. and XIV. are flesh-spicules, and, to show their sizes relatively, all, with the exception of fig. 32, *a*, Plate XIV., have been drawn on the scale of 1-12th to 1-6000th inch. Fig. 32, *a* is drawn on the scale of 1-12th to 1-1800th inch.

Fig. 1. *Halichondria incrustans*, Bk, equianchorate, three views: *a*, lateral, *b*, anterior, and *c*, posterior views, respectively; *d d d*, shaft; *e e e e*, anterior arm; *f f f f*, lateral arms; *g g*, falx of anterior arm; *h h h h*, falces of lateral arms; *i i*, tubercle, here linear.

In this instance the shaft is alate on each side, above and below, as seen in *b* and *c*.

N.B. The anchorate of *Halichondria incrustans* is figured and described in detail especially to enable the reader to comprehend the following forms of this spicule, which are so modified, that they would be almost unintelligible without a key of this kind.

Fig. 2. *Guitarra fimbriata*, n. gen. et sp., natural size.

Fig. 3. The same, magnified two diameters: *a*, apical vent, surrounded by a fringe of long spicules; *b*, root; *c*, smaller vents on the surface; *d*, portion of surface *en profil*, more magnified to show the structure of its villous surface.

Fig. 4. The same, three views of the anchorate: *a*, lateral view, *b*, anterior, and *c*, posterior view (all fringed on their inner aspect); *d*, fringe; *e*, tubercle; *f*, falx.

Fig. 5. The same, embryonic form of this anchorate.

Fig. 6. *Melonanchora elliptica*, n. gen. et sp., natural size, lateral view: *a a*, tubercular pore-areæ; *b*, small stone in the base.

Fig. 7. The same, basal view, natural size: *a*, tubercular pore-areæ; *b*, stone in the base.

Fig. 8. The same, tubercular pore-area, much magnified to show its cribriform sarcode, crossed by bundles of the dermal spicules, *a*.

Fig. 9. The same, anchorate, nearly fully developed, lateral view. When fully developed the notch in the centre of the inner margin of the arms (*a*) is entirely obliterated, and the arms thus rendered uninterruptedly continuous. All the arms present fine parallel striæ (*b*) perpendicular to the margin.

Fig. 10. The same, end view, showing the four melonoid divisions crossing each other at right angles.

Fig. 11. The same, earlier stage of development of anchorate when the arms are approaching each other but not united. The dotted lines indicate the direction in which they extend to meet each other so as, with the shaft, to form a melonoid form like figs. 9 & 10.

Fig. 12. The same, embryonic form: *a*, lateral; *b*, anterior view.

Fig. 13. *Esperia villosa*, n. sp.: *a*, naked fibre spreading below into a root-like form of attachment; *b*, magnified view of dermal sarcode, to show how the projecting tufts of spicules form the villous surface, with the pores intervening; *c*, the same, with the spicules broken off and their ends only showing.

Fig. 14. The same, fully developed anchorate navicular, or weaver's-shuttle-like form: *a*, anterior view; *b*, lateral view; *c*, half-developed form, to show the difference in width of the arms &c.; *d*, embryonic form; *e*, apparent constriction in shaft formed from approximation of lateral arms in fully developed form.

Fig. 15. The same, bihamate spicule: *a*, central canal.

Plate XIV.

Fig. 16. *Esperia cupressiformis*, n. sp., magnified two diameters: *a*, root; *b*, stem; *c*, branches; *d* upper extremity; *e*, branch, more magnified; *f*, end of same, still more magnified, to show termination of skeleton-spicules covered by sarcode densely charged with the flesh-spicules figs. 17 and 18, the ends of the former of which project; *g*, *Esperia cupressiformis* (variety of), the end magnified, to show *h*, branches of the same, webbed together by dermal sarcode.

Fig. 17. The same, flesh-spicule of inequianchorate: *a*, lateral view; *b*, anterior view.

Fig. 18. The same, forcipiform flesh-spicule: *a*, enlarged view of bulbous extremity.

Fig. 19. *Esperia cupressiformis*, variety of, natural size: *a*, lateral view of head, showing its compressed form and lip-like semi-division, in a line parallel to the compression, also its surface half-covered with projecting bundles of skeleton-spicules; *b*, the same, front view of flat side; *c*, stem and root.

Fig. 20. *Chondrocladia virgata*, Wy. Thomson: *a*, lateral view of equi-anchorate; *b*, anterior view of same; *c*, posterior view of one extremity as seen from behind, to show the form of teeth and head, with the union of the latter through the falx to the alate end of the shaft; *d*, head; *e e e e*, alate appendages of the shaft; *f*, falx or eighth arm of head joining the latter to the shaft.

Fig. 21. The same, bihamate flesh-spicule.

Fig. 22. *Cladorhiza abyssicola*, Sars, inequianchorate of, to compare with the foregoing: *a*, lateral view; *b*, dorsal view; *c c*, aborted ends; *d*, alate appendages of shaft; *e*, falx.

The other flesh-spicule, viz. the bihamate, being of enormous size, is too large to be here introduced.

Fig. 23. *Histoderma appendiculatum*, n. sp., natural size: *a*, body; *b*, tubular appendages; *c*, conical projection at the end.

Fig. 24. The same, equianchorate: *a*, lateral view; *b*, anterior view.

Fig. 25. The same, bihamate flesh-spicule.

Fig. 26. *Halichondria abyssi*, n. sp., natural size, on a deciduous ostracean shell: *a*, sponge; *b*, shell.

Fig. 27. The same, equianchorate: *a*, anterior view; *b*, lateral view; *c*, embryonic form.

N.B. Here there are no alate appendages, but the end of the shaft widens into the umbrella-like head.

Fig. 28. The same, tricurvate flesh-spicule, seen in one of the two specimens only.

Fig. 29. *Halichondria forcipis*, Bk., upper surface, natural size: *a*, fragment of dermal surface, to show pore-areæ = cribriform sarcode in the interstices of the skeleton-structure.

Fig. 30. The same, lower surface, natural size: showing large cancellous structure, and detritus imbedded in the sarcode: *a*, deciduous ostracean bivalve shell.

Fig. 31. The same, equianchorate: *a*, lateral view; *b*, anterior view.

Fig. 32. The same, forcipiform spicule incipiently spined: *a*, full-grown form; *b*, embryonic form.

Fig. 33. *Cliona abyssorum*, n. sp., spiro-sinuous flesh-spicule.

Plate XV.

All the spicules in this Plate are drawn on the scale of 1-12th to 1-1800th of an inch, with the exception of figs. 42, *a*, 43, *a*, *b*, 44, *a*, and 45, *a*, *b*, *c*, which are all on the scale of 1-24th to 1-1800th inch, and fig. 47, on the scale of 1-12th to 1-6000th inch, to show their relative sizes.

Fig. 34. *Guitarra fimbriata*, skeleton-spicule of one form only.

Fig. 35. *Melonanchora elliptica*, skeleton-spicules of two forms: *a*, small; *b*, larger form.

Fig. 36. *Esperia villosa*, skeleton-spicule of one form only.

Fig. 37. *Esperia cupressiformis*, skeleton-spicule of one form only.

Fig. 38. *Chondrocladia virgata*, Wy. Thomson, skeleton-spicule of one form only.

Fig. 39. *Histoderma appendiculatum*, skeleton-spicules of two forms: *a*, large; *b*, smaller form.

Fig. 40. *Halichondria abyssi*, skeleton-spicules of three forms: *a*, long acerate; *b*, shorter and stout acuate; *c*, smallest, with inflated ends.

Fig. 41. *Halichondria forcipis*, Bk., skeleton-spicule of two forms: *a*, small; *b*, large.

Fig. 42. *Desmacella pumilio*, Schmidt: *a*, skeleton-spicule of one form only; *b* and *c*, flesh-spicules, tricurvate and bihamate respectively.

Fig. 43. *Dictyocylindrus anchorata*, n. sp.: *a*, skeleton-spicule of one kind only; *b*, echinating spicule, spinous; *c*, equianchorate flesh-spicule, navicular, much bent upon itself.

Fig. 44. *Reniera fibulata*, Schmidt: *a*, skeleton-spicule of one kind only; *b*, flesh-spicule, bihamate.

Fig. 45. *Cliona abyssorum*, skeleton-spicules of two forms: *a*, large, pin-like; *b*, smaller, acerate; *c*, flesh-spicule, spiro-sinuous. See more magnified view of the latter in fig. 33, Pl. XIV.

Fig. 46. *Gummina Wallichii*: *a*, central canal; *b*, rows of tubercles; *c*, more magnified view of tubercle.

N.B. In the upper half, for convenience, the tubercles are omitted.

Fig. 47. *Forcepia colonensis.* Scale 1-12th to 1-6000th inch.

N.B. On one side the spines are partly omitted for convenience. This figure is intended for comparison with fig. 32, *a*, Pl. XIV.; but it should be remembered that it is drawn to a much larger scale, not being half so long as fig. 32 in reality, although stouter and more markedly spined.

Fig. 48. *Corticium Kittonii*: *a*, three-branched form; *b*, four-branched (here the spines are again omitted for convenience); *c*, two-branched form.

XXXII.—*Description of a new Species of Lizard of the Genus* Celestus. By A. W. E. O'Shaughnessy, Assistant in the Natural-History Departments of the British Museum.

Celestus bilobatus, sp. n.

Body slender, elongate, rounded; limbs short, the anterior not reaching to the eye, the posterior not quite to the middle of the side. Ear very small, almost closed. Head obtuse; muzzle rounded, shorter than the interorbital width of the head. Supranasals two pairs; internasal large, broad; frontal broad, oblong; small interparietal, smaller fronto-parietals, large parietals, and small occipital. A small scale or two scales wedged in between parietals and supraorbitals. Five supraorbitals, the fifth triangular, entirely on the flattened upper surface of the head and abutting on the internasal. Two narrow plates, one elongate, coming forward from the line of the supraoculars, are wedged in between the fifth supraorbital and internasal and the several postnasal or lateral plates, of which there are two postnasals proper, one over the other, and two consecutive loreals. Rostral very short and very wide. Supralabials eight. Teeth conspicuously bilobate. Scales in forty-one longitudinal series, twelve-to-fourteen-keeled, without prominent central keel; eighty-six scales in the median ventral series; the preanal scales much larger, in three rows, about twelve. All the scales rounded. Tail much longer than body and head.

Colour: sides with several widely placed vertical brown bands or patches, within which are one or two conspicuous white spots; a bluish-white stripe before the axilla.

One specimen in the collection of the British Museum, from Costa Rica, obtained of Mr. Higgins.

XXXIII.—*On the Invertebrate Marine Fauna and Fishes of St. Andrews.* By W. C. M'Intosh.

[Continued from p. 207.]

Series II. ARTHROPODA.

Class CRUSTACEA.

The sessile-eyed Crustacea of St. Andrews are tolerably numerous both in species and individuals. Between tide-marks the most conspicuous (as usual) are the swarms of *Talitrus locusta* which speedily reduce dead fish and other animals to skeletons at high-water mark and considerably beyond it, and the multitudes of *Gammarus locusta* and *Amphithoë podoceroides* under stones amongst the rocks. The *Podocerides*, *Pherusa bicuspis*, *Calliopius grandoculis*, and *Caprella tuberculata* are plentiful in the rock-pools, and *Corophium grossipes* in the brackish pools near the estuary of the Eden. *Janira maculosa* abounds both in the tidal region and in deep water, while *Jæra Nordmanni* occurs in numbers under stones near high-water mark. In the laminarian region one of the most abundant, perhaps, is *Atylus Swammerdami*, which congregates in swarms on the loose seaweeds. *Siphonœcetus typicus* is common amongst shell-gravel, and *Eurydice pulchra* on the surface of the sea as well as in rock-pools in autumn. Many of the rarer forms occur in the deeper water in considerable numbers; but the distribution of the group in British seas is still involved in considerable obscurity; and at present it will suffice to observe that two of the most plentiful in this region are *Ampelisca Belliana*, Bate, and the new *Calliopius bidentatus*, Norman. The former is likewise common on the beach after storms and in the stomachs of fishes; and the latter ranges to the laminarian zone.

Compared with the Zetlandic area, the absence at St. Andrews of such forms as *Acanthonotus Owenii*, *Dexamine vedlomensis*, *Cymodocea truncata*, and *Sphæroma Prideauxia-*

num in the laminarian region strikes even a superficial observer of the group; while the large number of rare and new species which were met with during the frequent dredgings of Mr. Gwyn Jeffreys and the Rev. A. M. Norman still further heightens the contrast. The southern region, again, is boldly separated by the presence in large numbers of *Cymodocea truncata* and *Sphæroma Prideauxianum* in the fissures of rocks between tide-marks, and *Dynamene* in rock-pools. The characteristic *Tanais vittatus*, *Paranthura costana*, *Næsa bidentata*, *Mœra grossimana*, *Chelura terebrans*, *Conilera cylindrica*, and the large *Cymothoa* parasitic on the fishes at once distinguish the fauna of the Channel Islands from that at St. Andrews. The rarity of *Orchestia littorea* at the latter and its abundance in the tidal region of the Outer Hebrides is another interesting contrast.

Many of the sessile-eyed Crustacea, such as *Talitrus locusta*, are extremely hardy. *Gammarus locusta* is often found in putrid localities, and it survives almost every other marine form in putrid vessels in confinement. The group as a whole is composed of extremely active animals; and even the most grotesque, such as *Caprella tuberculata*, are at home in the intricacies of *Ceramium* and other finely branched seaweeds. The boring forms (by jaws) are represented by *Limnoria lignorum*; but its depredations are comparatively insignificant, probably because little wood is employed within water-mark in the construction of the harbour. The perforations of *Talitrus*, again, abound in the sand, and the looped burrows of *Corophium* in the sandy mud of the flats it inhabits. The nest-forming crustaceans are represented by *Amphithoë podoceroides*, *Siphonœcetus typicus*, *Podocerus variegatus*, and *P. falcatus*; while the young of *Gammarus locusta* are often observed adhering to the abdominal region of the parent.

The Cirripedes occur abundantly between tide-marks, the most conspicuous being *Balanus balanoides*, which covers the bare rocky ridges opposite the Castle and other parts. In deep water the various species are attached to shells, stones, crabs, wood, cork, coal, tests of ascidians, and other structures.

I am indebted to Mr. Spence Bate for the determination of several doubtful forms, and especially to the Rev. A. M. Norman for his courteous assistance in this respect, and in revising the list. Mr. G. S. Brady kindly furnished me with the names of the Ostracoda occurring in shell-débris on the West Sands and other collections.

Order Pycnogonoidea.

Fam. **Pycnogonidæ**, Latreille.

Genus Pycnogonum, Brünnich.

Pycnogonum littorale, O. F. Müller.

Abundant under stones between tide-marks.

Genus Phoxichilidium, M.-Edwards.

Phoxichilidium femoratum, Rathke.

Occasionally under stones in rock-pools, and ranging to deep water.

Besides the foregoing, there are several species (one apparently identical with Mr. Goodsir's *Nymphon Johnstoni*, and another with his *N. spinosum*) not uncommon in the coralline region. Many delicate zoophytes are found on their limbs.

Order Cirripedia.

Suborder **SUCTORIA**.

Fam. **Peltogastridæ**, Claus.

Genus Peltogaster, H. Rathke.

Peltogaster paguri, H. Rathke.

Occasionally on *Pagurus bernhardus*. A more elongated form occurs on *P. cuanensis*.

Genus Sacculina, Thompson.

Sacculina carcini, Thompson.

Common on the abdomen of *Carcinus mænas*. Another is found on *Portunus holsatus*.

Suborder **THORACICA**.

Fam. **Lepadidæ**.

Genus Lepas, L.

Lepas anatifera, L.; Darwin, Mon. i. p. 73, pl. 1. f. 1.

On the bottoms of ships, and thrown ashore after storms attached to timber.

Genus Scalpellum, Leach.

Scalpellum vulgare, Leach; Darw. Mon. i. p. 222, pl. 5. f. 15.

On *Thuiaria thuja* and *Sertularia cupressina* from deep water.

Fam. **Balanidæ.**

Subfamily *Balaninæ.*

Genus Balanus, Lister.

Balanus porcatus, E. da Costa; Darw. Mon. ii. p. 256, pl. 6. f. 4.

Abundant on stones, *Ascidia sordida*, crabs, &c. in deep water, and occasionally between tide-marks.

Balanus crenatus, Bruguière; Darw. Mon. ii. p. 261, pl. 6. f. 6.

Not uncommon on *Hyas araneus*, *Lithodes maia*, and on rocks in the laminarian region.

Balanus balanoides, L.; Darw. Mon. ii. p. 267, pl. 7. f. 2.

Very abundant; coating extensive surfaces of the rocks between tide-marks and in the laminarian region, and adhering to mussels, sticks, posts, &c. Elongated varieties are not uncommon. The exuviæ swarm in the rock-pools and on the surface of the sea in summer.

Balanus Hameri, Ascanius; Darw. Mon. ii. p. 277, pl. 7. f. 5.

Occasionally in deep water; a small thorn-tree (still fresh) was covered with fine examples.

Fam. **Verrucidæ.**

Genus Verruca, Schumacher.

Verruca Strömii, O. F. Müller; Darw. Mon. p. 518, pl. 21. f. 1.

Abundant on rocks and stones between tide-marks in the laminarian region, and on crabs in the coralline.

Order Copepoda.

Suborder **GNATHOSTOMATA.**

Genus Notodelphys, Allman.

Notodelphys ascidicola, Allman.

Common in *Ascidia intestinalis* and others.

Suborder **PARASITA.**

Genus Caligus, O. F. Müller.

Caligus rapax, M.-Edwards.

Common on cod. Many specimens have *Udonella caligorum* attached to them. Free specimens often occur in rock-pools.

Genus Lepeophtheirus, Nordm.

Lepeophtheirus salmonis, Kröyer.

Abundant on the salmon.

Genus Cecrops, Leach.

Cecrops Latreillii, Leach.

Common on the gills of the sunfish (*Orthagoriscus mola*).

Genus Anchorella, Cuvier.

Anchorella uncinata, O. F. Müller.

Abundant on the gills of cod and haddock.

Anchorella emarginata, Kröyer, Naturhist. Tidsskrift, Band i. p. 287, tab. 3. fig. 7, *a–e*.

On the gills of the wolf fish (*Anarrhichas lupus*). Mr. Norman states that this is new to Britain.

Genus Lernæa, L.

Lernæa branchialis, L.

Common on the gills of cod and haddock.

An *Ergasilus*? is common on the gills and other parts of *Doris tuberculata*, *D. Johnstoni*, and occasionally on *Triopa claviger*.

Order Lophyropoda.

Suborder **OSTRACODA.**

Fam. **Cytheridæ.**

Genus Cythere, O. F. Müller.

Cythere pellucida, Baird; G. S. Brady, Monogr. Brit. Ostracoda, Linn. Trans. xxvi. 2, p. 397, pl. 28. f. 22–26 & 28.

Abundant in shell-sand from the West Sands.

The following come from the same locality :—

Cythere albomaculata, Baird; Brady, *op. cit.* p. 402, pl. 28. f. 33–39, pl. 39. f. 3.

Cythere lutea, O. F. Müller; Brady, *op. cit.* p. 395, pl. 28. f. 47–56, pl. 39. f. 2.

Cythere villosa, G. O. Sars; Brady, *op. cit.* p. 411, pl. 29. f. 28–32.

Cythere cuneiformis, Brady, *op. cit.* p. 404, pl. 31. f. 47–54.

Cythere viridis, O. F. Müller; Brady, *op. cit.* p. 397, pl. 28. f. 40, 41, &c. Also from deep water.

Cythere tuberculata, G. O. Sars; Brady, *op. cit.* p. 406, pl. 30. f. 25–41.

Cythere concinna, Jones; Brady, *op. cit.* p. 408, pl. 26. f. 28–33 &c.

Cythere finmarchica, G. O. Sars; Brady, *op. cit.* p. 410, pl. 31. f. 9–13.

Genus CYTHERIDEA, Bosquet.

Cytheridea elongata, Brady, *op. cit.* p. 421, pl. 28. f. 13–16 &c.

Cytheridea papillosa, Bosquet; Brady, *op. cit.* p. 423, pl. 28. f. 1–6 &c.

Genus LOXOCONCHA, G. O. Sars.

Loxoconcha tamarindus, Jones; Brady, *op. cit.* p. 435, pl. 27. f. 45–48.

Occasionally in the débris of the fishing-boats.

Loxoconcha guttata, Norman; Brady, *op. cit.* p. 436, pl. 27. f. 40–44.

In shell-débris from the West Sands.

Genus XESTOLEBERIS, G. O. Sars.

Xestoleberis aurantia, Baird; Brady, *op. cit.* p. 437, pl. 27. f. 34–37 &c.

Abundant in tide-pools.

Genus CYTHEROPTERON, G. O. Sars.

Cytheropteron latissimum, Norman; Brady, *op. cit.* p. 448, pl. 34. f. 26–30.

In the débris of the fishing-boats.

Genus Cytherideis, Jones.

Cytherideis subulata, Brady, *op. cit.* p. 454, pl. 35. f. 43–46.

In shell-débris from the West Sands.

Genus Sclerochilus, G. O. Sars.

Sclerochilus contortus, Norman; Brady, *op. cit.* p. 455, pl. 34. f. 5–10 &c.

Common in débris from deep water.

Genus Paradoxostoma, Fischer.

Paradoxostoma variabile, Baird; Brady, *op. cit.* p. 457, pl. 35. f. 1–7 & 12–17.

Abundant in tide-pools and in deep water.

Paradoxostoma ensiforme, Brady, *op. cit.* p. 460, pl. 35. f. 8–11.

In the débris of the fishing-boats.

Paradoxostoma flexuosum, Brady, *op. cit.* p. 461, pl. 35. f. 30–34.

In the same locality.

Paradoxostoma arcuatum, Brady, *op. cit.* p. 461, pl. 35. f. 37 & 38.

With the foregoing from deep water.

Order Amphipoda.

Group **NORMALIA**.

Division *Gammarina*. Subdivision Vagantia.

Tribe **Saltatoria**.

Fam. 1. **Orchestiidæ**.

Genus Talitrus, Latreille.

Talitrus locusta, L. Bate & Westwood, Brit. Sessile-eyed Crust. i. p. 16.

Abundant amongst the débris of seaweed and dead animals of all kinds near high-water mark, and in burrows in the sand even above the latter.

Genus Hyale, H. Rathke.

Hyale Nilssoni, H. Rathke; B. & W. *op. cit.* i. p. 40 (as *Allorchestes Nilssonii*).

In small pools near high-water mark on the surface of the bare rocks beyond the Maiden Rock, where almost the only vegetation is borne on the backs of the limpets, and under stones in littoral pools at the West Rocks. Stomachs of the cod and flounder.

Tribe **Natatoria.**

Fam. 2. **Gammaridæ.**

Subfamily *Stegocephalides.*

Genus Stenothoë, Dana (=*Probolium*, Costa; *Montagua*, Bate & Westwood).

Stenothoë monoculoides, Mont.; B. & W. *op. cit.* i. p. 54.

In débris of fishing-boats, not uncommon. The dorsum has rows of orange or reddish-orange specks, three distinct rows on the broad plates of the anterior limbs, and other isolated spots of the same hues; eyes orange or reddish orange, with small red dots posteriorly. A variety also occurs.

Stenothoë marina, Bate; B. & W. *op. cit.* i. p. 58.

Frequent in débris of fishing-boats. Ova green.

Stenothoë Alderi, Bate; B. & W. *op. cit.* i. p. 61.

With the foregoing, occasionally.

Stenothoë pollexiana, Bate; B. & W. *op. cit.* i. p. 64.

In the same locality. Body barred with red; eyes red.

Stenothoë clypeata, Bate; B. & W. *op. cit.* ii. Supplement, p. 499.

Occasionally in the débris of the fishing-boats.

Genus Lysianassa, M.-Edwards.

Lysianassa atlantica, M.-Edwards; B. & W. *op. cit.* i. p. 82.

Not uncommon in the stomach of the haddock.

Genus Anonyx, Kröyer.

Anonyx Holböllii, Kröyer, =*A. denticulatus*, B. & W. *op. cit.* i. p. 101.

Occasionally after storms on the West Sands, and in the stomachs of cod and haddock.

Genus Acidostoma, Lilljeborg.

Acidostoma obesum, Bate; B. & W. *op. cit.* i. p. 98.

Occasionally at the East Rocks.

Genus Callisoma, Costa.

Callisoma crenata, Bate; B. & W. *op. cit.* i. p. 120.

In the stomach of a haddock.

Subfamily *Ampeliscides.*

Genus Ampelisca, Kröyer.

Ampelisca carinata, Bruzelius; B. & W. *op. cit.* i. p. 127 (as *A. Gaimardii*).

Abundant in the stomachs of cod and haddock.

Ampelisca Belliana, Bate (= *A. macrocephala*, Lilljeborg?); B. & W. *op. cit.* i. p. 135.

Common in the stomachs of the cod, haddock, skate, and flounder, and dredged off the East Rocks. Nothing else is found in the distended stomachs of some haddocks except masses of this species; or they may be accompanied by green pea-urchins, tubes of *Terebellæ*, fragments of *Ophiocomæ*, and sea-mice. In multitudes on the West Sands after some storms.

Genus Amphilochus, Bate.

Amphilochus manudens, Bate; B. & W. *op. cit.* i. p. 180.

Occasionally in the débris of the fishing-boats. Eyes bright red; body purplish brown, speckled with dark granules; the tips of the antennæ are of the same purplish hue.

Genus Iphimedia, H. Rathke.

Iphimedia obesa, H. Rathke; B. & W. *op. cit.* i. p. 219.

Not uncommon in pools at the East Rocks, and in débris of the fishing-boats. The brownish-red markings of the young specimens form a double row on the posterior segments.

Subfamily *Gammarides.*

Genus Dexamine, Leach.

Dexamine spinosa, Mont.; B. & W. *op. cit.* i. p. 237.

Abundant in pools near low-water mark at the East Rocks, and in the stomach of the cod. Eyes white. Most have a straw-coloured body, very prettily mottled with brownish-red patches and many minute white specks; the antennæ are beautifully barred with white and brown.

Genus ATYLUS, Leach.

Atylus Swammerdamii, M.-Edwards; B. & W. *op. cit.* i. p. 246.

Occasionally in rock-pools at the pier, or clinging in hundreds to the seaweeds in the laminarian region off the West Rocks; abundant on the beach after storms, and in the stomach of the cod. Translucent and slightly yellowish, with three brownish-red spots along the dorsum, and a small one above the eyes; the latter are pinkish brown; the elongated heart pulsates very evidently on the dorsum.

Atylus bispinosus, Bate; B. & W. *op. cit.* i. p. 250.

In the débris of the fishing-boats, under stones at the pier rocks, and on the West Sands after storms. Eyes occasionally reddish. Most of the body and appendages are speckled with small black dots; many have specks of a carmine hue behind the eyes.

Genus PHERUSA, Leach.

Pherusa bicuspis, Kröyer; B. & W. *op. cit.* i. p. 253.

In the débris of the fishing-boats, and in swarms in the fine pools near high-water mark beyond the Rock and Spindle.

Genus CALLIOPIUS (Leach), Lilljeborg.

Calliopius læviusculus, Kröyer; B. & W. *op. cit.* i. p. 259.

Occasionally in pools near low water at the East Rocks.

Calliopius Ossiani, Bate; B. & W. *op. cit.* i. p. 261.

Frequent in the fishing-boats.

Calliopius grandoculis, Bate; B. & W. *op. cit.* i. p. 265.

In the same locality, and not uncommon in the rock-pools. Many show a decided brownish bar from the eyes along the dorsal ridge; and sometimes small reddish specks are present. A. Boeck includes this form under *C. læviusculus* *.

* 'Crustacea Amphipoda borealia et arctica,' p. 117.

Calliopius bidentatus (n. sp.), Norman, Nat. Hist. Trans. Northumb. & Durham, vol. i. 1865, p. 24.

This species is frequently dredged off the Harbour and the East Rocks, as well as in the deeper water outside the bay, and found on the West Sands after storms. Mr. Norman states that it is not uncommon all along the east coast.

The body is about two fifths of an inch long, of a pale straw-colour, tinted with brownish at the joints and the bases of the limbs. Superior antennæ twice as long as the inferior, beautifully banded with red. Eyes irregularly rounded, brownish red or pale brick-red. The first and second gnathopods are nearly equal (the second, however, being larger) and similar in structure. Hand almond-shaped, the palm being furnished with a series of very distinct stout spines, and a row of smaller spines reaching the base of the finger; the latter is long, boldly curved, and regularly divided on the concave side. The first and second pleopods have spines, that of the former, however, being sometimes indistinct. A very characteristic convexity occurs at the junction of the third and fourth pleopods; and the dorsal margin of the latter is concave.

Genus Leucothoë, Leach.

Leucothoë spinicarpa, Abildgaard; B. & W. *op. cit.* i. p. 271 (as *L. articulosa*).

Occasionally in pools at the East Rocks, and on the West Sands after storms.

Genus Aora, Kröyer.

Aora gracilis, Bate; B. & W. *op. cit.* i. p. 281.

Not uncommon in the débris of the fishing-boats. One had a spike beneath the second pair of gnathopoda.

Genus Microdeuteropus, Costa.

Microdeuteropus Websteri, Bate; B. & W. *op. cit.* i. p. 291.

In the stomach of a haddock, and in débris of the fishing-boats. Body of a straw-colour, the antennæ having lighter and darker bands of the same hue; eyes round, black.

Genus Bathyporeia, Lindström.

Bathyporeia pilosa, Lindström; B. & W. *op. cit.* i. p. 304.

Common off the East Rocks in the laminarian region.

Bathyporeia Robertsoni, Bate; B. & W. *op. cit.* i. p. 309.

Occasionally in pools at the East Rocks. The eyes in the examples were large, nearly meeting in the middle line.

Genus Melita, Leach.

Melita palmata, Mont.; B. & W. *op. cit.* i. p. 337.

In the débris of the fishing-boats; not common. The body is yellowish or straw-colour, with pale brownish antennæ marked at the joints with pale rings; eyes dark brown or black, with whitish specks.

Melita obtusata, Mont.; B. & W. *op. cit.* i. p. 341.

From the fishing-boats; not uncommon.

Genus Gammaropsis, Lilljeborg.

Gammaropsis erythrophthalmus, Lilljeborg; B. & W. *op. cit.* i. p. 354.

From the fishing-boats; not rare.

Genus Amathilla, H. Rathke.

Amathilla Sabini, Leach; B. & W. *op. cit.* i. p. 361.

A single example in the stomach of a haddock.

Genus Gammarus, Fab.

Gammarus marinus, Leach; B. & W. *op. cit.* i. p. 370.

In the stomach of a cod, and occasionally off the East Rocks in a few fathoms.

Gammarus locusta, L.; B. & W. *op. cit.* i. p. 378.

In swarms below the flat stones on sand between tide-marks and in the laminarian region. It swims a considerable time amongst putrid water. Occurs frequently in the stomachs of cod and haddock.

Genus Heiscladius, B. & W.

Heiscladius longicaudatus, B. & W. *op. cit.* i. p. 412.

In the fishing-boats; rare.

Subdivision Domicola.

Fam. **Corophiidæ.**

Subfamily *Podocerides.*

Genus Amphithoë, Leach.

Amphithoë rubricata, Mont.; B. & W. *op. cit.* i. p. 418.

In the débris of the fishing-boats.

Amphithoë podoceroides, H. Rathke; B. & W. *op. cit.* i. p. 422 (as *A. littorina*).

Common in the laminarian region, and under stones between tide-marks, where it constructs tubes or nests. Most of the fine specimens have the hand of the second pair defined by a distinct tooth, as Rathke and Dr. Johnston state.

Genus Podocerus, Leach.

Podocerus falcatus, Mont.; B. & W. *op. cit.* i. pp. 436 & 447 (as *P. pulchellus* and *P. pelagicus*).

In rock-pools on *Ceramium rubrum* at the Pier, in the laminarian region beyond, in the stomachs of flounders, and in the fishing-boats. Sometimes gaudily tinted with reddish brown and white, and with red bars on the inferior antennæ.

Podocerus variegatus, Leach; B. & W. *op. cit.* i. p. 439, & p. 442 (as *P. capillatus*).

Not uncommon in pools near low-water mark at the East Rocks.

Genus Cerapus, Say.

Cerapus difformis, M.-Edwards; B. & W. *op. cit.* i. p. 457.

Common in deep water. The straw-coloured body is marked with dark grains; and the superior antennæ have the basal third of the second and third segments tinted of a crimson hue, the flagellum being similarly coloured for its proximal half; the eyes have black centres and, as usual, a pale margin.

Genus Siphonœcetus, Kröyer.

Siphonœcetus typicus, Kröyer; B. & W. *op. cit.* i. p. 465.

Abundant in the laminarian region in 3 to 6 fathoms off the East Rocks, where it constructs nests on the inner surface of bivalve shells. *S. Whitei*, Gosse, is probably the female of this species.

Genus Nænia, Bate.

Nœnia tuberculosa, Bate; B. & W. *op. cit.* i. p. 472.
Occasionally in the débris of the fishing-boats.

Nœnia rimapalmata, Bate; B. & W. *op. cit.* i. p. 474.
With the former.

Nœnia excavata, Bate; B. & W. *op. cit.* i. p. 476.
Common in the same débris from the coralline ground.

Subfamily *Corophiides.*

Genus Corophium, Latreille.

Corophium grossipes, L.; B. & W. *op. cit.* i. p. 493 (as *C. longicornis*).

Abundant in the brackish pools near the mouth of the Eden, and occasionally at the West Rocks. It is common in July: swims excellently on its back.

Division *Hyperina.*

Fam. **Hyperiidæ.**

Genus Hyperia, Latreille.

Hyperia medusarum, O. F. Müller; B. & W. *op. cit.* ii. p. 12 (as *H. galba*).

Common in the cavity of *Aurelia aurita*; each medusa had six or eight large examples. The *Lestrigonus Kinahani*, Bate, is a sexual variety (male). Some large specimens are found swimming freely on the surface of the water.

Hyperia oblivia, B. & W. *op. cit.* ii. p. 17.
In a tide-pool on the West Sands after a storm.

Group **ABERRANTIA.**

Fam. **Caprellidæ.**

Genus Ægina, Kröyer.

Ægina phasma, Mont.; B. & W. *op. cit.* ii. p. 45.
Abundant in the débris of the fishing-boats.

Genus CAPRELLA, Lamarck.

Caprella linearis, L.; B. & W. *op. cit.* ii. p. 52.
Plentiful in the same locality.

Caprella lobata, O. F. Müller; B. & W. *op. cit.* ii. p. 57.
Frequent in the fishing-boats.

Caprella tuberculata, Guérin; B. & W. *op. cit.* ii. p. 68.
Common on *Ceramium rubrum* in rock-pools, and in the stomachs of cod and haddock.

Caprella hystrix, Bate; B. & W. *op. cit.* ii. p. 63.
Not uncommon in the fishing-boats. The Rev. A. M. Norman does not think this is the *C. hystrix* of Kröyer, but rather the *C. septentrionalis* of that author.

Order ISOPODA.

Group **ABERRANTIA**.

Tribe *VAGANTIA*.

Genus ANCEUS, Risso.

Anceus maxillaris, Mont.; B. & W. *op. cit.* ii. p. 187.
Not uncommon in the débris from the coralline ground.

Division **AQUASPIRANTIA**.

Tribe *PARASITICA*.

Fam. **Bopyridæ**.

Genus PHRYXUS, H. Rathke.

Phryxus paguri, H. Rathke; B. & W. *op. cit.* ii. p. 240.
Occasionally on *Pagurus bernhardus*.

Fam. **Ægidæ**.

Genus CIROLANA, Leach.

Cirolana spinipes, M.-Edw.; B. & W. *op. cit.* ii. p. 299.
A large specimen occurred in the stomach of a haddock.

Genus Eurydice, Leach.

Eurydice pulchra, Leach; B. & W. *op. cit.* ii. p. 310.

Abundant on the surface of the sea off the East Rocks in autumn, and in the stomachs of cod and haddock.

Tribe *Liberatica*.

Fam. **Asellidæ.**

Genus Jæra, Leach.

Jæra Nordmanni, H. Rathke; B. & W. *op. cit.* ii. p. 320.

Common under stones near high-water mark at the East Rocks.

Genus Janira, Leach.

Janira maculosa, Leach; B. & W. *op. cit.* ii. p. 338.

Frequent on shells and *Filigrana* from the coralline ground, and under stones in pools near low water at the East and other rocks. This species has many of the habits of *Idotea*.

Genus Limnoria, Leach.

Limnoria lignorum, Rathke; B. & W. *op. cit.* ii. p. 351.

Abundant in the stakes for the salmon-nets on the West Sands, and in wood elsewhere.

Fam. **Arcturidæ.**

Genus Arcturus, Latreille.

Arcturus longicornis, Sowerby; B. & W. *op. cit.* ii. p. 365.

Common in the stomachs of cod, haddock, and flounders.

Arcturus gracilis, H. Goodsir; B. & W. *op. cit.* ii. p. 373.

Abundant in débris from the coralline ground and in the stomachs of haddocks.

Fam. **Idoteidæ.**

Genus Idotea, Fab.

Idotea tricuspidata, Desmarest; B. & W. *op. cit.* ii. p. 379.

Frequent near low water in the laminarian region, and in the stomachs of all the common fishes.

Idotea linearis, Pennant; B. & W. *op. cit.* ii. p. 388.

Common in 3 or 4 fathoms on sand near the bar of the Eden, in the trawlers' boats, and in the stomachs of the common fishes. They are active swimmers.

Messrs. Bate and Westwood state that I sent *Cymodocea truncata*, Mont., from St. Andrews; but this is doubtful. The specimens probably came from the Outer Hebrides.

Division **AEROSPIRANTIA.**

Fam. **Oniscidæ.**

Genus Lygia, Fab.

Lygia oceanica, L.; B. & W. *op. cit.* ii. p. 444.

Abundant at the margin of high water at the East Rocks.

A specimen of *Porcellio scaber* occurred in the stomach of a cod.

Order Cumaceæ.

Fam. **Diastylidæ.**

Genus Diastylis, Say.

Diastylis Rathkii, Kröyer.

Common off the East Rocks in 3 to 4 fathoms, and in the stomach of the cod, haddock, and flounder.

[To be continued.]

XXXIV.—"Eozoon" *examined chiefly from a Foraminiferal Stand-point.* By Professors W. King, Sc.D., and T. H. Rowney, Ph.D.

[Plate XIX.]

Like most scientific men, it has been the lot of Dr. Carpenter, in the course of his career, to be placed under the necessity of defending certain of his views against the opposition of others. But unlike many who could be named, and who have risen above petty personal feelings, he does not scruple to speak of his opponents, or discuss their arguments, in a way ill-befitting any one that "loveth truth better than system"*. No other alternative, however, is open to us but to leave Dr. Carpenter to indulge in what he always imbues with a spirit of genuine sincerity, though it may recoil on himself to an extent that we, with others, cannot but regret.

It will be recollected that in the May number a summary was given of the evidences and arguments that have been advanced by us against the "eozoic doctrine." Of the twenty-one points contained in that summary, Dr. Carpenter has only grappled with two, the 9th and 19th (one relating to the "nummuline wall," and the other to the "canal-system" †); the rest, as may be presumed, appearing to him to be "entirely destitute of logical force." Of course, those that are noticed must be of a different character. Let us see how *they* are treated, as we may then be able to judge whether he has not displayed considerable exemplary discretion in not "troubling" himself with the remaining nineteen.

"Nummuline Wall" or Acicular Crust.

In our first memoir we noticed the fact, previously mentioned by Dr. Carpenter, that the aciculæ "sometimes pass off very obliquely, or even tangentially, so as to run for considerable distances in the chamber-walls;" also his admission that

* Exceptions to any objectionable rule ought to be frankly acknowledged. "The accuracy of Prof. King's information of Micro-Palæontology may be estimated by the fact that when (about the same time) he made his first acquaintance with the *Orbulina universa* brought up in the 'Porcupine' soundings off the west of Ireland, he forthwith described them as not improbably affording the explanation of the granular concretionary structure of the Oolites." I confess to feeling myself under great obligation to Dr. Carpenter for having drawn the reader's attention to a fact nearly forgotten, and evidently of much importance in my favour; but, doubtless, influenced by a laudable desire not to occupy so prominent a position as his share in them justly entitles him to take, my colleague felt himself under the necessity of making no reference to our joint micro-palæontological labours on *Rhynchopora Geinitziana*, *Spirifer cuspidatus*, and the "Histology of the Palliobranchs" that have appeared in preceding volumes of the 'Annals' (1856, 1865, 1868, &c.) and other publications. —W. K.

† Dr. Carpenter, we find, makes some slight reference to two or three other points. What he states in connexion with the 16th does not apply to *our* arguments, which were against his *quasi-alchymical* explanation (see 'Intellectual Observer,' vol. vii. pp. 290 & 294) of a number of untoward difficulties frequently presented by the "proper wall" and "canal-system," and which *cannot be ignored* in any criticism on these parts. As to the 20th point, it must astonish those belonging to the Canadian Geological Survey to learn that all the essential features of "*Eozoon*" occur in the highest state of preservation in specimens showing the least evidence of any mineral change.

he has "seen no parallel to this disposition in other Foraminifera." We, therefore, expressed ourselves as being disposed to regard so anomalous a peculiarity as evidence on our side. Mr. H. J. Carter (without, we suspect, being aware of the above admission, or of the view we were inclined to take), when he became acquainted with the anomaly, belonging, be it observed, to a part "by which the organic origin of *Eozoon* is capable of being most unmistakably recognized," emphatically pronounced against the identification of this part with the chamber-wall of a Foraminifer, and no wonder.

Mr. Carter mentions that the aciculæ are "sometimes observed to be standing perpendicularly on, but much more frequently parallel with, the surface of the grains of serpentine:" and Dr. Carpenter, in his first reply, "freely admits" that this "fact" is one of "two anomalies in the arrangement of the" aciculæ*; but, not being able to meet it, he runs off by appealing to "the wonderful variability of the Foraminiferal type, &c." However, in his second reply (having, apparently, just made the discovery), he states, "I now find a perfectly simple explanation of the fact in the structure of those very *Nummulites* which Mr. Carter knows so well." The explanation is afforded by a figure, "after D'Archiac and Haime," representing the tubulation of *Nummulites lævigatus*, which tubulation, we are given to understand, is "the *precise counterpart to*" the parallel aciculæ of "*Eozoon canadense.*"

Considering the admissions made by Dr. Carpenter, we were certainly surprised to learn from himself that similar *counterparts* are abundantly represented by D'Archiac and Haime in their 'Animaux Fossiles du Groupe Nummulitique de l'Inde.' We have no intention of criticising the figure that has been copied; for the original was made when the minute structure of the shell-layers of a nummulite was only imperfectly known. Having, however, some knowledge of the "pillars" or "cones" (so called by Sowerby) belonging to these layers, but respecting which various opinions have been advanced, we refused to put any faith in the explanation until the true character of the "pillars" and their relation to the chambers became known to us.

Within the last few months we have been kindly favoured by Mr. Carter with the loan and presentation of some valuable specimens of recent and fossil Foraminifers, together with copious information; so, when the "precise counterpart" came under our observation we solicited his further favours. The specimens he sent us in return were exactly what were re-

* The other anomaly will be noticed hereafter.

quired: a slide which he had specially prepared for us, containing *Nummulites broachensis* infiltrated with mineral matter, is particularly instructive.

Before offering any opinion on the alleged "explanation," we shall make a few remarks preparatory to its consideration.

All the *investing* chambers * of a nummulite are individualized by *walls* and a *roof* †—the former being vertical or variously inclined to the plane of the median chambers, and the latter more or less parallel to the same plane. The roofs form an important portion of the shell-layers of which a nummulite consists: and the walls, besides bounding the chambers laterally, *extend upwards*, passing through the suprajacent layer. Frequently, a number of walls are piled above each other, and the roof of one chamber serves as the basement of another. The walls are usually thin, but widest at the top; occasionally thick, as when situated at the junction of three or four chambers: the wall-extensions are often thicker, especially in the latter case. Both are pellucid. They form the "pillars" or "cones" (inverted) previously alluded to. In certain species (probably in all) the walls exhibit an asbestine or fibrous structure, the divisional lines being at right angles to that portion of the layer to which they individually belong. The roofs (possibly also asbestine) are opaque, of considerable areal extent, and generally thick: they are everywhere penetrated by fine tubules, which lie parallel to the above divisional lines.

It will thus be understood that every chamber is separated from those adjoining by a vertical asbestine wall, and that every layer is made up of roofs and walls. The layers, consequently, consist largely of tubular, and, to a much less extent, of asbestine portions, in alternating order ‡. Through various peculiarities characteristic of, and irregularities incidental to the

* The *median* chambers require no particular notice, not being directly concerned in the present question; and, for the same reason, only incidental allusions are made to the "canal-system."

† Believing that they are more explanatory, we have given these names respectively to the parts usually called *septa* and *wall*: the latter is often designated "*nummuline layer*," &c., from being tubulated, as in the Nummulites.

‡ The resemblance of the asbestine to the fibrous structure of arragonite is so close as to suggest that, instead of being original, as assumable, it may be superinduced and of inorganic origin, resulting from fossilization. Much could be said in favour of this view: nevertheless, in most cases of a change of the kind stated that have come under our notice, the process has been more or less destructive of original structure, obliterating the difference between the roof and the walls, or converting alike their substance into a structureless and pellucid condition, often so unequally, that certain laminæ of the shell-layers are opaque, and show

layers, the chambers, and the walls, vertical and oblique sections of a nummulite are rarely without some apparent deviations from the general plan of structural arrangement.

We have represented in figures 1 and 2 (Pl. XIX.), as faithfully as our abilities will allow, two medio-vertical sections, displaying the forementioned characters. Fig. 1, a section of *Nummulites lævigatus*, as seen magnified 120 diameters, shows a portion of two layers, between which is a series of investing chambers (*a*), and underneath other three that are median (*a* x). The walls (*c*), including their extensions (*c* x), pass through the layers with a slight curve: it is noteworthy that one of them ends at the floor of an overlying chamber. The only structures discernible in these parts are a few transverse lines, which characterize the entire layers, and evidently belong to their constituent laminæ. The chamber-roofs (*b*) are distinctly tubulated, as represented by the black lines: the tubules run straight out for the most part, but with a slight curve occasionally *. Fig. 2 represents a section of *Nummulites broachensis* (attached, with five more, to the slide presented to us by Mr. H. J. Carter)—a tumid species, with its different parts less repetitively developed than in many others. The chamber-roofs (*b*) have the tubules (marked in the figure by dark lines) filled with yellow (? hydrous) oxide of iron †; causing them to appear strongly in contrast to the white semi-opaque walls (*c*, *c* x): the latter parts everywhere display a fine asbestine structure. Every layer, besides being tubular and asbestine, is distinctly laminated, the laminæ traversing

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traces of tubulation, while others in *immediate* connexion are perfectly pellucid and structureless. We have never seen asbestine structure in *Nummulites lævigatus*; but in another species, from Biarritz, the walls exhibit a vertical lineation, though indefinitely, which appears to be due to it. Whether the structure be original, or superinduced does not affect the question; for the parts characterized by it, if they were even structureless, would be different from the roofs. Mr. H. J. Carter has delineated the walls and their extensions ("columns of condensed shell-substance") of *Orbitoides dispansa*, with something like a prismatic structure (Ann. Nat. Hist. 3 ser. vol. viii. pl. xvi. fig. 1 *d*), which may be asbestine; or, possibly, from being fasciculated and divergent, it is due to the canal-system: if the former, the case is the only one known to us, with the exception of the doubtful one represented by D'Archiac and Haime, of the asbestine structure having been published. Mr. Carter, however, has been for some time acquainted with it in *Nummulites broachensis*: and it was from him we first got our information on the matter.

* The roof and wall belonging to the median chamber on the left side are broken: they lie below the plane of the section, and therefore come out indefinitely.

† The chambers, also the canals, are filled with a red variety, which may be anhydrous oxide of iron.

continuously both roofs and walls. A few exceptional appearances occur: a bundle of tubules intersects two or three layers (one seems to be interpolated) in a mass of asbestine shell-substance, but without any chambers. The absence of the latter is evidently due to their being cut off from the section.

Furnished with what may be deemed sufficient data, we may now pause to take into consideration the figure brought forward by Carpenter, "after D'Archiac and Haime."

What does the figure show as it appears?—or, what are we to understand from it, as described by Dr. Carpenter? Evidently (1st) that the layers are everywhere lineated; and (2nd) that the lineation is to be taken as representing tubules, not only in the roof of the chambers, but as "*passing by*" their ends or sides. Now we unreservedly declare that no section of a nummulite can show in reality, except accidentally, any thing of the kind.

Every chamber, as we have shown, is circumscribed by walls. The lineations adjoining or *passing by* the ends of the chambers, represented by D'Archiac and Haime, must, if they were really present in the specimen, belong to the walls and their extensions; so that instead of indicating the presence of tubules, they can only represent asbestine divisional lines. The French *savans* may not have been acquainted with the difference between the walls including their extensions and the roofs of the chambers (we are not able to consult their work): if this were the case, much could be said in their favour. But nothing of the kind can be urged on the side of Dr. Carpenter; who, with all the modern appliances at his command for obtaining, if necessary, the information, and more especially after having, on different occasions, described and figured the walls as "pillars" formed of "solid substance not perforated by tubuli," deliberately brings forward this case, declaring oracularly that it is the "*precise counterpart to*" what has been admitted by himself to be an *anomalous fact*, and which is regarded by Mr. Carter and ourselves as "incompatible with nummuline tubulation" *.

* We have just had the opportunity of reading Mr. Carter's valuable communication in the current number of the 'Annals,' "On the Striæ of Foraminiferous Tests." The general structure of the nummulite he has sketched out makes it clear that there is nothing in "Eozoon" answering (except *mere simulations*) to any thing in a foraminiferal shell. Mr. Carter's *striæ* form our *asbestine structure*, which it would appear is not uncommon among fossilized nummulids. We cannot bring ourselves to accept unconditionally the view that "the striæ are the lines of cleavage," although a number of considerations could be urged in its favour: the close conformity in direction between the striæ and the adjoining tubulation seems to be relative, and therefore militating against it; while, on

Entertaining no doubt that Dr. Carpenter perfectly understood the point which he so confidently pronounces "betrays" our "shocking state of ignorance of Foraminiferal structure," we cannot but give expression to our astonishment at the evidences he has brought forward by way of justifying himself.

"*Eozoon*" is stated to be furnished with chambers that have an *upper* as well as an *under* "nummuline" or "tubulated wall" (a roof and a *floor*), also an "intermediate skeleton" between them; added to which it must be understoood that the tubules (aciculæ) of the "walls" often pass continuously from one chamber to another to the exclusion of the skeleton*. Notwithstanding the "wonderful variability of the Foraminiferal type," we have invariably held that the presence of an upper and an under "wall" is a pseudopodial impossibility; while it has been "freely" admitted by Dr. Carpenter, but only lately ('Annals,' April, p. 282), that the "fact" is an *anomaly*†. Determined, however, not to be outdone, he copies a figure, by Carter, representing a vertical section of *Orbitoides dispansa*, in which, it is stated, the "pseudopodial tubulation *normally* passes," and is circumstanced, as in "*Eozoon*." But, unfortunately for this statement, neither *Orbitoides dispansa* nor *Nummulites* possesses any intermediate skeleton, or an *under* "tubulated wall." The tubulation that is present is *upper*: it belongs absolutely and essentially to the *roof* of the chambers. We challenge our opponent to point out a single "fact" among the entire group of Foraminifers enabling him to get over this stumbling-block. Even in *Calcarina* (stated to be "the nearest parallel to *Eozoon* among recent Foraminifera"), which possesses an intermediate skeleton, a "tubulated wall" is wholly absent from the *bottom* of the chambers, every one of which *rests directly on* the skeleton.

Dr. Carpenter would fain wish it to be understood that we have *never seen* what he emphatically calls "my *true* num-

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the other hand, the organic development of the asbestine structure (in other words *prismatic*) is supported by certain observations made by Dr. Carpenter, which show that in *Operculina arabica* the tubules of the chamber-roofs are each in the *centre of a prism* (see 'Introduction to Foraminifera,' pl. xvii. fig. 8, p. 256). But the subject is one that requires much more attention than has yet been given to it; and the bearing thereon of Mr. Carter's discovery of some instances of rhombohedral (true) cleavage in fossilized nummulites must not be overlooked.—August 12, 1874.

* See Quart. Journ. Geol. Soc. vol. xxi. p. 63; Intellectual Observer, vol. x. pp. 294, 295, tinted pl. fig. 1 (upper part left-hand side); Popular Science Review, vol. iv. pl. xv. fig. 10.

† This is the second of the "two anomalies" previously mentioned.

muline wall;" yet he inconsistently asserts, "if the chambers and tubuli of a nummulite were infiltrated with serpentine, and the calcareous skeleton were removed by acid, the appearance presented would be exactly that figured" in one of our delineations of it.

Referring to his original description of "*Eozoon*," we find it stated that "in decalcified specimens, the free margins of the casts of the chambers are often seen to be bordered with a delicate white glistening fringe; and when this fringe is examined with a sufficient magnifying-power, it is seen to be made up of a multitude of extremely delicate *aciculi*, standing side by side like the fibres of asbestos:" and reference is made to fig 4, pl. ix., accompanying the memoir. Dr. Carpenter asserts that "Professors King and Rowney *certainly have not* seen" any thing answering to this description, "if they can identify it with a film of chrysotile or asbestiform serpentine, and can assert that in its typical condition it occurs in cracks or fissures of the serpentine." As the figures which represent the fact that sustain this identification (somewhat incorrectly expressed by Dr. Carpenter) are contained in a publication less known, considering its merits, than it ought to be, we have selected two additional examples, detected in a mounted section, kindly presented to one of us by himself some years since, of "*Eozoon*," in its *laminated* condition, from a specimen of Canadian ophite*. In the examples represented in fig. 3 "extremely delicate aciculæ" (*b*) are seen "standing side by side," exactly as in Dr. Carpenter's illustration; while in the other, given under fig. 4, similar aciculæ occur, but more obviously separated. The latter may be taken for typical examples of the "nummuline wall"—the "calcareous lamella perforated by minute tubuli" (they show the calcareous separations removed by decalcification, the casts of the tubuli alone remaining). But now comes the point which is to decide whether *we* are labouring under "confusion in the mind," or Dr. Carpenter is "suffering under tubulation on the brain." Reverting to the example represented in fig. 3, the aciculæ are seen to "stand side by side" (when, of course, the interspaces must be much thinner than they are in example fig. 4), and to be closely compacted, with absolutely nothing more separating them than their own divisional lines; and as such they pass here and there into the condition of true chrysotile (*c*), which actually runs into, and forms a *vein* in, the adjacent serpentine (*a*), retaining the green colour of the structureless mineral. The change from one

* The entire section is represented in 'Proceedings Royal Irish Acad.' vol. x. pl. xli. fig. 4.

extreme to the other, in this the most demonstrative example we have yet met with, is without a break or interruption of any kind.

We have no doubt that Dr. Carpenter has often seen examples resembling the above; but, considering that they are called by him "pseudomorphs," considerable doubts may be entertained of his being "perfectly acquainted with" them. Be this as it may, he "freely admits their resemblance to certain forms of the acicular layer left after decalcification of the nummuline layer." To us the resemblance is too close—of too graduating a character to be dismissed in this manner. Dr. Carpenter will have, therefore, still to repeat—"Professors King and Rowney persist in likening them, notwithstanding *my repeated assertions* that the two things are altogether different"*.

So, proofs of the complete passage of the "true nummuline wall" into chrysotile or fibrous serpentine, and exhibited in a highly metamorphosed rock with a complex mineral composition, are to be set aside by mere assertions, based on nothing more than simulations, and made, too, by one who rightly confesses that he is "not a mineralogist."

It is quite unnecessary to bring forward any other cases than those elsewhere made known † to show that the "nummuline wall, in its typical condition, occurs in cracks or fissures of the serpentine." It so happens that one of the cases referred to is seen in the section which has yielded the demonstrations that have been described and figured.

We have all along maintained that the "nummuline wall" is an integral portion of the grains and other aggregations of serpentine which it invests: hence, when a "constructed" figure was continually being republished, and which, by representing the "wall" with two continuous bounding lines, made it appear as a part independent of the skeleton, like the chamber-roof of a *Calcarina*, we deemed ourselves called upon to make known the objection we have to such representation.

Specimens are abundant which show the surfaces of the grains gradually changing into the "nummuline wall," and consequently proving the latter to be, not an independent part, but an acicular variety of the serpentine. The specimens last under consideration are evidences in point; and we give, under fig. 5, a representation of another specimen to sustain more

* The italicization is ours.

† See Quarterly Journal Geol. Society, vol. xxii. pl. xiv. fig. 4, p. 196; Proc. Royal Irish Acad. vol. x. pl. xliii. figs. 5, 6.

directly our objection. It will be observed that the side of the "wall" in contact with the serpentine (*a*) (in eozoic parlance, the face of a "chamber") exhibits a number of serpentine extensions or openings of various widths without aciculæ. Openings of a similar character are not uncommon on the other or calcitic side of the "wall" (*d*), called the "intermediate skeleton," though they do not occur in the specimen now under consideration*. In some cases the serpentine extensions are slender rods, and pass right across the "wall."

Both sets of openings are represented by Dr. Carpenter in the "nummuline wall" of the "constructed" figure to which we make objection; but he has represented them bridged over by a continuation of the line defining the acicular portions, as will be seen by our enlarged and roughly approximate copy of a portion of the "wall," under fig. 6. The openings on the "skeleton" side (*d*) consist of calcite; those on the opposite or "chamber" side (*a*) we have represented filled with serpentine, as warranted by fig. 5. To some observers, endowed with the gift of foraminiferizing †, the latter openings might be, and, if we are not mistaken, have been regarded as due to "pillars of non-tubular" shell-substance, similar to the wall-extensions that intersect the layers of a nummulite; but this view is obviously incorrect, as it requires the openings *belonging to both sides to be filled with calcite, also to be extensions of chamber-walls*: nothing, however, that can be considered to represent any thing of the kind is ever present. Clearly, then, as the openings cannot be identified with the non-tubular portions belonging to the shell-layers of a nummulite, they ought to have been represented unbridged, as in fig. 7. Dr. Carpenter had no more right to introduce bridging lines than we have in our fig. 5. It may be suggested that he has merely given a hypothetical reconstruction; but nothing of the sort can be allowed after his express declaration—"I have represented nothing that my specimens do not

* As, from their similarity of composition, we cannot demonstrate any difference between the "intermediate skeleton" and the adjoining *calcitic openings*, and as it is immaterial to the point, it is unnecessary to make any further allusion to the latter.

† It is much to be feared that the spheroids, &c., common in the magnesian limestone of Durham, will not escape being converted into gigantic Foraminifers. Dr. Carpenter, after making some remarks in connexion with these bodies, thus concludes—"The only question now is, whether a careful microscopic examination of the minute structure of the Permian concretions may not afford, through its likeness to that of *Parkeria*, more or less definite indications of *their* organic origin obscured by subsequent metamorphism"! (Nature, vol. iii. p. 186). The late Professor Sedgwick, in a letter to one of us, spoke strongly against the "eozoic doctrine:" what would he have said respecting this idea?

distinctly show." Observations properly and patiently conducted, with a true appreciation of all the collateral elements, and discarding partial simulations, instead of giving rise to the idea that the openings on the "chamber" side should be represented as bounded by a line and filled with calcite, would have resolved them into portions of serpentine, remaining unconverted into chrysotile or into the acicular condition.

It will now, to some extent, be understood in what sense we contend that the "nummuline wall" is not a chemically differentiated part. In certain places, as shown on the left side of fig. 4, it is largely made up of calcite (it may be dolomite, or magnesite); and, as such, shutting out of view the fact that it oftener consists of closely compacted aciculæ, it might, allowing some exaggeration, be called "a calcareous lamella"; but in these places the "wall" certainly cannot be regarded otherwise than as having assumed an exceptional condition, it being, according to its discoverer, "rarely well preserved" (the expression evidently refers to what is considered to be its "true" or "typical" character); and, which is of far greater weight with us, more especially when, as in the places already noted, it completely and insensibly passes into the state of *true* chrysotile*.

Dr. Carpenter has brought forward an entirely new "probative fact," consisting of a fragment of the "nummuline

* According to our theory, stated elsewhere (Quart. Journ. Geol. Soc. vol. xxii. pl. xiv. fig. 2, p. 192; Proc. Roy. Irish Acad. vol. x. pl. xli. fig. 2, p. 315; Geol. Mag. Jan. 1872), the presence of calcite in the "nummuline wall" is the result of chemical action, effected by the agency of carbonated solutions, similar to what has taken place in the production of pseudomorphs consisting of calcite after a silacid mineral. In the latter, the original mineral substance is often represented by a siliceous skeleton, or it is entirely removed, nothing being left but its crystalline form composed of calcite. With the exception that no original crystalline form is preserved (for a rock mass has been dealt with), the "wall" displays similar changes; the calcite has partially, or wholly replaced the serpentine—partially where the aciculæ are imbedded in it, and wholly where they are absent. The aciculæ, when separated merely by divisional spaces, manifest the first change of the chrysotile (which is *indefinitely fibrous*): when separated by calcitic interspaces, as in the "*true* nummuline wall," they are no more than the remains of the latter mineral, preserving in their "usual straight and parallel lie," and their "often more or less curvedness," its characteristic *fibrosity*. Similar chemical action, or methylosis as we have called it, has converted amorphous serpentine into lobulated grains ("chamber-casts") and arborescent forms ("canal-system"), but mainly shaped by irregular *conchoidal* divisional structure. In all cases the change terminates with the production of the "intermediate skeleton," the result of the conversion of serpentine into calcite.

wall," in which it is stated that "many of the tubuli remain empty; and *they can be distinguished as tubuli under any magnifying-power that the thickness of the covering-glass allows to be used.*" If we are correct in our interpretation of this statement, we think, although pronounced with italic emphasis, that it ought to have been accompanied by some confirmatory information. The "explanation" of the figures representing the fragment is even less satisfactory. Dr. Carpenter must excuse us; but he ought to know that a mere statement of this kind is totally insufficient to convince those who thoroughly disbelieve in "*Eozoon.*" What may appear to him to be *empty tubuli* cannot appear as such to the latter, unless they are convinced of the validity of the evidence on which he relies. Microscopic appearances are often difficult of interpretation. Besides, it must not be forgotten that Dr. Carpenter is as fallible as any other mortal*. To us this case does not add a single particle of weight to the "eozoic doctrine." Having been brought forward without one iota of evidence, we are under the necessity of making no further comments on it, except to state that we do not dispute but the fragment exhibits some structural peculiarity giving rise to *appearances* of empty tubulation; but being familiar with numerous things in various minerals which cannot possibly be what they are in appearance, as well as with tubular cavities in the same of inorganic origin, we unhesitatingly demur to Dr. Carpenter's interpretation,—more especially as it involves the existence in their *original empty* condition of *fossilized* tubules, stated to be "less than $\frac{1}{10,000}$ part of an inch in diameter," and preserved in a well crystallized and complexly mineraliferous rock, like ophite, that has participated in all the mechanical and physical movements undergone by the violently disturbed and highly metamorphosed Laurentians of Canada. It was hard enough for geological or mineralogical believers (full exception must be made in favour of those belonging to the biological class) to accept "the fact that the organic structure of the shell is in many instances even more completely preserved than it usually is in the Nummulites and other *Foraminifera* of the Nummulitic limestone of the early Tertiaries"†, or the statement that "*Eozoon*" is best preserved in the Laurentians of a "highly

* It will not be the first time that Dr. Carpenter has committed some grave errors, even in cases surrounded by no such difficulties as pertain to the one under notice. We need only mention his idea, apparently held for some years, that the "solid pillars" of the Nummulites were perforations filled up with mineral matter. Of course we attach nothing more to this error than its pertinency to the case of the "*empty* tubuli."

† Carpenter, Quart. Journ. Geol. Soc. vol. xxi. p. 64.

crystalline condition"*; but any attempt to accept the "probative fact" of *nummuline* tubules, in their original "*empty*" state, occurring in such rocks, they will find to be labour in vain; though, science failing, Faith, which removes mountains, will undoubtedly stand in its stead.

Is it surprising that Professor Schultze, when he became acquainted with the evidences adduced in our papers, requested his friend, Mr. Arthur E. Barker, "to tell Messrs. King and Rowney, that, with respect to the proper wall of Carpenter, I am entirely of their opinion, that it is of inorganic origin"†; or that Carter emphatically declared the identification of it with the chamber-roof of a nummulite "to be nonsense!"

"Canal-system" or Serpentinous Arborescences.

Our remarks on this part must be comparatively brief, Dr. Carpenter having advanced nothing new respecting it. We must, in the first place, express our approval of his figures 3 and 4, which show the "canals" under their characteristic aspect; also the non-acicular portion of fig. 1, in which some simpler forms are represented; though we are as confident as ever that they are nothing more than examples of arborescent serpentine, related to, if not identical with, metaxite. As regards those shown in fig. 5, their appearance is so untypical that we cannot avoid expressing a fear about our being correct; we are nevertheless willing, with some reservation, to allow them to stand as examples of the "canal-system." The bodies taken to represent this system in the figure last referred to, it is stated, "show by their semiopacity in one part the extent to which the serpentinous infiltration has proceeded, and, by their transparence in the rest, that their canalization is not the result of any foreign infiltration whatever." It is next stated that the "canals" (? presumably the transparent portions) "are filled with calcite, having the same crystalline axis as that of the matrix." Again, "as I know them (the "canals filled with calcite") to be contained in the section which I long since forwarded to Prof. Rowney, the only conceivable reason for the non-recognition of them by the two Galway professors is that they have not used the reduced light, which, through the extreme transparence of the minuter canaliculi, is necessary to bring them into view." As Dr.

* Dawson. This statement is quite correct in the sense that the structures forming the presumed organism are of mineral origin.

† Dr. Carpenter has credited us with many things: his last favour of the kind, that Max Schultze "had changed his opinion respecting the canal-system, as asserted by" *us*, we are under the necessity of returning—it being without any endorsement.

Carpenter has totally ignored the report we gave of our examination of the section in question, we shall give the substance of it, which, with a few additional remarks, will be sufficient to enable the reader to understand the estimate we have formed of the last case he has brought forward.

We stated that the section was crowded with "canals," distinguished as usual by their semiopacity: intermixed with them were others (encircled by the donor with ink) quite colourless or transparent, and not visible under full light. They were imbedded in transparent calcite, affected with both rhombohedral and macro-diagonal cleavage; but while in most there was nothing of the kind seen, a few had the appearance of possessing calcitic divisional structure. To make ourselves certain with respect to the composition of the transparent "canals," we tested them. Obviously, if they consisted of calcite, the section, when *superficially* dissolved (to prevent their dropping out), would display them quite as much acted on by the acid as the matrix. But instead of this being the result, all the transparent "canals" distinguished by a circle in ink were seen projecting out of the remaining portion of the matrix as clear as glass: none showed any traces of cleavage except one, *where it was still overlaid by calcite* *. This simple test completely demonstrated that the transparent "canals" were entirely siliceous bodies.

At various times we have been told of the occurrence of "canals filled with carbonate of lime of the same nature"—"of the same crystalline character"—"having the same crystalline axis as that of the matrix." Taking this to refer to cleavage (for such is represented by lines obliquely crossing the transparent "canals" in Dr. Carpenter's fig. 5; *the same lines*, it will observed, are *represented* (!) *equally crossing the semiopaque or "serpentinous* canals"), and, considering the absence of all allusion to chemical and optical evidences confirmatory of their alleged composition, we are strongly inclined to the belief that the crystalline character observed in the "transparent canals," of late made known, does not belong to them, but to their calcitic matrix; and, as in other cases of the kind, it is our opinion that there are the strongest grounds for removing *this* "cardinal fact" from the category of reliable evidence on the side of the "eozoic doctrine."

* A figure was appended of a portion that had been marked with ink, showing five of the "transparent canals," as seen magnified 210 diameters, and under Webster's condenser with graduating diaphragms. For a full account of this section, and specimens of a similar character, the reader is referred to the 'Proceedings of the Royal Irish Academy,' vol. x. pp. 532, 534, 535, pl. 44. fig. 11; also *id.* new series, vol. i. p. 132.

It will be understood from the title of our paper that we have restricted ourselves chiefly to the speciality which, admittedly, Dr. Carpenter ought to be thoroughly conversant with. Fully examined from his own special stand-point, the "nummuline layer" or "feature by which *Eozoon* is capable of being most unmistakably established" turns out to be a *Foraminiferal impossibility*; while, as made known by the twenty-one points of our summary, geology, mineralogy, and chemistry irresistibly relegate it to the domain of inorganic nature. Let us hope, for the reputation of geology, which owes so much to the correlative sciences, that in future its labourers will be severely critical on new doctrines—that before accepting them they will give more weight and consideration to opposing evidences belonging to mineralogy and chemistry; otherwise the noble legacy which they have received from a generation that has scarcely passed away will assuredly fall a prey to sensational doctrines, based on mere *appearances* and *probabilities* uncorrelatively and isolatedly interpreted in opposition to the teaching of a wide range of established facts.

EXPLANATION OF PLATE XIX.

Fig. 1. Vertical section of the shell-layers of *Nummulites lævigatus*, showing the chambers (*a*, *a* x), each with a tubulated roof (*b*), and non-tubular walls (*c*) including their extensions (*c* x): as seen magnified 120 diameters.

Fig. 2. Vertical section of *Nummulites broachensis* (Carter). (The letters refer to the same parts as in fig. 1.)

Fig. 3. Section (decalcified) of *Eozoon canadense*, showing "chamber-casts" (*a*) in serpentine, "intermediate skeleton" (*d*) in calcite (dissolved out by decalcification), and "nummuline wall" (*b*) in its *typical* condition (the aciculæ were separated by calcitic spaces) where the letter is opposite, but passing *gradually* into chrysotile (*c*), which forms an intersecting vein in the serpentine: as seen magnified 60 diameters.

Fig. 4. Section (decalcified) of "*Eozoon canadense*" (from same specimen as the last), showing "nummuline wall" (*b*) in its *typical* condition, on the left side, but gradually passing into the *closely compacted* condition (*unseparated* except by mere divisional lines) above letter *a*.

Fig. 5. Section of same, showing the side of the "nummuline wall" next to the serpentine (*a*) with *openings*, to prove that it is only differentiated from the latter by its acicular or fibrous structure; the serpentine in the openings remaining structurally unaltered: as seen magnified 210 diameters.

Fig. 6. Approximate copy, enlarged, of Dr. Carpenter's representation of a portion of the "nummuline wall" of "*Eozoon canadense*," which he has represented bounded by two continuous lines under the belief that it is a "calcareous lamella," and thus differentiated from the serpentine "chamber-cast" (situated on the side *a*).

The bounding-line, or rather the lines bridging the *openings* (*a*), we contend ought not to have been introduced.

Fig. 7. Same, as the "nummuline wall" really occurs, there being nothing in specimens, as will be seen in fig. 5, to show that the *openings* (*a*, fig. 6) were ever filled with calcite (according to the "eozoic doctrine" the part is a "calcareous lamella"): on the contrary, they were always filled with serpentine.

XXXV.—*On a Collection of Hemiptera Heteroptera from Japan. Descriptions of various new Genera and Species.* By John Scott.

Not the least interesting amongst the many novelties obtained by Mr. George Lewis in Japan are the Hemiptera, which I have had the pleasure of examining; and although the major part of the collection contains many well-known forms, some of which are European, on the other hand there are several possessing peculiar characters. These last are all entirely new to science; and their description forms a portion of the present paper. Subjoined I give a complete list, showing which genera and species are new and which have been previously described.

List of Hemiptera Heteroptera collected by Mr. George Lewis in Japan.

Those species with an asterisk (*) in front are found in England.
Those species with an obelisk (†) occur on the continent of Europe, but are not known to be British.

Fam. Pachycoridæ.

Pœcilocoris ornatus, *Dallas.*
Callidea grandis, *Thunb.*

Fam. Eurygastridæ.

Bolbocoris reticulatus, *Dallas.*
*Eurygaster maurus, *Linn.*
†Graphosoma lineata, *Linn.*

Fam. Podopidæ.

Scotinophora lurida, *Burm.*
—— tarsalis, n. sp.

Fam. Odontoscelidæ.

No representative.

Fam. Plataspidæ.

Coptosoma cribraria, *Fab.*
—— biguttata, *Motsch.*

Fam. Oxynotidæ.

No representative.

Fam. Asopidæ.

*Zicrona cærulea, *Linn.*
Menida violacea, *Motsch.*
Picromerus Lewisi, n. sp.
Pinthæus sanguinipes, *Fab.*

Fam. Cydnidæ.

Æthus nigropiceus, n. sp.
Macroscytus japonensis, n. sp.
Canthophorus niveimarginatus, n. sp.
Sehirus triguttatus, n. sp.

Fam. Sciocoridæ.

Laprius varicornis, *Dallas.*
Drinostia Lewisi, n. sp.

Fam. Phlœidæ.

No representative.

Fam. Halydidæ.

Eurydema rugosa, *Motsch.*
Agonoscelis nubila, *Fab.*
Stollia guttigera, *Thunb.*

Fam. Pentatomidæ.

Ælia Fieberi, n. sp.
Plautia Ståli, n. sp.
Zangis melanostictus, *Voll.*
Nezara antennata, n. sp.
—— viridis, *Linn.*
Piezodorus rubrofasciatus, *Fab.*
Polycoris verbasci, *De G.*
Palomena angulosa, *Motsch.*
—— rubricornis, n. sp.
Halyomorpha picus, *Fab.*
Carbula humerigera, *Uhler.*
Acanthosoma distincta, *Dallas.*
—— scutellata, n. sp.
Elasmucha Putoni, n. sp.
—— Signoreti, n. sp.

Fam. Urostylidæ.

Urostylis striicornis, n. sp.
—— annulicornis, n. sp.
—— Westwoodii, n. sp.

Fam. Edessidæ.

No representative.

Fam. Phyllocephalidæ.

Gonopsis affinis, *Uhler.*
Prionochilus decempunctatus, *Motsch.*

Fam. Megymenidæ.

1 species, about which I am doubtful.

Fam. Spartoceridæ.

No representative.

Fam. Mictidæ.

Mictis fuliginosa, *Uhler.*

Fam. Nematopidæ.

No representative.

Fam. Homœoceridæ.

Homœocerus striicornis, n. sp.
—— unipunctatus, *Thunb.*

Fam. Syromastidæ.

No representative.

Fam. Acanthocoridæ.

Acanthocoris sordidus, *Thunb.*

Fam. Anisoscelidæ.

Plinacthus bicoloripes, n. sp.
Pachycephalus opacus, *Uhler.*

Fam. Alydidæ.

Riptortus clavatus, *Thunb.*
Megalotomus costalis, *Ståil.*

Fam. Stenocephalidæ.

No representative.

Fam. Berytidæ.

No representative.

Fam. Coreidæ.

Cletus rusticus, *Stål.*
Paraplesius, nov. gen.
—— unicolor, n. sp.

Fam. Rhopalidæ.

Stictopleurus abutilon, *Rossi.*

Fam. Lygæidæ.

Arocatus melanostoma, n. sp.
Melanocephalus cruciger, *Motsch.*
Ischnodemus spinicaput, n. sp.
Chauliops, nov. gen.
—— fallax, n. sp.
Nysius, 1 species undetermined.
Peliosoma antennata, *Uhler.*
Geocoris varius, *Uhler.*
Tropistethus antennatus, n. sp.
*Platygaster ferrugineus, *Linn.*
Lasiosoma pallipes, n. sp.
Diplonotus rusticus, n. sp.
—— hemipterus, n. sp.
—— luridus, n. sp.
—— lateralis, n. sp.
Metochus, nov. gen.
—— abbreviatus, n. sp.
Prosomœus, nov. gen.
—— brunneus, n. sp.
Gyndes albomarginatus, n. sp.
Lethæus Dallasi, n. sp.
Calyptonotus albomaculatus, n. sp.

Graptopelta albomarginata, *Uhler?*
Ischnorrhynchus colon, *Thunb.*

Fam. Dipsocoridæ.

No representative.

Fam. Anthocoridæ.

No representative.

Fam. Microphysidæ.

No representative.

Fam. Pyrrhocoridæ.

Physopelta cincticollis, *Stål.*
—— gutta.
Pyrrhocoris coriaceus, n. sp.
Melanospilus cruciger, *Motsch.*

Fam. Largidæ.

No representative.

Fam. Capsidæ.

1 species of *Deræocoris*, but whether already described I cannot ascertain.

Fam. Phymatidæ.

No representative.

Fam. Macrocephalidæ.

No representative.

Fam. Hebridæ.

No representative.

Fam. Zosmenidæ.

No representative.

Fam. Piesmidæ.

No representative.

Fam. Tingididæ.

Tingis pyrioides, n. sp.
Monanthia monstrosa, n. sp.
—— Fieberi, n. sp.
Cantacader Lethierryi, n. sp.
†Laccometopus clavicornis, *Linn.*

Fam. Brachyrhynchidæ.

Mezira scabrosa, n. sp.

Fam. Aradidæ.

No representative.

Fam. Acanthiidæ.

No representative.

Fam. Holoptilidæ.

No representative.

Fam. Lobocephalidæ.

No representative.

Fam. Sycanidæ.

No representative.

Fam. Harpactoridæ.

Isyndus obscurus, *Stål.*
Cydnocoris russatus, *Stål.*

Fam. Saccoderidæ.

No representative.

Fam. Hæmatocoridæ.

No representative.

Fam. Tagalidæ.

No representative.

Fam. Stenopodidæ.

Oncocephalus squalidus, *H.-Sch.*

Fam. Reduviidæ.

Acanthaspis humeralis, n. sp.
Sphedanolestes nodipes, *Uhler.*
—— impressicollis, *Stål.*

Fam. Ectrichodidæ.

Larymna Andræ, *Thunb.*
Mendis japonensis, n. sp.

Fam. Apiomeridæ.

No representative.

Fam. Piratidæ.

Pirates, 1 species not determined.

Fam. Nabidæ.

Nabis brevilineata, n. sp.

Fam. Saldidæ.

No representative.

Fam. Pelogonidæ.

Pelogonus flavomarginatus, n. sp.

Fam. Emesidæ.

No representative.

Fam. Henicocephalidæ.

Henicocephalus, 1 species without elytra.

Fam. Gerridæ.

Limnobates albolineatus, n. sp.
Gerris, 4 species; but as they may probably be described elsewhere, I leave them for the present.

Fam. Veliidæ.

No representative.

Fam. Galgulidæ.

No representative.

Fam. Naucoridæ.

Naucoris exclamationis, n. sp.

Fam. Belostomidæ.

Belostoma, ? n. sp.
Appasus Lewisi, n. sp.

Fam. Nepidæ.

Laccotrephes japonensis, n. sp.
Ranatra pallidenotata, n. sp.
—— unicolor, n. sp.

Fam. Corixidæ.

No representative.

Fam. Notonectidæ.

Notonecta triguttata, *Mostch.*

Family **Podopidæ.**

Genus Scotinophora, Stål.

Scotinophora tarsalis.

Black, thickly and deeply punctured. *Pronotum* anterior angles produced into a longish, somewhat acute tooth; lateral margins waved, terminating posteriorly in a stout tooth. *Legs* black. *Tarsi* brown.

Head black, rugosely punctured; central lobe elevated, shorter than the side lobes, which are somewhat acute at the apex, and leave a wide notch between them. *Antennæ* black. *Rostrum* piceous.

Thorax.—Pronotum black, rugulose punctate; in front with a narrow flat collar and a transverse channel in a line with the posterior teeth, the intermediate space much elevated and with a fine central longitudinal keel, on either side of which is a round punctured callus. *Scutellum* black or deep pitchy black, thickly and coarsely punctured; the punctures thickest next the basal angles, those on the disk disposed in short irregular sinuous rows. *Elytra* black or deep pitchy black, thickly punctured. *Membrane* pale. *Sternum* and *legs* black. *Tarsi* brown.

Abdomen beneath convex, black, finely crenulate.

Length $2\frac{3}{4}$ lines.

When in fine condition I believe this insect will be found to be clothed with short yellowish hairs, as there are slight indications here and there on the two examples in the collection. It is little more than half the size of *S. lurida*, from which it may be distinguished by the shape of the head, the longer tooth at the anterior angles of the pronotum, the elevated portion of the same, and the entire puncturing.

Family **Asopidæ**.

Genus PICROMERUS, Am. et Serv.

Picromerus Lewisi.

Luteous, generally with a fuscous shade, caused by the thick and irregular black puncturing; head somewhat bronzy in front.

Head somewhat bronzy in front, with a more or less distinct yellow streak between the base and the central lobe of the face. *Antennæ* reddish yellow; first joint fuscous, apex of the third and apical half of the fourth and fifth black. *Eyes* pitchy brown. *Ocelli* red. *Rostrum* yellowish, apical joint brown.

Thorax.—Pronotum in front frequently dark fuscous; spines pitchy black, frequently somewhat bronzy; lateral margins serrate; disk in front with two slight callosities more or less punctured, and with an irregular, slight, somewhat orange-coloured central keel. *Scutellum* crenate punctate, more or less clouded with dark fuscous, near the basal angles a small, somewhat orange spot. *Elytra*: *corium* more finely punctured than the pronotum. *Membrane* fuscous, nerves slightly darker, inner basal angle with a pale triangular patch divided longitudinally into two unequal portions by a slightly curved dark fuscous streak, widest at the commencement, and extending from the apex of the anterior margin to about the middle of the base, where it curves round and joins the inner margin below the pale triangle. *Sternum* yellowish or luteous, thickly black-punctured. *Legs* yellow or luteous: *thighs* thickly black-punctured; upper, inner, and outer sides piceous, somewhat bronzy: *tibiæ* yellow, with short black streaks at the base and apex on the inner and outer sides: *tarsi* yellow, apical joint black: *claws* reddish brown, apex black.

Abdomen above black, very thickly and finely punctured; beneath yellowish or luteous, black-punctured here and there, the punctures forming little irregular patches; third, fourth, fifth, and sixth segments with a dark bronzy triangular patch in the centre, the last generally largest and more rhomboid in shape. *Connexivum* black or slightly bronzy, finely crenate punctate; on each segment beyond the middle a round orange or yellowish spot; exterior margins of the segments narrowly orange or yellowish, base black.

Length 5½–6 lines.

The characters on the antennæ, legs, abdomen underside, and connexivum will enable any one to separate this species from *P. bidens*, to which it bears a great resemblance.

Family **Cydnidæ**, Stål.

Genus Æthus, Dallas.

Æthus nigropiceus.

Black or deep pitchy black, shining; anterior margin of the head and sides of the pronotum with long castaneous hairs.

Head: anterior margin slightly concave in the middle, and with four foveæ adjoining, one placed at the lower angle of the inner margin of each eye and one on either side of the apex of the central lobe: *crown* unpunctured, shining. *Antennæ* piceous, apex of the terminal joint pale brown. *Eyes* reddish or brownish red. *Rostrum* piceous.

Thorax.—Pronotum shining; anterior margin with four foveæ, placed two on either side, between the two inner ones are a few punctures in a curved line; sides and posterior margin rather broadly but finely punctured; across and before the middle of the disk are four foveæ, the two exterior ones deepest. *Scutellum* deeply and coarsely punctured, apex depressed. *Elytra* deeply, but more thickly and finely, punctured than the scutellum, the punctures disposed somewhat in rows. *Membrane* pale fuscous. *Legs* piceous; base of the *tibiæ* reddish; *tarsi* yellow.

Length 1½–2 lines.

Immature specimens are reddish chestnut.

Genus Macroscytus, Fieb.

Macroscytus japonensis.

Pitchy black or black, slightly shining.

Head with a few long, stoutish, piceous hairs. *Antennæ* ferruginous brown, first joint sometimes piceous. *Rostrum* pale brown.

Thorax.—Pronotum posteriorly somewhat flattened in the middle, with three transverse rows of punctures, or the space enclosed by these entirely punctured; at the anterior margin are four foveæ placed as follows—one near each anterior angle, and one in a line with the inner margin of each eye, between the latter an irregular row of punctures; sides broadly punctured; margin with a few long, stoutish, piceous hairs. *Scutellum* coarsely and irregularly punctured, the apex lanceolate and depressed. *Elytra* thickly and irregularly punctured, the punctures finer than those on the scutellum, posterior margin almost straight. *Membrane* pale fuscous yellow, with three or four somewhat darker spots near the apex, above which is an irregular transverse line widest next the anterior margin. *Legs* pitchy black or black: *tarsi* reddish brown.

Length $3\frac{1}{2}$–4 lines.

Apparently a somewhat common species, as there are several examples.

Genus Canthophorus, Muls.

Canthophorus niveimarginatus.

Blue-black, with a violet tinge, shining, thickly and deeply punctured; the lateral margins of the pronotum and the anterior margin of the elytra narrowly white.

Head finely punctured; anterior margin much reflexed and slightly dentate in the centre. *Antennæ*, *eyes*, and *rostrum* black.

Thorax.—*Pronotum* transverse, finely punctured next the anterior margin; across the centre of the disk, but not reaching to the sides, is a deep channel, in front of which is an elevated transverse space almost without punctures; posterior portion coarsely and irregularly punctured. *Scutellum* at the base with about three irregular rows of fine punctures; centre of the disk somewhat sparingly and irregularly punctured, posterior portion rugulose punctate; apex deflected almost at right angles to the disk. *Elytra*: *clavus* with two longitudinal rows of punctures next the suture, at the base interiorly rugulose punctate: *corium* punctured, the punctures finer and more regularly disposed than on the pronotum or scutellum, next the claval suture a single longitudinal row; anterior margin white. *Membrane* piceous. *Legs* and *tarsi* black.

Abdomen beneath convex, shining, very delicately punctured. *Connexivum* black; exterior margin of the segments narrowly white.

Length 3 lines.

This insect bears a great resemblance to *Schirus dubius*, from which it may readily be distinguished by the greatly reflexed anterior margin of the head, the deflected apex of the scutellum, and the whiter lateral margins of the pronotum and anterior margin of the elytra.

Genus SEHIRUS, Am. et Serv.

Sehirus triguttatus.

Black, shining, thickly punctured; margin of the pronotum and elytra, two spots upon the latter, apex of the scutellum, and basal two thirds of the tibiæ exteriorly white.

Head black, thickly and deeply punctured; anterior margin reflexed. *Antennæ* pitchy black; first and second joints short, subequal, third about as long as the two former, fourth shorter than the fifth, apex of the latter reddish brown.

Thorax.—*Pronotum* black-punctured, except a transverse space next the anterior margin; the punctures at the anterior margin and on the sides towards the anterior angles finer and more thickly disposed than those on the posterior portion of the disk; lateral margins white. *Scutellum* black, sparingly and irregularly punctured, posteriorly somewhat transversely wrinkled; apex white. *Elytra* black, somewhat thickly punctured. *Corium*: anterior margin white; disk with an unpunctured, short, white oblong streak, placed somewhat obliquely and pointing towards the apex of the scutellum. *Membrane* brown. *Legs* black: *tibiæ* black, basal two thirds, except the knees, exteriorly white; spines black: *tarsi* somewhat reddish, third joint piceous.

Abdomen above piceous, beneath black. *Connexivum*: exterior margin narrowly white.

Length 2¼ lines.

This insect somewhat resembles a small *S. biguttatus*, with the addition of a white apex to the scutellum; but here ends all likeness, as the sculpture is different, and the exterior margin of the tibiæ from the base downwards, for a considerable distance, is white. There is also a great difference in the length and proportion of the joints of the antennæ in the present species when compared with others of the genus; but I am averse to creating a new genus for the reception of this species on this character alone, as I have only seen a single example.

Family **Sciocoridæ.**

Genus DRINOSTIA, Stål.

Drinostia Lewisi.

Pale luteous, finely black-punctured. *Elytra*: anterior margin broadly white. *Sternum* and *abdomen* with a more or less distinct black-punctured streak down the sides; the latter in addition with a broad black line down the centre.

Head thickly black-punctured, except a small space next the eyes, in which is a single slightly curved row of punctures.

Crown on each side of the centre with a luteous line extending to the base of the central lobe. *Antennæ* luteous; first joint with a short black streak exteriorly, second spotted with black, third, fourth, and fifth black, extreme apex of the two former brownish. *Eyes* reddish or reddish brown. *Ocelli* red, centre black. *Rostrum* luteous; apical half of the terminal joint black.

Thorax.—Pronotum finely black-punctured, the punctures disposed in interrupted, tortuous, transverse lines, becoming more dense as they approach the narrowly luteous lateral margins; from the centre of the anterior margin proceeds a short, slightly elevated, pale luteous line; a little beyond the hinder angles is a slightly elevated, shining, piceous spot. *Scutellum* punctured similar to the pronotum; base narrowly, and a short, central, longitudinal line pale luteous. *Elytra* finely black-punctured. *Corium*: anterior margin as far as the first nerve white, thickly punctured, except a narrow line next the nerve; first nerve black, except a short pale space at the base. *Membrane* pale fuscous brown, at the inner basal angle a piceous patch; first and second nerves next the anterior margin piceous; the entire margin finely wrinkled transversely. *Sternum* pale luteous or greyish white, with a broad black-punctured streak, more or less distinct in different individuals down each side; at the base of each pair of legs a black spot. *Legs* pale luteous, finely black-punctured: *thighs* with two distinct black spots near the apex: *tibiæ* thickly and finely black-punctured, almost in longitudinal rows; extreme base exteriorly with a small black spot: *tarsi* pale luteous; apex of all the joints piceous: *claws* pale; apex piceous.

Abdomen above black; terminal segment, posterior margin narrowly, and a small round spot next the connexivum brownish yellow; beneath pale luteous or greyish white, sparingly black-punctured a little on each side of the centre, down which runs a broad black line; on the sides and continuous with that on the sternum is a broad black-punctured streak, more or less distinct in different individuals. *Spiracles* black above, very narrowly margined with white. *Connexivum* above white, very finely punctured; exterior angle of all the segments narrowly black; inner and basal margin of the last segment black.

Length $5\frac{1}{2}$–$6\frac{1}{2}$ lines.

Family **Pentatomidæ**.

Genus Ælia, Fab.

Ælia Fieberi.

Flavous or ochreous, thickly black-punctured; lateral margins of the *head* narrowly black; a broad black streak runs down the centre of the insect, and is widest at the base of the *pronotum*; it then narrows to the apex of the *scutellum*, where it terminates in a short black dash; the black streak is divided down its centre by a narrow yellow line extending from the central lobe of the face to about the middle of the scutellum.

Head.—Face: central lobe yellow or fuscous yellow, somewhat convex from the middle to the apex; side lobes distinctly constricted before the apex, are rounded and enclose the central lobe, leaving a small notch between them; lateral margins narrowly black. A black-punctured streak runs down the centre of the head, commencing almost in a point at the apex, gradually widening until about in a line with the middle of the central lobe, where it slightly curves and then continues almost of the same width to the base of the head; the black streak is divided down the centre by a narrow yellow line extending from the central lobe to the base. *Antennæ* red, first and second joints yellow. *Eyes* black. *Ocelli* reddish. *Rostrum* yellow, apex black.

Thorax.—Pronotum: lateral margins narrowly yellow, within which is a black streak, widest next the hinder angles; basal region transversely more or less inclined to fuscous; posterior margin across the scutellum very narrowly yellow; the broad black streak down the centre of the disk divided by the narrow yellow line slightly disappears before reaching the posterior margin. *Scutellum* somewhat broad; basal angles with a short punctured black channel; lateral margins from the centre to the apex generally pale; down the centre is a broad black streak, terminating at the apex in a short black dash; the black streak is divided by a narrow yellow line extending from the base to about the middle of the disk; punctures at the base larger than those on the sides and apex. *Elytra* black-punctured, similar to those on the apex of the scutellum. *Corium*: nerve yellow, unpunctured and with a row of fine punctures on its inner margin; interior margin below the middle of the scutellum more or less piceous. *Membrane* clear; first exterior nerve piceous. *Sternum* ochreous, sides and in front black-punctured; base of first and third pairs of legs with a large black puncture, second with two. *Legs* ochreous or yellow: *thighs*, first pair on the underside thickly black-punctured, second and third at the apex finely black-punctured, in the latter sometimes almost obsolete, all the pairs with two large transversely placed black spots on the inside a little before the apex: *tibiæ*, *tarsi*, and *claws* yellow; apex of the last dark piceous.

Abdomen above black, beneath ochreous or yellow, with six longitudinal rows of black punctures. *Connexivum* above yellow, with a narrow longitudinal black line near the inner margin, widened in the last segment.

Length $3\frac{1}{2}$ lines.

Smaller and with the black streaks more decided than in *A. acuminata*, to which it bears a great *prima facie* resemblance.

Genus Plautia, Stål.

Plautia Ståli.

Green, somewhat shining. *Corium*, except the anterior margin, red. *Abdomen* above purple; underneath (in the ♂) very pale green or greenish white, (in the ♀) thickly punctured with red; *connexivum* green, the acute exterior angles of the segments black; last genital segment depressed in the middle and with two small black spots placed close together.

Head finely rugulose punctate. *Antennæ* yellow; first joint green; apical half of the third and fourth black; fifth black, basal third yellow, apex yellowish. *Eyes* brown, posterior margin greenish or whitish green. *Ocelli* brown. *Rostrum* yellow, apex brown; above the antenniferous tubercle is a short longitudinal black line.

Thorax.—Pronotum deeply, irregularly, and somewhat coarsely punctured with black, behind the anterior margin more finely and sparingly; extreme edge of the lateral margins black; hinder angles posteriorly reddish or red. *Scutellum* more finely black-punctured than the pronotum; apex frequently whitish. *Elytra* red, somewhat thickly and irregularly black-punctured. *Corium*: anterior margin green, except at the apex, with two longitudinal rows of punctures, the intermediate space with a few scattered punctures. *Membrane* fuscous; nerves darker, their bases and the interior angle piceous. *Legs* green: *tarsi* yellow.

Abdomen above purple, slightly metallic, very finely punctured; ♂ underneath pale green or greenish white, very finely punctured. *Connexivum* green, the acute exterior angles of the segments black; last genital segment depressed in the middle, and with two small black spots placed close together.

♀. The entire upper surface partakes of a reddish tinge, and the underside of the *abdomen* is red-punctured.

Length $4\frac{1}{2}$–5 lines.

Genus Nezara, Am. et Serv.

Nezara antennata.

Green; not shining, finely crenulate punctate. *Head*:

underneath and adjoining each eye a small black spot. *Antennæ* green; apex of the third joint and upper half of fourth and fifth black.

Head finely crenulate punctate; anterior margin adjoining each eye slightly yellowish. *Antennæ* green; third joint, apex black; fourth and fifth joints yellow, the former green at the base, apical half black; the latter with the apical two thirds black, apex brownish. *Eyes* black or pitchy black. *Ocelli* yellow, with piceous centres. *Underside*: adjoining each eye and close to the anterior margin is a small black spot. *Rostrum* greenish or yellowish; apex narrowly black.

Thorax.—Pronotum finely crenulate punctate; lateral margins very narrowly yellowish, the extreme edge with an exceedingly fine black line. *Scutellum* crenulate punctate; beyond the middle the punctures are coarser; base generally with indications of three small yellow spots, one in the centre, and one on either side: these latter are considerably nearer to the centre than to the basal angles, at which there is a small black puncture. *Elytra*: *corium* finely crenulate punctate. *Membrane* pale. *Legs* and *tarsi* green; *claws* black.

Abdomen: underside very finely punctured, basal half deep violet, apical half green; exterior angles of the segments very narrowly black. Underside green, thickly punctured, and with a yellow central line. *Connexivum* above green, finely and irregularly punctured.

Length $5\frac{1}{2}$–6 lines.

Genus Palomena, Muls.

Palomena rubricornis.

Luteous, thickly and finely black-punctured; nerves of the *membrane* irregularly spotted with brown.

Head thickly and finely black-punctured, except a small space next the eyes. *Face*: central lobe distinctly shorter than the side lobes. *Antennæ* bright red; first joint luteous, black-punctured; second and third bright red; fourth red at the base, apical two thirds fuscous; fifth orange-red or yellow, apical half black. *Eyes* brown, with a pale margin. *Ocelli* red, somewhat inconspicuous. *Rostrum* luteous.

Thorax.—Pronotum most thickly punctured next the lateral margins; on either side of the centre, and behind two unpunctured eye-shaped patches situate at a little distance from the anterior margin, is a small luteous spot. *Scutellum* punctured as in the pronotum. *Elytra* the same, except at the base of the anterior margin of the corium, where a few of the punctures run into small irregular spots. *Membrane* very pale brownish, with the nerves at irregular intervals, and sparingly spotted with brown. *Sternum* pale luteous, punctured, the punctures brownish; near the base of the first and second pair of legs is a small black spot. *Legs* luteous, spotted with black. *Thighs* not thickly spotted; the larger spots on the sides run somewhat in longitudinal rows. *Tibiæ* more thickly and finely spotted. *Tarsi* yellow. *Claws* yellow at the base; apex black.

Abdomen above black or with a faint purple tinge; beneath luteous, with a few black punctures on each segment; diagonally from the spiracles and in the direction of the posterior margin of each segment is a small black spot. *Connexivum* above luteous, black-punctured beneath, the margin narrowly black; exterior angle of each segment brownish yellow.

Length 6 lines.

Genus Acanthosoma, Curtis.

Acanthosoma scutellata.

Head and the anterior portion of the *pronotum* pale brownish ochraceous; hinder angles of the latter slightly recurved, black; apex obtuse. *Scutellum* with a large ochraceous or pale brownish ochraceous patch in the centre. *Elytra*: ♂ dusky luteous, anterior margin green; ♀ brown, anterior margin pale yellow.

Head narrowed in front, pale brownish ochraceous. *Face*: side lobes finely wrinkled transversely. *Antennæ* green, third joint (except a broad ring at the base) fuscous, fourth and fifth dusky brown. *Ocelli* red. *Rostrum* yellow, apex black.

Thorax.—Pronotum anteriorly pale brownish yellow; posteriorly somewhat luteous with a greenish shade, and with a single transverse row of deep-red punctures adjoining the anterior margin, not reaching the anterior angles; disk, except a portion in front, black-punctured, the punctures placed somewhat close together and running in short irregular rows in various directions, the rows somewhat wide apart; central longitudinal line yellow, unpunctured; hinder angles black, slightly recurved, apex obtuse. *Scutellum* brown, with a large, almost heart-shaped, ochraceous or pale brownish ochraceous patch in the centre, around which are two or three rows of deep-black punctures; side margins, a short posterior central keel, and the apex unpunctured; in the ♀, apex yellow, and punctures deeper and closer together. *Elytra*: ♂ dusky luteous, ♀ brown, somewhat thickly black-punctured, the punctures not so deep as those on the pronotum; ♂ anterior margin as far as the first nerve green, base yellow; ♀ pale yellow, the punctures coarser, deeper, and more thickly placed than on the disk, and not extending to the anterior margin in either sex. *Membrane* pale fuscous, nerves pale brown. *Prosternum* yellow, somewhat inclined to orange. *Legs* yellow: *thighs* somewhat inclined to orange-yellow.

Abdomen underneath yellow, like the prosternum.

Length, ♂ 5½, ♀ 6 lines.

An extremely conspicuous species, owing to the somewhat heart-shaped ochraceous spot on the scutellum. I have only seen a male and a female.

Genus Elasmucha, Stål.

Elasmucha Putoni.

Luteous, brownish, or greenish grey, somewhat sparingly black-punctured; basal angles of the *scutellum* whitish. *Membrane* with a transverse brown band irregularly dentate on both the upper and lower margins.

Head somewhat thickly black-punctured, except a narrow portion next the eyes. *Antennæ* yellow; apical two thirds of the fourth joint black; fifth black, base narrowly yellow. *Eyes* piceous or black. *Rostrum* yellowish, apical half of the last joint black.

Thorax.—Pronotum more sparingly punctured than the head, generally yellowish or bone-white in front as far as the transverse channel, which does not extend to the lateral margin, and is deepest at its extremities; lateral margins narrowly yellowish or bone-white; hinder angles produced into a short piceous or black tooth. *Scutellum* luteous or bone-white, punctured similar to the pronotum; disk with a lunate piceous patch next the base; basal angles narrowly yellowish or bone-white; generally a pale unpunctured and indistinctly elevated central line extends from the apex to the middle of the disk; margins round the apex slightly thickened, pale, and unpunctured. *Elytra*: *corium* black-punctured; between the anterior margin and the first nerve two to three longitudinal rows, the third generally interrupted near the middle, the other punctures are more irregular, except about two rows next the *clavus*, in which last also they are regularly disposed. *Membrane* pale, with a short, transverse, brown, irregular streak near the base, and a band of the same colour near the apex, dentate on both the upper and lower margins, leaving an oval pale patch at the apex of the anterior margin. *Sternum* yellowish or yellowish white, black-punctured. *Legs* yellow: *thighs* beneath with long, fine, erect pale hairs: *tibiæ* with long semierect pale hairs: *tarsi* brownish yellow: *claws* brown, apex black.

Abdomen above pale chestnut-brown, somewhat shining, junctions of the segments narrowly yellow; beneath yellow or yellowish white, finely punctured on the sides: spiracles black, exterior to each spiracle is a small black puncture, to which they are connected by a slightly curved channel. *Connexivum* yellow, apex of the segments black.

Length $3\frac{1}{2}$ lines.

Closely allied to the following species.

Elasmucha Signoreti.

Head yellow, black-punctured. *Pronotum* yellowish in front, posteriorly with a greenish tinge and black-punctured; near the anterior margin a stout transverse unpunctured ridge, widening into a triangular form towards the thickened lateral margins; hinder angles recurved, black; apex acute. *Elytra* pale brownish yellow, black-punctured, the punctures coarsest between the first nerve and the anterior margin; apex of the latter reddish.

Head yellow: *crown* with a few black punctures between the ocelli. *Face*: central and side lobes longitudinally black-punctured, lateral margins and the space between the eyes and the ocelli unpunctured. *Antennæ* yellow, apex of the last joint brownish. *Ocelli* red. *Rostrum* yellow, apex black.

Thorax.—Pronotum in front to beyond the transverse ridge yellow, next the anterior margin with two or three transverse irregular rows of black punctures, centre of the transverse ridge with four or five punctures; disk with a greenish tinge, and with short, somewhat remote, curved rows of black punctures; lateral margins yellow, thickened, with a row of black punctures; hinder angles recurved, black, base reddish; apex acute. *Scutellum* yellow, with a large lunate black patch next the base; all the margins with a row of black punctures; disk with a few punctures. *Elytra* pale brownish yellow, black-punctured, the punctures somewhat in longitudinal rows, following the course of the nerves; between the anterior margin and the first nerve the punctures are deeper and coarser than on the disk; apex of the anterior margin reddish. *Membrane* pale, apex of the anterior margin and middle of the posterior with a large fuscous patch; interior margin narrowly and a portion of the nerves posteriorly fuscous, the latter connected by a transverse zigzag line of the same colour. *Prosternum* yellow, finely black-punctured on the sides. *Legs* yellow.

Abdomen yellow, finely black-punctured on the sides; fourth and fifth segments next the middle with a large, brown, unpunctured patch.

Length $3\frac{1}{4}$ lines.

Smaller than *E. Putoni*, to which it is closely allied; but the longer and recurved hinder angles of the pronotum, the black lunate patch on the scutellum, and the difference in puncturing will at once distinguish it from that species.

[To be continued.]

XXXVI.—*Notes on the Sulphur-bottom Whale of the New-Zealand Whalers.* By JAMES HECTOR, M.D., F.R.S. *With a Note by* Dr. J. E. GRAY, F.R.S. &c.

ON the 10th of June last a large whale, reported by the whalers to be a true "sulphur-bottom," was cast ashore in Port Underwood, on the south side of Cook Strait, and an assistant was dispatched from the Museum to secure the skeleton and take measurements.

The carcass was stranded on a rocky point close to deep water, and had to be dragged into a fresh position before it could be handled. It was so much decomposed that the skull and jaws dropped through the flesh during the removal; and on this account the external measurements are not reliable.

The whole of the skeleton was ultimately secured and placed out of reach of the tide to sweeten, the paddles and smaller bones being carefully buried.

The general form of the whale was slender in proportion to the height, the head appearing long and pointed, and the after-part produced, so that the greatest girth was behind the shoulder.

The throat and belly strongly plaited with longitudinal bars of hard skin, $2\frac{1}{2}$ inches wide, the interspaces having elastic skin.

Scapula.

The paddles appeared short in proportion to the general size; and there was a low recurved and pointed fin on the back just over the vent, and the same distance from the tip of the tail as the length of the head.

The brain-case is one third the length of the skull. The baleen slightly longer than broad, black on outside edge, shading to pure white inside the mouth. Width of base 2 feet 6 inches.

The following measurements were obtained :—

	ft.	in.
Total length	70	0
Total length of skeleton	67	3
Length of head	19	0
Lower jaw	17	0
Occiput to last rib	14	0
Last rib to first caudal (*i.e.* vertebra with chevron bone)	16	0
Caudal series of vertebræ	18	3
Length of bones in the paddles, from the glenoid cavity	8	6
Width across phalanges	1	3
Distance from anus to tip of tail	17	0
(Penis 3 feet in front of anus.)		
Tip of tail to hump	18	0
Height of hump	2	0
Length of base of hump	1	0
Length of shoulder-blade	5	9
Height	2	10

Fifteen ribs, longest 10 feet.

Stomach contained a quantity of stones. Colour black above, and yellow on the belly.

Note by Dr. J. E. Gray, F.R.S. &c.

This is evidently not only a whale that has not yet been described, but it is also the type of a new genus, peculiar for the shortness of its pectoral fins, its plaited belly, and low recurved and pointed fin placed over the vent, and very peculiar among all whalebone-whales for the form of its bladebone (*see* figure).

The sulphur-bottom of New-Zealand is very distinct from the sulphur-bottom of California, which is named *Sibbaldius sulphureus* by Cope. It is evidently the type of a new genus, and may be entered in the catalogues as *Stenobalæna xanthogaster.*

XXXVII.—*On Priority in the Discovery of the Canal-System in Foraminifera.* By Messrs. Parker, Jones, and Brady.

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

Gentlemen,

That portion of Mr. Carter's communication to your August number, which is entitled "Reply to Criticism," does not need any notice at our hands in so far as it affects the *facts* of the letter "On Priority in the Discovery of the Canal-System in Foraminifera," which you were good enough to publish in July. Mr. Carter, however, accuses us, by implication, of *suppressio veri*; he also practically charges us with ignorance in not finding out his misquoted reference, and he reiterates his claim of prior discovery, inconsistent with his own early recognition of the results arrived at by Williamson and Carpenter.

Mr. Carter had stated (we regret to have to copy the paragraph again), "Before Schultze's or Carpenter's books were published, I had described and illustrated, in the 'Annals,' the canal-system, 'nummuline' tubulation, and general structure of the Foraminifera, both in the recent *Operculina* and in the fossilized *Nummulite* ('Annals,' 1852, vol. x. p. 161, pl. iv.). Even Schultze in his book, as well as I can remember (for I have not the work by me to refer to), gives me the credit of having discovered the 'canal-system,' which at least proves the priority of my publications; and since then up to the present time I have more or less occupied myself with the structure of the Foraminifera, as my papers in the 'Annals' will show."

Our letter was little more than a statement as to the course of discovery in respect to Foraminiferal structure up to the time of Mr. Carter's paper on *Operculina arabica* in 1852. It was written in the most friendly tone, and was intended only to counteract the serious injustice of the paragraph in question to at least two previous observers. We gave a brief summary of the contents of four papers earlier than Mr. Carter's, and left the readers of the 'Annals' to draw their conclusions from them. To this, the only essential portion of the letter, Mr. Carter replies that, besides Prof. Williamson's and Dr. Carpenter's memoirs, we ought to have mentioned that by MM. Joly and Leymerie. If these observers really understood the "canal-system," to them also his paragraph was unjust. But for the desire not to impart controversial matter, we might have said a good deal about MM. Joly and Leymerie's results.

Mr. Carter in quoting Max Schultze refers pointedly, though from memory, to his "book." The only "book," so far as we know, that the learned German Professor ever published on the Foraminifera is the beautiful folio "Ueber den Organismus der Polythalamien." We therefore searched this work for the passage alluded to, and quoted the only sentence we could find bearing upon the question. In the paper on *Polytrema*, now referred to by Mr. Carter, Prof. Schultze certainly expresses his own opinion that Mr. Carter first described the system of ramified tubes in Foraminifera.

The final paragraph of the "Reply to Criticism" requires a word of comment. We are first charged with imputing blame to the author for the non-insertion of detail which he had given elsewhere. We can only reply, that we did not blame him for it; all we did was to deny his right, however freely he may have acknowledged the labours of others twenty years ago, to claim their results as his own now.

The last sentence runs thus, "That they [*i. e.* ourselves] should have commenced the second paragraph of their letter with 'The question has nothing to do with the *Eozoon* controversy,' is therefore, to say the least of it, 'most significant'!" If this means any thing, it conveys an insinuation which is as false as it is uncalled for. If Mr. Carter wishes an explanation of our unwillingness to join in the *Eozoon* controversy he need not look beyond his own "Reply to Criticism" for our reason. A simple statement verified at every point by accurate references to authorities, drawn up in a friendly spirit, and with no object except the desire to correct an injustice which we believed the author to have committed unconsciously, and a reference to a quotation which, owing to his own misdirection, was not the passage he intended to allude to, have brought down upon us not merely a taunt of ignorance, but the serious charge of "suppressing the truth." Under these circumstances your readers will not wonder at our unwillingness to enter into the discussion of a confessedly difficult and complicated subject, with one so ready in the denunciation of those who do not happen to agree with him in the reading of evidence and the correlation of facts. We may, however, say this much, that our individual views as to the structure of *Eozoon* have not been affected by Mr. Carter's additions to the literature of the subject. Declining further correspondence on the subject of this letter, We have the honour to be, Gentlemen,

Faithfully yours,

W. K. Parker,
T. Rupert Jones,
Henry B. Brady.

BIBLIOGRAPHICAL NOTICE.

The Birds of Shetland, with Observations on their Habits, Migration, and Occasional Appearance. By the late Henry L. Saxby, M.D., of Balta Sound, Unst. Edited by his brother Stephen H. Saxby, M.A. Edinburgh: 1874. 8vo, pp. xviii, 398, pls. 8.

Shetland from its geographical position deserved the devotion of a volume to its ornithology. Thirty years have passed since any connected account of its birds was published; and that consisted of a list, meagre in the amount of information it conveyed, and, as the book now before us shows, inaccurate in many respects. Numerous ornithologists in the mean time have visited this interesting group of islands, but none have made a sufficiently long stay to do more than communicate to the world an occasional note, except the lamented author of 'The Birds of Shetland,' who, unfortunately, has not lived to complete his manuscript, much less to see any portion of it in the printer's hands. Fraternal affection, however, has supplied the remainder from the late Dr. Saxby's note-books; and Mr. Stephen Saxby is, we think, on the whole to be congratulated on the way in which he has edited his deceased brother's work; for, though not pretending to scientific distinction, his sympathies are so clearly turned that way, and he is so highly appreciative of the author's labours, that his self-imposed duty is far better done than is usual in similar cases. He remarks, and rightly as it seems to us, in his preface, that the present book differs from all the numerous monographs by which in this generation British ornithology has been so largely promoted, because

"It tells of a most marked and rapid change in a Fauna actually going in a direction the very opposite of that which we are accustomed to deplore as the result of the development of material prosperity and of increasing civilization. It is true that the customary issue of contact with this latter force is being only too grievously seen in the case of some few species, but as regards a large number of others the accession is very decided. The planting a few trees, carefully sheltered by stone walls from the sweeping gales of the Atlantic, has had a curiously marked effect in attracting birds hitherto unknown as visitors to the islands; an effect, indeed, altogether disproportionate to the small scale on which the experiment has been tried. The extensive and often extremely rich peat-grounds of Shetland attest, not only by their existence, but by the occasional conservation of the actual roots and trunks, the former prevalence of luxuriant forest growth where all is now a treeless wild; though, in the present state of our knowledge as to the distribution of species, none may venture to assume that at that remote epoch it would have been possible for the Fauna to have been as in these days. There can, however, be little doubt that in numerous instances as the author was adding to the Shetland list now one and now another of our southern birds, he was but chronicling the return, after the lapse of many a century, of a species reappearing after its long exile."

We might, perhaps, take exception to the supposition of a few plantations "attracting" these visitors; but if, instead, we read "retaining," the passage seems to be unexceptionable, and, indeed, is somewhat consoling; for the proofs that "Man marks the earth with ruin" are but too distinctly traced in the vanishing faunas of group after group of islands; nor does his dominion over the fowls of the air, like his control over the rest of nature, "stop at the shore." But we must remark that these successive points of interest are not, to our regret, brought out in this volume quite so clearly as they should have been. It is rather hard upon the readers of any book that each should have to make an abstract of its contents for himself; and such a summary as we are sure the Author would, and we think the Editor might, have given us would have here been very acceptable. From the list at the end we can only make out that there are about *sixteen* species which seem to be becoming commoner than formerly in Shetland, and all but three of them naturally are perching birds; of the rest, the Woodcock's name tells us of its arboreal tastes, and the Water-Rail's predilections in the same direction are easily understood when we recollect what a "tree" is apt to be like on a storm-swept island in lat. 61° N. or thereabouts; but we do not see how the Lapwing can have been affected by planting, and think that some other cause must be assigned for its gaining ground, though this cause we are left to seek. Still the fact seems to be unquestionable that the avifauna of Shetland is growing, not merely in the way told us by Gilbert White's old observation, to the effect that the place which is best looked after yields most (for that may be said of almost any district), but from the increased number of individual birds as well as of species which breed on the islands; while, on the other hand, those which are reported as decreasing are but few in number; and, indeed, only one of them, the Razorbill (*Alca torda*), seems to demand consideration; for the statement that such birds as the Golden Eagle and Snowy Owl formerly bred in Shetland is unsupported by satisfactory evidence. Why the Razorbill should be diminishing in numbers is not at all clear: the suggestion (p. 314) that it "offers an easier mark to gunners," being "a good deal bigger than the Guillemot," is inadmissible if the Common Guillemot (*Uria troile*) be meant, for the simple reason that that bird is slightly larger than the Razorbill; and if the Tysty (*U. grylle*) be the species intended, we have at once a very different set of conditions. Unless we are mistaken, the habits of the two species differ considerably—one seeking its food much further from its breeding-quarters than the other, and the food of each not being, we suspect, precisely identical. There is also the fact that the Tysty lays at least twice as many eggs as its relative; though in this there may not be quite so much importance as at first would appear, since Mr. Darwin tells us (on what authority he does not say, but it is doubtless not bad) that the Fulmar Petrel, which lays but one egg, is believed to be the most numerous bird in the world. However, the relation which production bears to existence is, as all must know, a most complicated problem, and any consideration of it would lead us far from our present business, though we have thought these remarks not inopportune as bearing upon a general question interesting to all naturalists, that of the supersession of certain species by others.

To return to the 'Birds of Shetland.' It is plain matter of fact from one end to the other, and full of information which is always valuable, though, perhaps, not of the very best quality, or such as is accumulated by profound research. Apart, indeed, from the subject in hand, neither Author or Editor can be regarded as a very high authority, or as knowing very much of matters ornithological: this is shown by the latter's designation of a worthy gentleman as one "who has for so many years sat at the focal point," which cannot fail to raise a smile on the face of those who are best fitted to appreciate his scientific efforts and ability. Another merit of the book is that its author has resisted all those attempts at fine writing to which most men with such a subject would have succumbed. We have no fabulous narratives interspersed, and no mottoes from *The Pirate* to distract our attention. Claud Halcro does not appear in the volume; and though we do indeed meet with Magnus Troil (p. 87), it is only to show that he was not a better ornithologist than most of his countrymen. This is as it should be. We like the hairs and the butter served in separate dishes.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

June 11, 1874.—Joseph Dalton Hooker, C.B., President, in the Chair.

"Note on the alleged Existence of Remains of a Lemming in Cave-deposits of England." By Professor Owen, C.B., F.R.S.

In the "Report on the Exploration of Brixham Cave" (Phil. Trans. 1873) it is stated (p. 560):—"With the appearance in the cave of the smaller common rodents now living in this country, we have to note a remarkable exception, that of the Lemming (*Lagomys spelæus*)." And again, in the list of animal-remains as determined by Dr. Falconer and by Mr. Busk, there occurs (p. 556):—"16. *Lagomys spelæus*. Lemming . . 1." This is throughout the "Report" treated as an original discovery, the importance of which is impressed upon the Royal Society by the remark:—"This circumstance tends to give a greater antiquity to a portion of the smaller remains than from their condition and position we might have been disposed to assign to them" (*ib.* p. 560, note). These remains are referred to "the smaller common rodents now living in this country," viz. "Hare, Rabbit, Water-rats," "at least two species of *Arvicola*" (*ib.* p. 548).

The supposed existence of remains of a Grisly Bear in the Brixham Cave (Mr. Busk having "reason to believe that bear-remains referred to *Ursus priscus* belong in fact to *Ursus ferox*"—an "important determination") leads to the remark:—"The presence of another small North-American animal has been ascertained, viz. the Lemming" (*ib.* p. 556). At the date of publication of my 'British Fossil Mammals,' it is true that no fossil evidence of a Lemming (*Georychus*, Illiger; *Lemmus*, Link) had come to my knowledge; but I have since obtained such of species of both *Spermophilus* and *Georychus*, the latter nearly allied to, if not identical with, the Siberian Lemming (*Georychus aspalax*), from a deposit of lacustrine brick-earth near Salisbury, associated with *Elephas primigenius*. The Lemmings, I may remark, belong to the family of "Voles" (*Arvicolidæ*), not of "Hares" (*Leporidæ*); but the fossil from "the surface of the cave-earth far in the Reindeer gallery" of the Brixham Cave (Report, p. 558) appears from the figures (plate xlvi. figs. 12, 13) to be rightly referred to *Lagomys*, and to the same species determined and named (p. 213, figs. 82, 83, 84) in the 'British Fossil Mammals' (1846). The specimen submitted to me by Dr. Buckland was found by the Rev. Mr. M'Enery in Kent's Hole, Torquay, and includes a larger portion of the skull than the specimen figured in the "Report" from the Brixham Cave. It is evidently a Pika, or tailless Hare, not a Lemming. And the determination of the original or first evidence of *Lagomys spelæus*, now in the British Museum, led me also to remark:—"None of the circumstances attending its discovery, nor any character deducible from its colour or chemical state, indicate it to be an older fossil than the jaws and teeth of the Hares, Rabbits, Field-voles, or Water-voles already described; yet it unquestionably attests the former existence in England of a species of rodent, whose genus not only is unrepresented at the present day in our British fauna, but has long ceased to exist in any part of the Continent of Europe" ('British Fossil Mammals,' p. 213). The Lemmings still disturb, by their multitudinous migratory swarms, the husbandmen of Scandinavia.

June 18, 1874.—Joseph Dalton Hooker, C.B., President in the Chair.

"Description of the Living and Extinct Races of Gigantic Land-Tortoises.—Parts I. and II. Introduction, and the Tortoises of the Galapagos Islands." By Dr. Albert Günther, F.R.S.

The author having had the opportunity of examining a considerable collection of the remains of Tortoises found in the islands of Mauritius and Rodriguez associated with the bones of the Dodo and Solitaire, has arrived at the following conclusions:—

1. These remains clearly indicate the former existence of several species of gigantic Land-Tortoises, the Rodriguez species differing more markedly from those of the Mauritius than these latter among themselves. All these species appear to have become extinct in modern times.

2. These extinct Tortoises of the Mascarenes are distinguished by a flat cranium, truncated beak, and a broad bridge between the foramina obturatoria.

3. All the other examples of gigantic Tortoises preserved in our museums, and said to have been brought from the Mascarenes, and likewise the single species which is known still to survive, in a

wild state, in the small island of Aldabra, have a convex cranium, truncated beak, and a narrow bridge between the obturator foramina; and therefore are specifically, if not generically, distinct from the extinct ones.

4. On the other hand, there exists the greatest affinity between these contemporaries of the Dodo and Solitaire and the Tortoises still inhabiting the Galapagos archipelago.

These unexpected results induced the author to subject to a detailed examination all the available material of the gigantic Tortoises from the Mascarenes and Galapagos which are still living, or were believed to be living, and are commonly called *Testudo indica* and *Testudo elephantopus*, and to collect all the historical evidence referring to them. Thus, in the *first* (*introductory*) part of the paper a selection from the accounts of travellers is given, by which it is clearly shown that the presence of these Tortoises at two so distant stations as the Galapagos and Mascarenes cannot be accounted for by the agency of man, at least not in historical times, and therefore that these animals must be regarded as indigenous.

The *second* part consists of a description of the Galapagos Tortoises. The author shows that the opinion of some of the older travellers, viz. that the different islands of the group are inhabited by different races, is perfectly correct; and he distinguishes four species, the adults of which are characterized as follows:—

A. *Shell* broad, with more or less corrugated plates. *Skull* with the palatal region concave; outer pterygoid edge sharp in its entire length or for the greater part of its length; a deep recess in front of the occipital condyle; anterior wall of the entrance of the tympanic cavity constricted. One of the two species is from James Island.

1. *Shell* depressed, with the upper anterior profile subhorizontal in the male, and with the striæ of the plates not deeply sculptured; sternum truncated behind. *Skull* with the facial portion very short, and with an immensely developed and raised occipital crest. *Testudo elephantopus* (Harlan).

2. *Shell* much higher, with the upper anterior profile declivous in the male, and with the striæ deeply sculptured; sternum excised behind. *Skull* with the facial portion much longer, and with low occipital crest. *Testudo nigrita* (Dum. & Bibr.).

B. *Shell* oblong, smooth. *Skull* with the palatal region shallow; the outer pterygoid edge expanded in its whole length; no deep recess in front of the occipital condyle; anterior wall of the tympanic cavity not constricted.

3. *Shell* with some traces of former concentric striæ, compressed anteriorly into the form of a "Spanish saddle" in the male; sternum truncated behind. *Skull* with the tympanic cavity much produced backwards. *Testudo ephippium* (Gthr.), from Charles Island. *Extinct.*

4. *Shell* perfectly smooth, with declivous anterior profile in the male, and with truncated posterior extremity of the sternum.

Skull resembling that of the young of the larger species, with the tympanic case not produced backwards. The smallest species. *Testudo microphyes* (Gthr.), from Hood's Island.

Part III. will contain the account of the still existing Tortoises of the Mascarenes, and Part IV. that of the extinct species.

Received June 9, 1874.

P.S. The author has just received from Professor Huxley the carapace and skeleton of another adult male, which evidently belongs to a fifth species of Galapagos Tortoises. With regard to the form of the carapace, it resembles much that of *T. elephantopus*, the dorsal shell being depressed, broad, with the upper profile nearly horizontal. Striæ distinct, broad. However, the skull differs widely from that of *T. elephantopus*, and has all the characteristics of that of *T. ephippium*, from which it differs in having a circular tympanic opening. The form of the sternum is quite peculiar, the gular portion being much constricted and produced forwards, whilst the opposite end is expanded into the large anal scutes and deeply excised. This species may be named *Testudo vicina.*

MISCELLANEOUS.

On the Annelids of the Gulf of Marseilles. By M. A. F. Marion.

I have the honour to submit to the Academy the principal results of the researches on the Chætopod annelids of the Gulf of Marseilles, which I made in conjunction with M. Bobretzky, of Kiew, during the winter of 1873–74. We have been able to determine ninety-six species, among which ten appear to us to be entirely new to science; for four of them we shall even have to establish new generic divisions.

Of the eighty-six known species which we have observed, and of which we have completed our study, eighteen exist in the Black Sea, or are represented there by forms which can only be regarded as local varieties or as subspecies of more or less importance. These are :—

Pholoë synophthalmica.	Syllides pulliger.
Eunice vittata.	Eteone picta.
Lysidice ninetta.	Eulalia virens.
Staurocephalus rubrovittatus.	—— pallida.
Nereis Dumerilii.	—— macroceros.
—— cultrifera.	Audouinia filigera.
Syllis gracilis.	Polyophthalmus pictus.
—— spongicola.	Aricia Œrstedii.
Trypanosyllis Krohnii.	Saccocirrus papillocercus.

We find also seventeen of our Marseillese species in the lists of annelids of the oceanic coasts of France, and eight of these likewise exist in the Black Sea:—

*Staurocephalus rubrovittatus.	*Syllis gracilis.
Eunice Harassii.	—— variegata.
Marphysa sanguinea.	Odontosyllis gibba.
*Lysidice ninetta.	*Syllides pulliger.
Onuphis tubicola.	*Sphærosyllis hystrix.
Nematonereis unicornis.	*Eteone picta.
Arabella quadristriata.	Heterocirrus saxicola.
*Nereis cultrifera.	Sabella reniformis.
*—— Dumerilii.	

We do not wish, however, to indicate these faunal relations except in a provisional manner; for it is probable that future researches will considerably modify their significance.

The great family Eunicea has furnished us with a new species of *Marphysa* (*M. fallax*), well characterized by the composite setæ with bidentate uncini existing in the inferior bundle, and by the form of the parts of the maxillary apparatus. In its general aspect this *Marphysa* resembles *Lysidice ninetta.*

The Syllidea are excessively abundant and very varied. We have ascertained the existence of a new species of the genus *Anoplosyllis*, very distinct from that of the Bay of Naples by the arrangement of the dorsal appendages, which are articulated from the third setigerous segment. *Syllis torquata*, sp. nov., bears in the anterior region a large transverse blackish band, which is not figured in any annelid of the same group. Lastly, *Eusyllis lamelligera*, sp. nov., and *Autolytus ornatus*, sp. nov., possess still more important peculiarities of structure. It may be remarked that the genus *Eusyllis*, proposed by Malmgren for some worms from Spitzbergen, had not hitherto been indicated in the Mediterranean.

In the family Hesionea I have to cite a very curious undescribed type, *Magolia perarmata*, of which the trunk is armed with two maxillaries and a style, whilst the anterior region of the body presents two antennæ, two palpi, and twelve tentacular cirri. The new genus *Gyptis*, with an unarmed proboscis, appears to be allied to the *Oxydromi*; but this latter group, which is very badly determined, remains still unsettled.

It is undoubtedly near the Hesionea and at the head of the Phyllodocea that we must place the annelid that we name *Lacydonia miranda*, the characters of which may be given as follows:—

Head furnished with four small anterior appendages representing two palpi and two antennæ; buccal ring provided with a single pair of tentacular cirri; dorsal and ventral cirri pinniform: feet of the first three segments setigerous and uniramose; feet of the following segments furnished with a dorsal ramus of simple setæ and a ventral ramus of composite setæ: trunk unarmed, comparatively short, and situated between two very complicated tubular secretory apparatus, no doubt representing the lateral tubes of the *Hydrophani.*

In the Gulf of Marseilles, among the rolled pebbles of the shore of Ratonneau, we have found the interesting *Saccocirrus* of the Black Sea. The sexes are separate; but the reproductive apparatus presents perfectly exceptional peculiarities. In the male the testes are placed in the anterior region of each segment, starting from the thirteenth or fourteenth setigerous segment. The fecundating elements detach themselves from these glandular bodies, and are received by two vibratile chambers, situated one to the right and the other to the left of the intestine, in the posterior part of the segment and above the transverse septum. A deferent duct forms a continuation of each of these vibratile funnels. This canal pierces the septum and penetrates into the following segment, where it becomes inflated into a seminal vesicle opening at the base of a very protractile conical penis, which projects from the dorsal surface a little beyond the feet. There are consequently two penises for each zoonite, and the organs for conducting the semen are arranged exactly in accordance with the plan of structure of the segmental organs; the deferent ducts are moreover replaced by true segmental organs in the anterior region of the body.

In the females the ovaries occupy the same position as the testes in the males. Beneath them we notice a yellowish sac full of spermatozoids. This organ, a true copulatory pouch, communicates by a vaginal duct with an aperture situated on the ventral surface of the same segment. Hence we find on each female segment two ventral vulvæ corresponding to the two dorsal penises of the males. But we have also distinguished in the females two vibratile ducts situated in the dorsal region, and piercing the septum below the copulatory pouch. These organs, evidently homologous with the deferent ducts, must be regarded as oviducts; but we have been unable to determine exactly the relations of the copulatory pouch with the general cavity. We have also to notice the remarkable degradation of the pedal organs of *Saccocirrus*, which are formed by tubes which can project more or less, or be retracted entirely within the body; in these protractile sheaths there are seven or eight very simple setæ.

The tribe Trichobranchidea of Malmgren is represented in the coralligenous bottoms of the coasts of Provence by a Terebellian very nearly related to the *Trichobranchus* of Spitzbergen, but furnished with eight filiform branchiæ. This worm will become the type of a new division: its first four segments bear a membranous frill covering the ventral surface, and in part passing over to the dorsal region.

Lastly, we have been able to study some Serpulea, and chiefly two species of *Apomatus*, the general structure of which greatly resembles that of *Psygmobranchus*. The globular operculum of these sedentary annelids, situated at the apex of a branchial filament still furnished with secondary barbules, is a true operculum in course of differentiation. The setigerous apparatus of these *Apomati* is rather complex, but it exactly corresponds to that of the *Psygmobranchi*. It may be said that the *Apomati* are *Psygmobranchi* of which one of the branchial filaments, deviating from its original functions, becomes an opercular axis, just as the *Filigranæ* are *Salmacinæ* with modified branchial filaments. With regard to the last two genera it is curious to find that all the *Salmacinæ* are hermaphrodites, while the *Filigranæ* seem to be generally unisexual.—*Comptes Rendus*, August 10, 1874, p. 398.

The Pigmy Whale (Neobalæna marginata). By Dr. Hector.

I have the calf of this whale, 2 feet 3 inches in total length. The length of the head, &c., given as the characters, are constant, as in the large skull formerly figured. There is no mistake, as the baleen is all *in situ*. I am convinced that it is not uncommon on the coast of New Zealand; but it is rarely got, as it does not grow large.

On Dolichodon Traversii. By Dr. Hector.

Dr. Haast has a complete skeleton of this whale. I have compared it with a pair of jaws, on board the 'Challenger,' of the true *D. Layardi* of the Cape, and could only find a difference in the fact that the teeth were not chamfered behind as in the New-Zealand specimen; the teeth are nearly locked over the muzzle, as in the specimen from which the species is described in the British Museum, whereas in the Chatham-Island one they are wide apart.

Remarks on the Revivification of Rotifer vulgaris. By J. Leidy.

Prof. Leidy remarked that during the search for rhizopods, having noticed among the dirt adhering to the mosses in the crevices of our pavements many individuals of the common wheel-animalcule (*Rotifer vulgaris*), he had made some observations relating to the assertion that they might be revivified on moistening them after they had been dried up.

Two glass slides, containing beneath cover-glasses some dirt, exhibited each about a dozen active living rotifers. The glass slides were placed on a window-ledge, the thermometer standing at 80°. In the course of half an hour the water on the slides was dried up, and the dirt collected in ridges. The next morning, about twelve hours after drying the slides, they were placed beneath the microscope. Water was applied, and the materials on the slides closely examined. On each slide a number of apparently dried rotifers were observed; these imbibed water and expanded, and some of them in the course of half an hour revived and exhibited their usual movements, but others remained motionless to the last.

The same slides were again submitted to drying, and from one of them the cover-glass was removed. They were examined the next day, but several hours after moistening them only two rotifers were noticed moving on each slide.

A slide was next prepared on which there were upward of twenty actively moving rotifers, and exposed to the hot sun during the afternoon. On examination of the slide the following morning, after moistening the material, all the rotifers continued motionless, and remained so till the last moment.

From these observations it would appear that the rotifers and their associates become inactive in comparatively dry positions, and may be revived by supplying them with more moisture, but when the animals are actually dried they are incapable of being revivified. Moisture adheres tenaciously to earth; and rotifers may rest in the earth, like the *Lepidosiren*, until returning waters restore them to activity.—*Proc. Acad. Sci. Philad.* 1874, p. 88.

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XXXVIII.—*Notes on the Structure and Development of* Myriothela phrygia. By Professor ALLMAN, M.D., LL.D., F.R.S., Pres. Linn. Soc.

In the structure and development of *Myriothela phrygia* are many hitherto unrecorded points of high morphological and physiological interest. The following notes contain some of the more important results to which I have been led by a recent study of this remarkable and little-known hydroid.

1. The tentacles when extended are by no means the short papilliform organs which we usually meet with in specimens confined in our aquaria. They present, on the contrary, when in complete extension a thin, cylindrical, and very motile stem nearly a line in length, and a large terminal capitulum very well defined and distinct from the stem.

2. The animal is attached to fixed objects, not by the general surface of hydrorhizal offsets (as is usual among the Hydroida), but by the sucker-like truncated ends of short fleshy processes which are given off from the basal extremity and, clothing themselves with chitine, become permanently adherent to the object which gives it support.

3. The *endoderm* of the body is composed of numerous layers of large spheroidal cells composed of clear protoplasm, enclosing a nucleus with some brown granules and refringent corpuscles. Externally it is continued in an altered form into the tentacles, while internally it forms long villus-like processes which project into the cavity of the body. Towards the free ends of these processes there are abundantly developed, among the large clearer cells, smaller easily isolated spherical cells

filled with opaque brown granules. Where the endoderm passes into the tentacles it loses its large-clear-celled condition, and consists of small round cells so loaded with opaque granules that the axis of the tentacle appears nearly white under reflected light.

4. The free surface of the endoderm carries long, very slender, sluggishly vibrating cilia, and is overlaid with a thin layer of transparent homogeneous protoplasm, which on the villus-like processes becomes especially distinct, and which develops minute mutable pseudopodia which are being constantly projected and withdrawn. Indeed the vibratile cilia appear to be but a modification of these pseudopodial processes of protoplasm.

5. Interposed between the endoderm and the ectoderm is the *fibrillated layer*. It is extremely well developed, and consists of longitudinal muscular fibrillæ, closely adherent to the outer surface of a structureless hyaline membrane—the "Stützlamelle" of Reichert. The fibrillated layer, with its supporting membrane, is so strong as to remain entire in a section of the animal after the tissues on both sides of it have been broken down.

6. The *ectoderm* is composed mainly of two or three layers of small round cells containing yellowish granules. Among these cells the thread-cells may be seen, lying chiefly near the outer surface of the body. Two forms of thread-cells may be here distinguished—one ovate with the invaginated tube occupying the axis, the other fusiform with the invaginated tube oblique. The whole free surface of the ectoderm is overlaid with an exceedingly thin, transparent and structureless pellicle.

7. The deeper part of the ectoderm consists of a very remarkable tissue composed of peculiar membraneless cells, each of which is prolonged into a long fine process which can be directly traced into the fibrillated layer. I am thus enabled so far to confirm the observations of Kleinenberg on cells of apparently the same significance in *Hydra*. In *Myriothela*, however, these caudate cells do not, as in *Hydra*, reach the surface. They form a deep zone interposed between the muscular layer and the superficial layer of the ectoderm. Though the caudate cells are in intimate association with the fibrillated layer, I did not succeed in tracing a direct continuity of the individual fibrillæ with the processes of the cells as described by Kleinenberg in *Hydra*. While the deep zone may, in accordance with Kleinenberg's views of the caudate cells in *Hydra*, be regarded as a nervous layer, the superficial zone of the ectoderm will represent an epidermis.

8. The structure of the tentacles is in the highest degree interesting. In their narrow stalk-like portion the condition of the endoderm departs widely from that of this tissue in the tentacles of other marine hydroids; for it presents no trace of the septate disposition so well marked in these. It is, on the contrary, composed of a layer of small cells loaded with opaque granules and surrounding a continuous wide axile cavity.

9. It is, however, in the terminal capitulum of the tentacle that the structure of these organs departs most widely from any thing that has as yet been recognized in the tentacles of other hydroids. Here a very peculiar tissue is developed between the muscular layer and the proper ectoderm, where it takes the place of the zone of caudate cells. It forms a thick hemispherical cap over the muscular lamella and endoderm of the tentacle, and is composed of closely applied exceedingly slender prisms, with their inner ends resting on the muscular lamella, to which the prisms are perpendicular, the whole structure forcibly suggesting the rod-like tissue associated with special sense-apparatus in higher animals. It appears to be but a modification of the tissue which elsewhere forms the zone of caudate cells.

10. Extending in a radiating direction from the convex surface of this rod-like tissue, towards the external surface of the tentacle, may be seen numerous clear cylindrical rods, each of which, making its way among the cells of the ectoderm, terminates distally in a very delicate transparent oviform sac, which carries near its distal end a minute styliform process. Within this sac, and completely filling it, is an oviform capsule with firm transparent walls, and having immersed in its very refringent contents a cylindrical cord wound upon itself in two or three coils. Under pressure the contained cord may be sometimes forced out through the smaller or distal end of the capsule. Notwithstanding the obvious resemblance of these bodies to thread-cells, their significance is, without doubt, something entirely different. Their assemblage constitutes a zone parallel to the spherical surface of the capitulum, and lying at a slight distance within it. Though it is impossible with certainty to assign to them their exact function, we feel compelled to regard the whole system, including the rod-like tissue to which their stalks can be traced (and which is only a modified portion of the nervous zone), as an apparatus of sense. This is the only known instance of the existence in a hydroid trophosome of any thing which may with reason be regarded as a special apparatus of sense.

11. The male and female sporosacs are borne by the same trophosome.

12. The generative elements, whether male or female, originate in a special cavity, which is formed in the substance of the endoderm of the sporosac.

13. In the female the primitive plasma becomes gradually differentiated into a multitude of cell-like bodies having all the characters of true ova with their germinal vesicle and spot. They are entirely destitute of enveloping membrane.

14. These bodies next begin to coalesce with one another into numerous roundish masses of protoplasm, which develop over their surface minute pseudopodial retractile processes.

15. The masses thus formed still further coalesce with one another; and there results a single spheroidal plasma mass, through which are dispersed numerous small spherical vesicles mostly provided with a nucleus. These vesicles appear to be nothing more than the nucleolated nuclei of the coalesced ova-like cells.

16. About the time of the completion of this last coalescence the resulting plasma mass, enveloped in an external structureless membrane, is expelled by the contraction of the sporosac through an aperture in its summit.

17. Immediately after its expulsion it is seized by the sucker-like extremities of certain remarkable organs (claspers), which are developed among the blastostyles and resemble long filiform and very contractile tentacles.

18. It is apparently now that fertilization is effected; for the plasma becomes again resolved into a multitude of roundish masses. This phenomenon may be regarded as representing the yelk-cleavage of an ordinary ovum.

19. The mulberry-like mass thus formed, surrounded by its structureless membrane, which has now acquired considerable thickness, and forms a firm capsule, continues to be held in the grasp of the claspers during certain subsequent stages of its development. An endoderm and ectoderm with a true multicellular structure become differentiated; a central cavity is formed by excavation; and the germ becomes thus converted into a spheroidal non-ciliated planula. This, after acquiring certain external appendages, ultimately escapes by the rupture of the capsule as a free actinuloid embryo.

20. The actinuloid, on its escape from its capsule, is provided not only with the long arms already noticed by Cocks and Alder, but with short scattered clavate tentacles. The short clavate tentacles become the permanent tentacles of the fully developed hydroid; the long arms, on the other hand, are purely embryonic and transitory.

21. The long embryonic arms originate in the spheroidal planula. They are formed by a true invagination, and at

first grow inwards into the body-cavity of the planula. It is only just before the escape of the actinuloid from its capsule that they evaginate themselves and become external.

22. After enjoying for one or two days its free existence, during which it moves about by the aid of its long arms, the embryo fixes itself by its proximal end, the long arms gradually disappear, the short permanent tentacles increase in number, and the essential form of the adult is soon acquired.

XXXIX.—*Development of the Marine Sponges from the earliest Recognizable Appearance of the Ovum to the Perfected Individual.* By H. J. Carter, F.R.S. &c.

[Plates XX., XXI., & XXII.]

It is now twenty-five years since my figure of the Freshwater Sponges, viz. *Spongilla*, as it grows out of the so-called "seed-like body," was described and published ('Annals,' 1849, Sept., vol. iv. pl. iv. fig. 2), and seventeen years since the observations and illustrations in my paper "On the Ultimate Structure of *Spongilla*" were obtained by following this development ('Annals,' July 1857, vol. xx. p. 21, pl. i.). My military duties at Bombay then compelled me to remain much at home, while in the tanks of the garden about the house where I lived *Spongilla* grew abundantly; so that, although I resided for many years at Bombay, and thus on the borders of the sea, I could only make use of the opportunities which the freshwater tanks of the island afforded.

Time has passed, and I have retired to my native place (Budleigh-Salterton, south coast of Devon), still on the "borders of the sea," but now in Great Britain. The duties of official occupation are over, and I have yet a little time left to study now the physiology of the marine sponges.

This may explain to those who, like Häckel ('Die Kalkschwämme,' vol. i. p. 28), express wonder that I should have exclusively studied the freshwater sponges while at Bombay, where there is, too, such a rich sponge-fauna on the "coasts of the Indian Oceans" for this purpose. Had I been a German professor, the matter might have been different, and I might have obtained indulgences in the way of "leave" for studying the marine sponges, which the military authorities at Bombay, if they had been appealed to on this behalf, would have laughed at.

But to show that while on "the coasts of the Indian Oceans" I did not entirely neglect the marine sponges, it might be stated that, while attached to the survey of the south-east coast of Arabia in 1844–46, I made a collection of all the marine sponges that I could find there, and sent them home just afterwards to Dr. Bowerbank, who received and thanked me for them; but here *this* matter ended, and would have ever done so had I not felt the loss of a report on them, and especially the specimens themselves, in arranging the coltion of the British Museum, where I should have been most glad of representations of this part of the world.

If another survey is made of that unfrequented shore, and another collection of sponges is gathered from it, I trust that the latter may not be attended by such misfortune!

Two or three of these sponges, however, whose figures I had drawn and whose duplicates I had retained, I have been able to describe and illustrate ('Annals,' 1869); and since then my kind friend Dr. J. E. Gray has, by his desire that I should go on with the study of the marine sponges generally, and his unceasing exertions to place within my reach every thing in his power to facilitate this inquiry, ending with opportunities for examining and arranging the whole collection in the British Museum, caused me to obtain such a practical knowledge of the subject, so far as specimens of sponges, both dry and in spirit are concerned, that I felt it absolutely necessary to preface a *résumé* of all this by that physiological study of the development of the living marine ones which my present residence on the sea-shore enables me to follow.

For this purpose I have for some time past been desirous of finding out specimens of these sponges in an oviparous state; and although this may be often done in any part of the year while the ovum is very young, or only just distinguishable, yet it has not been until lately that I have found specimens of these sponges in which the ovum has become much enlarged and developed into the embryonal state—that is, ready for delivery.

Of the calcareous sponges it was stated ('Annals,' 1874, vol. xiv. pp. 98 & 107) that *Grantia compressa* &c. went through this oviparous development in the months of March, April, and May, and that at this time none of the siliceous sponges that I could find appeared to be in a like condition.

Since then, however, viz. on the 30th July and 29th August respectively, I have found several siliceous sponges, together with one of the non-spiculous ones belonging to Schmidt's Halisarcinæ, viz. *Halisarca lobularis*, Sdt., in which the ovum has presented all the stages of development, from its earliest appearance to the full-formed embryo; that is to say, on the former date was found *Halisarca lobularis*, *Halichondria* *simulans*, Johnston, *Esperia ægagropila*, var., Cart., with still a few specimens of *Grantia compressa* in this condition, and on the 29th of August *Halichondria sanguinea*, Johnst., *H. incrustans*, J., *H. panicea*, J., and *H. plumosa*, J., together with many more specimens of the sponges first mentioned; so that it would appear that the active reproductive state of the siliceous sponges, viz. that in which they are about to throw off their ova in the state of embryos, should be chiefly sought for in the months of July and August, probably including September,—a point which it appears to me desirable to establish for the advantage of others wishing to follow this pursuit, while before entering upon the development of the ovum and embryo into the perfect sponge it also seems advisable briefly to premise, for the same purpose, what experience has taught me in this respect, which is as follows, viz.:—that sponges for the most part grow upon the *under* surfaces of rocks; that to obtain the greatest variety it is necessary to be present at the "springs," as the tide falls lowest then, provided the wind be blowing "off" instead of "on" shore; that we should work down with the last hour's fall of the tide; and that this work should chiefly consist in breaking off with a heavy crow-bar such ledges of the rocks as bear sponges of different kinds in large quantities, and carrying them up to a pool far above low-water mark, where they can be examined deliberately after the tide begins to rise, since both the fall and the rise of the tide take place so rapidly that there is no time for examining the specimens at the moment. Particular portions may be knocked off with a heavy hammer and cold chisel; and good specimens, if they cannot be obtained otherwise, must be loosened at the base with a putty-knife or spatula.

Besides these instruments I carry with me a clasp-knife to cut off the overhanging "sea-weeds" which intercept a view of the rocks beneath, and a little pad or canvas pillow stuffed with air and attached to a leather strap and buckle (which may be gartered round the right leg just above the calf to protect the bare knee against the cutting rock &c., as it is almost always necessary to bend down very low to see the under surface), a shrimp-net on a 6-feet pole, and weeding-iron on the like, to cut off and catch specimens which may be hanging from the under surface of the rocks beyond arm-reach, a 2-inch focus watchmaker's eye-glass, and two or three tin cans with covers (slung to strings attached to lateral ears, which they should each have for this purpose), to receive the selected specimens, in sea-water, as they are broken off from the parent rock respectively, whether at the time or at the examination subsequently made of the large pieces transported to the pool, as above stated, far above low-water mark. Add to this a basket and an old pair of boots to wade through the water, which will be often much above the knees, and thus protect the feet from being cut by the rocks and fragments of shells adhering to them.

Returning to the development of the sponge-ovule, I would observe that the oviparous sponges gathered on the 30th July have furnished me with all the observations needed for this communication, and therefore that those gathered on the 29th August were chiefly to corroborate the fact that about this time the marine siliceous sponges will be found available for the study.

Again, I have not been able to follow up the development of the ovule from its earliest appearance to that of the embryo and fully formed sponge in any *one* species only, from circumstances which will hereafter be mentioned; hence my illustrations of the early stages have been taken from one, and those of the later ones from another species.

Most of these illustrations, too, have been drawn to the same scale, viz. 1-12th to 1-1800th inch, in order that the relative size of the different objects at different periods of development may be the better realized. Thus, with the exception of fig. 1 in Plate XX., all the figures, from 2 to 12 inclusively, which are taken from *Halisarca lobularis*, are drawn to the scale mentioned; so are the remainder of the figures in this Plate (with the exception of the slight detail otherwise noticed), which have all been taken from *Grantia compressa*, in order, as before stated, that their sizes, relatively and respectively, may be compared with the figures of the embryos of *Halisarca lobularis* in the same, and of *Halichondria simulans* in the following Plate, in which the figures appear to be unusually large, but, to still preserve the scale for the purpose above mentioned, it was necessary that they should not be reduced; while in the third Plate, on account of the increasing size of the embryo after it begins to pass into the true sponge, and for other reasons which will be noticed hereafter, the figures, for convenience, *have been* reduced to the scale of 1-12th to 1-830th inch: thus it should be remembered that, for comparison with the foregoing, they should be more than double their present size.

By the illustrations in Plates XX. and XXI., having been drawn to the same scale, we are able to realize the relative sizes of the embryo of the gelatinous sponge, or *Halisarca lobularis*, of the calcareous sponge, *Grantia compressa*, and of the siliceous one, *Halichondria simulans*, respectively.

In studying the soft parts of a sponge, including the ovule, it is also essential to remember that they are *all* polymorphic, and, like *Amœba*, may at one moment appear in one form and at another in a different one. Thus the active spongozoon, which *in situ* may present a defined body, neck, head, and cilium, may, shortly after having been torn out from its natural position, and thus rendered passive, be changed into a simple, globular form. This form, in returning to partial activity, may again throw out pseudopodia from its sides (*Amœba*-like) and become reptant. The cilium, when the spongozoon is *in situ*, is used for bringing objects to the body; when the spongozoon is isolated it becomes an organ of locomotion, by which the body is propelled in front of it; from this state it may pass into a pseudopodial, prehensile form, and finally be retracted altogether; while the ovum, from its first appearance until after it has attained a considerable size, is always provided with a sarcodal envelope which, *Amœba*-like, gives it (up to a certain stage of development) a locomotive power. The student, therefore, must not be surprised, by-and-by, to find the embryo, after this manner, losing at once the cilia of its surface-layer of cells (the ectoderm), and the latter becoming a homogeneous-looking polymorphic or *Amœba*-like lamina of sarcode.

When the ovule for the first time becomes recognizable in *Halisarca lobularis* it does not exceed the 1-3000th inch in diameter, and then appears to be confined to the tissue of the sponge among the ampullaceous sacs (Pl. XX. fig. 3, *a*). Its envelope, however, already possesses the power of polymorphism and locomotion, as may be seen when it is scratched out from the parent upon a slide.

Subsequently, in *Grantia compressa*, it may be seen to be hanging, pear-shaped, upon the surface of the excretory canals, where it remains for a certain time locomotive, until, after further development, it becomes permanently fixed and the locomotive envelope seems to pass into a capsule. In this condition, too, I have described and figured it in *Tethya zetlandica* ('Annals,' 1872, vol. ix. p. 426, pl. xxii. fig. 14).

Although by necessity spread *throughout* the walls of the purse-like forms of calcareous sponges (ex. gr. *Grantia compressa*), it is nevertheless developed in *Halisarca lobularis* and *Halichondria simulans* (with which again in form the sessile spreading species of calcareous sponges, ex. gr. *Leuconia nivea* &c., are identical) close to the rock on which the sponge may be growing, where it becomes heaped up into masses, which present the ova in all stages of colour and development, from the first degree of duplicative division of the yelk to the fully developed embryo, whose colour seems generally to accord with, and be more intense than, that of the parent sponge, although in *Halichondria simulans* it is opaque white; while the upper part of the sponge becomes atrophied into a mere capsular layer (especially in *Halisarca lobularis*), and the vents appear to be in direct communication with the branches of the excretory canal-system, now expanded into common coverings for the heaps of ova respectively, which thus enables the embryos, when fully formed, to make their exit without difficulty. The position, in point of aggregation, of the ova in these sponges corresponds with that of most species of *Spongilla*; still, in some species of the latter, as well as in some of the marine siliceous sponges, they appear to be diffused throughout the mass—perhaps after all, however, being most plentiful about the base or oldest-formed portions of the sponge. While, therefore, in many instances, if the piece of rock on which the oviparous sponge, in this stage, may be growing is not broken off with it, the upper portion alone may be taken, and thus the ova escape observation. At the same time, almost all the specimens of *Halisarca lobularis* which I obtained on the 29th August, having been reduced to mere surface-shells, in which the red-violet colour of the spongozoa was unusually intensified, and from which the whole of the ova, having passed into the locomotive ciliated embryos, had escaped, and had thus left them hollow at the base, indicated that this date is too late for finding *Halisarca lobularis* in that oviparous condition which is requisite for following the development of the ovum.

To obtain the *ova* for examination it is absolutely necessary to tear the mass to pieces, and either examine them *in situ*, or seek for those which may have fallen out entire; while a few of the ciliated embryos that are far advanced may also thus be forcibly eliminated.

But, to obtain the embryos in a fully matured state, either in *Halisarca lobularis*, *Halichondria simulans*, or *Grantia compressa*, it is best to place the oviparous specimens of these sponges respectively in this stage of ovi-development in sea-water uninjured, and let the embryos escape by themselves naturally. This can be done by breaking off a portion of the rock on which the two former sponges may be growing, while with *Grantia compressa* it is only necessary to cut off the branch of *Ptilota* to which it may be attached.

Having thus got out a sufficient number of embryos for immediate examination and the study of their subsequent development, we have only to transfer them, by means of a pipette, to any convenient place for this purpose. In doing this, the end of the pipette, whose aperture should be large enough to admit the embryo, must be put into the water close to it, while the finger is pressed tightly upon the opposite end; then, when the finger is withdrawn, the embryos will, by the capillary attraction of the water, pass up into the mouth of the tube, and, by subsequently gravitating towards the lower part, when the pipette is held upright, may thus be transferred to a slide for examination or to a vessel for holding them without any further force. They will live for several days in pure sea-water, changed now and then for a fresh supply; and their whole development into the perfect sponge may thus be easily followed; but, as this process is not stationary, the embryo itself can only be expected to be in its perfect condition at the moment it issues from the parent sponge, and must then be examined for this purpose, as it changes somewhat every hour afterwards.

It has been above stated that to give the whole of the development of the ovule, from its first appearance to the fully developed sponge, I have had to study it in *two* species; that is, that, owing to the transparency of the ovules in the non-spiculous sponge *Halisarca lobularis*, the segmentation of the yelk is much better seen here *in situ* than in *Halichondria simulans*, where the ovum is opaque; while, as regards the embryonal form and subsequently developed sponge, not only its larger size, but the presence of spicules in the embryo, and their final arrangement into the skeleton-structure of *Halichondria simulans*, render the embryo of this sponge much more eligible for this part of the development than that of *Halisarca lobularis*, in which there are no such aids.

We shall first, then, commence with the development of the ovule from its earliest appearance to the ultimate segmentation of the yelk in *Halisarca lobularis*, and then follow the development of the embryo into the perfect sponge in *Halichondria simulans*, comparing the latter afterwards with the development of the embryo of *Grantia compressa* into *its* perfected form, thus supplying, to a certain extent, that detail of which the late Prof. R. E. Grant discovered the salient points forty-seven years since ('Edinb. Phil. Journ.'), and taught them to me, his friend and pupil, in his lectures thirty-three years ago at University College.

It should be here mentioned that this subject is not *entirely* new to me, as I have already described and figured the ovum, in *Tethya cranium* and *T. zetlandica* respectively, from preserved specimens, in which it had probably advanced to very nearly the full period of embryonal development ('Annals,' 1872, vol. ix. p. 409, pl. xxii.).

Entering, now, upon the chief subject of this communication, it will, for convenience, be desirable to divide the development of the living sponge-ovule into four periods, viz.:—

1. That from its earliest appearance to the commencement of the duplicative division of the yelk.

2. That from the first duplicative division of the yelk to its ultimate duplicative subdivision.

3. That from the formation of the embryo to its fixation or stationary position.

4. That from the stationary position of the embryo to the development of the perfect sponge.

First and Second Periods.

As the first and second periods are taken from *Halisarca lobularis*, it is desirable to premise a description of the oviparous state of this sponge in both these periods; but as the former has already been done ('Annals,' 1874, vol. xiii. p. 433), there is no occasion for a repetition of it here, though it is necessary to add to my former description that the surface of *Halisarca lobularis* is covered with vibratile cilia (Pl. XX. fig. 1, *ee*), which is not the case with that of *Halisarca Dujardinii*.

In the second period, however, it differs in that the ova are greatly enlarged, and, instead of being diffused throughout the substance of the sponge, are gathered, as before stated, into heaps at its base (fig. 1, *bb*), where they rest upon the bare rock on which the sponge has grown (fig. 1, *cc*).

Here, too, although they are respectively encapsuled, the heaps or groups are each as respectively enclosed in a common membrane (fig. 1, *g*), which appears to be a dilated form of the excretory canals opening at the vent (fig. 1, *f*), by which the embryo (fig. 1, *i*) when it leaves the capsule (fig. 1, *k*) can find an easy exit. Further, the parent sponge has become reduced to a mere shell or layer (fig. 1, *aa*), in which however, the spongozoa of the ampullaceous sacs, as before stated, seem to present a more intensified red or pink-violet colour than ever (fig. 1, *d*), and the vents show themselves to be provided with a sphinctral diaphragm of sarcode (fig. 1, *f*) somewhat contracted, as if to regulate the egress of the embryos.

First Period.

That from the earliest appearance of the ovum to the commencement of the duplicative division of the yelk.

If we take a portion of *Halisarca lobularis*, at any time of the year probably (if it is not too young), and tear it to pieces in sea-water (for sea-water must always be used for these purposes to keep the parts alive), we may observe, with $\frac{1}{4}$-inch compound power, ova from the 1-3000th to the 1-1000th inch in diameter (fig. 3, *a*, *b*) ; in the smallest of which (*a*) the yelk and nucleus are already visible, although the nucleolus and germinal vesicle can hardly be distinguished with this power until they have become a little larger (*b*), while all are respectively enveloped in a layer of sarcode, which, being polymorphic, carries the ovum about with it as an *Amœba* does its nucleus (fig. 3, *c*).

At this time the ova appear to be imbedded in the substance of the *Halisarca*, while the smallest size only exceeds by one quarter the diameter of the spongozoon (fig. 2, *a*). How they escape from this position, except by their reptant power, I do not know.

But if we take a horizontal slice off the inner surface of a *Grantia compressa*, and place it on a slide in a little sea-water with a glass cover over it, we may see the ova, when they are not more than 1-1700th inch in diameter, attached to the surface of the excretory canals, where they not only hang pendent in a pyriform shape, but sometimes leave this position and become reptant (perhaps the human ovum creeps down the Fallopian tubes in this way?) ; so that we may fairly infer from this that, in *Halisarca lobularis*, they follow the same course—that is, pass into and become attached to the excretory canals. This stage, as already noticed, I have described and figured in *Tethya zetlandica* (*op. et loc. cit.*). After a while, however (that is, in the latter position, viz. the excretory canals), they increase to the size of 1-180th of an inch in diameter (10-1800ths), when the polymorphic envelope appears to become transformed into a capsular covering, which, at one point, adheres to the parent sponge, and thus placenta-like probably continues to nourish the ovum.

Second Period.

That from the first duplicative division of the yelk to its ultimate duplicative subdivision.

In the second period I have above stated that the ova are found to be much enlarged and congregated upon the rock at the base of the sponge, where they appear in all stages of development, from the first duplicative division of the yelk (figs. 4 to 10 inclusively) to the perfect embryo (figs. 11 & 12); hence it is only necessary to place a portion of the sponge bearing the ova in this condition under $\frac{1}{4}$-inch compound power, and seek for the successive duplicative subdivisions of the yelk, from the first to that which appears to be the last duplicative subdivision (fig. 1, *hhh*), since, although it is easy enough to determine these divisions from the first to the third degree inclusively, in which the yelk becomes divided into *eight* cells (fig. 6), the other degrees (figs. 7–10) must be judged of by the comparative size of the cells; and thus all the rest of the illustrations of this duplicative subdivision have been selected in this way, from the fourth (fig. 7) to the seventh (fig. 10) inclusively.

If, on the other hand, the ovum, while undergoing this duplicative subdivision, be isolated and compressed under a glass cover and $\frac{1}{4}$-inch compound power, a nucleus and nucleolus will be observed, as figured in the illustration of the first degree of duplicative division, viz. that in which the yelk is divided into *two* cells only (fig. 4, *dd*). But, as this compression &c. cannot be carried into effect when the ova are viewed *in situ* and *en masse* (as in fig. 1), the nucleus cannot be then seen for want of sufficient light, and therefore is not introduced into the other figures, although it must be assumed that, whenever a cell undergoes division, the nucleus does so also, and that if these cells, however much subdivided, could be brought under sufficient compression, and thus rendered sufficiently transparent, each would be found to contain a nucleus.

There is also another feature which characterizes this period, viz. that the ovum is *without colour*, while very soon after the ultimate duplicative subdivision of the yelk is reached, and the yelk begins to be elongated into the form of the embryo (figs. 11 & 12), the latter presents the same kind of red-violet colour as the spongozoa.

Striking, however, as this distinction is, the ciliated ectoderm, which becomes such a prominent feature of the embryo, is developed over the yelk while the ovum is still colourless and apparently has not begun to elongate itself into the embryonic form.

It is thus interesting to find that the yelk in the lowest undergoes the same kind of segmentation as in the highest animals, as if in all this preliminary process were absolutely necessary to the further evolution of the new being. Nor is it a little interesting to me to find also that my drawings of it *to-day* in the sponge correspond exactly with those which I made in 1837 from the ova of the freshwater newt, when as a student, aided by my dear friend Dr. Sharpey, I followed throughout the development of this reptile in ova obtained from a pool in the "Regent's Park."

There are yet two illustrations of the embryo of *Halisarca lobularis* to be described; but as it is our object to proceed direct from the last segmentation of the ovum in this sponge to the formation of the embryo in *Halichondria simulans* (that is, from the second to the third period of ovular development), we shall have to return to these hereafter.

Third and Fourth Periods.

As the third and fourth periods of the development of the sponge-ovum will be followed out in *Halichondria simulans*, Johnst., it might be as well to briefly premise the following description of this sponge:—

Halichondria simulans.

General form digital, cylindrical, solid, branched; procumbent, adhering here and there to the rock on which it lies; or flat, sessile, and spreading. Colour greyish brown or yellowish. Vents sparse, scattered, large. Internal structure composed of sarcode and the usual ampullaceous sacs (Pl. XXI. fig. 23), hung upon a reticulated, anastomosing, horny, fibrous skeleton, imbedding *one* form of spicule *only*. Spicule acerate, smooth, curved, rather abruptly pointed, often somewhat bent in the middle; average largest size 8 by 1-1800th inch in its greatest diameters (fig. 24). Size of entire specimens variable.

Hab. Marine.

Loc. Plentifully on the under and overhanging surfaces of rocks.

This sponge, which is very common on this coast, has been named by Dr. Bowerbank "*Isodictya simulans*" in one part (vol. ii. p. 308) and "*Chalina simulans*" in another (vol. i. p. 101), also (*ib.* p. 277) "*Isodictya simulans.*" At this confusion I do not wonder, since in my proposed division of the sponges generally this sponge would come among the Chalinidæ or third division, and *Isodictya* in the fifth division or Raynerlæ; while the distinction between *Chalina* and *Isodictya* is only one of degree, viz. the almost total absence of supporting *horny* fibre in the latter.

The ova of *Halichondria simulans* in the second period appear in the form of opaque *white* grains in the centre or oldest portion of the cylindrical forms, and at the base close to the rock in the spreading forms, just as in *Halisarca lobularis.*

By what stages the spheroidal ovum passes into the elongated embryonal form, I do not know; but the ciliated ectoderm as well as the spicules are already developed in the former, as before stated, in *Halisarca lobularis*, and shown in the illustration of the ovum of *Esperia œgagropila*, var. (Pl. XXI. fig. 25)—that is, probably immediately after the subdivision of the yelk has been completed.

Third Period.

That from the formation of the embryo to its fixation or stationary position.

As, however, the spheroidal ovum elongates, the posterior end becomes marked by the development of a brownish-yellow coloured mass of cells, which subsequently take on a globular form (Pl. XXI. fig. 22, *a*), or are arranged round the base in a circle (fig. 21, *f*), contrasting strongly with the *opaque white* colour of the embryo. The latter, now becoming fully matured, bursts through its capsule and swims into the water. At this time it is very large, as may be seen by the illustrations (figs. 21 & 22), compared with the embryo of *Halisarca lobularis* (Pl. XX. figs. 11 & 12), and especially that of *Grantia compressa* (figs. 13 & 15), which, for this purpose, are all drawn, as before stated, to the same scale. In shape it is cylindrical (fig. 21), conical at one end and round truncate at the other, measuring 1-30th inch long by 1-90th inch wide. At the anterior end is a papillary projection (fig. 21, *e*, & fig. 22, *f*), and at the posterior one the brown cells mentioned (fig. 21, *f*, and fig. 22, *a*); while all the rest of the surface is covered by the ciliated ectoderm or layer of minute monociliated cells (fig. 21, *d*).

(In the illustrations this ciliated layer has only been generally represented, by dots all over the body, in the embryo of *Halisarca lobularis* [Pl. XX. fig. 11], but for convenience has been omitted in the rest, or rather reduced in representation to the dotted line round the margins of the other figures respectively.)

Besides the cilia of the surface there is a line of very large ones of a distinct kind, and five times as long as those of the ectodermal layer, which encircles the base and forms a mutual boundary to the brown-coloured mass of cells on one side and the ectodermal ciliated surface on the other (fig. 21, *g*, and fig. 22, *e*).

The cells of the brown-coloured mass, on the other hand, which are much larger than those of the ectodermal layer, present themselves, as before stated, in a globular form (fig. 22, *a*) or in a simple circle round the base (fig. 21, *f*).

In progression the embryo swims with the papillary or pointed end foremost, and rotates upon its long axis from left to right, as indicated by the arrows respectively on the illustration (fig. 21, *h*, *i*), and as if the cilia on its surface were arranged spirally.

When the embryo is crushed it is found to be filled with sarcode charged with cells and granules of different sizes, together with the spicules of the species (figs. 21 & 22, *b*), the latter very delicate, and the larger cells filled with smaller ones (figs. 21 & 22, *c*), as if they were the commencement of the ampullaceous sacs, which we shall by-and-by find so numerous in the perfected sponge.

While the cells of the coloured mass (fig. 22, *a*) at the posterior extremity are of the same size throughout, and independent of the colouring-matter of the sarcode which surrounds them, the cells of the ectoderm of the body and of the coloured mass are, respectively, about ½, 3, and 2-6000ths inch in diameter.

It has already been stated that the ciliated ectoderm and the spicules make their appearance while yet the ovum retains its spheroidal shape; and it might be added that all the forms of the spicules belonging to the species make their appearance about the same time, whereby, even at this early stage of development, the species may thus be determined to which the ovule belonged, as will be seen by the illustration of an ovum of *Esperia ægagropila*, Cart., var., on the rocks here (fig. 25), wherein the skeleton-spicule (*b*) and the three forms of flesh-spicules, viz. anchorate (*c*), bihamate (*d*), and tricurvate (*e*), are all present. The tricurvate here is very long and straight, as may be seen by fig. 26, which represents one in its mother cell from the parent sponge, thus chiefly constituting the "variety."

It should be particularly remembered, however, that the spicules in the embryo are not confusedly dispersed throughout the body-substance, but are, in their natural position, *confined* to the *posterior* part, close to the root-cells, where the long ones are grouped parallel to each other and to the longitudinal diameter of the embryo, with their large ends posterior and their small or pointed ones anterior (Plate XXII. fig. 28, *e*). It is only when the embryo is carelessly crushed on the slide, for microscopical examination with a high power, that they appear to be *generally* dispersed throughout the body.

Having placed twenty embryos of *Halichondria simulans*, such as that above described, in a glass vessel (finger-glass) two thirds filled with fresh sea-water, I observed that while they often attached themselves, by the posterior end, to the bottom of the vessel, some became shorter in length, with a corresponding widening (Plate XXI. fig. 22); and thinking that they wanted to become fixed, while remembering the habit of this sponge to grow on the under surface of the rocks, I dropt into the bottom of the vessel a small, dark, subangular pebble of quartzite, about ½ inch in diameter, obtained from the *centre* of a piece of red-sandstone conglomerate in order that it might be free from impurities, and shortly afterwards observed that one of the embryos had become fixed to the under part of an overhanging portion of this pebble, which in no position ever risked the crushing of the embryo by resting upon the glass. This pebble with attached embryo (Plate XXII. fig. 28, *d*) was immediately transferred to another finger-glass of the same kind, and the remainder of the embryos left to themselves. As it might be confusing to state any more about the latter here, I defer *this* for a future opportunity.

Fourth Period.

That from the stationary position of the embryo to the development of the perfect sponge.

Having now a fixed embryo, I placed it under an inch compound power, and observed that it had become attached by the *posterior* end (Pl. XXII. fig. 28), which still presented the brown-yellow-coloured mass of cells that distinguishes this point (*c*), and was further marked by the circlet of long cilia that, undergoing retraction, still played languidly round the base (*e*), while the whole of the ectodermal cilia had become retracted (*a*), leaving the embryo with a white, smooth, even surface, and the papillary projection still on the summit (*b*).

(Here it should be observed that, whenever the embryo was subjected to examination, the pebble was turned over or to one side, so that both the upper and lateral surfaces of the embryo might be seen and measured respectively, while at the same time this was always done *under* water, out of which the embryo was *never* taken until after it had become developed into the perfect sponge. Finding, too, that I was obliged to use another microscope for this, in order to get the vessel in between the table and the object-glass, and that this necessitated my using another micrometer, whose divisions were equal to the 1-830th of an inch, instead of the one I had been using, whose divisions were equal to only 1-1800th of an inch, while if the measurements had been reduced to the latter and the objects drawn to this scale, in accordance with those on the previous plates, they would be inconveniently large for this one, I determined to draw them on the scale first mentioned, allowing 1-12th to 1-830th of an inch, by which it will be seen, and should be remembered, that they are on a scale which makes them a little less than half the size they would be if drawn upon the scale first used, viz. 1-12th to 1-1800th of an inch.)

The fourth period occupied just a week, viz. from the 4th to the 10th of August inclusively; and the embryo was examined in the way above mentioned twice a day, viz. morning and evening, during this time.

On the 4th and 5th it altered very little in appearance from what has been above stated, beyond becoming a little wider and shorter (Pl. XXII. fig. 28).

On the morning of the 6th the now unciliated ectodermal layer seemed to have descended from the body of the embryo, and, in a homogeneous and transparent form, to have spread out on each side in a denticulated manner, much like that of an *Amœba* (fig. 29, *a a*), by which the body, now erect and conical (fig. 29, *b*), but still opaque, white, and smooth, became more firmly fixed to the pebble. The papillary eminence also appeared to have somewhat subsided into a depression or excavation (fig. 29, *c*).

But in the evening of the 6th the embryo, still continuing the same in other respects, had lost its smooth even surface, and now presented a monticular or polygonal one of a more or less globular form (fig. 30, *a*), with the vent more pronounced (fig. 30, *b*). It was evident, from what I had seen before in the development of the young *Spongilla* from the seed-like body to which I have alluded, that the spicules in the interior of the embryo of *Halichondria simulans* were being arranged into a skeleton-structure in which their ends, in bundles, forced outwards the dermal membrane of the embryo, and thus gave rise to the irregular monticular surface mentioned.

During the 7th and 8th days, the projection of the spicules, still *under* or *within* the ectodermal membrane, became more pronounced, the body more expanded at the base, and the homogeneous transparent ectodermal expansion more or less withdrawn (fig. 31).

On the morning of the 9th the ectodermal membrane had become separated from or raised into a kind of film all over the free surface of the embryo (fig. 32, *c c*), by the projection of bundles of spicules from the opaque white body of the latter (fig. 32, *b b*), thus causing the opaque portion (fig. 32, *a a*) to be surrounded throughout above the base by a hollow interval (fig. 32, *d d*), bounded by the ectodermal layer on one side and the opaque body of the young sponge, *now fully formed*, on the other. To the ectodermal layer and this cavity I had, in my paper "On the Ultimate Structure of *Spongilla*," given the names respectively of "investing membrane" and "its cavity" ('Annals,' 1857, vol. xx. p. 24, pl. i. fig. 1). The latter forms the "intermarginal cavities" of Dr. Bowerbank—strangely, figured from the same sponge as our embryo came from, viz. *Halichondria simulans*, under the names (as before stated) of *Chalina simulans* in one part, and *Isodictya simulans* in another (B. S. *l. c.* plate xix. fig. 299).

At this point of development the spicules, now in a naked form, project a little beyond the "investing membrane" or ectodermal layer (fig. 32, *c c*); and could I have brought a $\frac{1}{4}$-inch compound power to bear upon it in this development, as in the development of *Spongilla* from the seed-like body, in a watch-glass, I might have observed the pores, and finally the composition of the investing membrane or ectodermal layer itself, which again, strangely, in *Spongilla* I have described as consisting of flat cells like *Amœbæ*, forming a "foliated arrangement not unlike a compressed layer of multifidous leaves ever moving and changing their shapes" (*l. c.* p. 25, pl. i. fig. 7). I say "strangely," because this membrane, in the embryo of *Halichondria simulans*, must also be composed of polymorphic cells, although with their cilia now retracted.

Of the same nature, composition, and functions as the investing membrane in *Spongilla* we may, then, fairly assume that in the embryonal sponge of *Halichondria simulans* to be; and I would recommend any one who wishes to make himself confident of this to consult my paper and illustrations on the ultimate structure of *Spongilla* (*op. et loc. cit.*).

The single vent, now the end of the branched excretory canal-system, may be observed to traverse the cavity of the investing membrane and to open on the surface (fig. 33, *a*).

Thus the passing of the embryo into the perfected sponge may be considered to have become complete.

On the 11th of August I sought, as before, eagerly for a current of particles issuing from the vent, but could observe none; and fancying that the development had become stationary (in fact, that a slight retraction all round the young sponge indicated approaching dissolution), I determined not to try to feed it with indigo in order that I might see if it already contained fully-formed spongozoa and ampullaceous sacs, but at once tore it to pieces on a slide in sea-water for this purpose, well knowing that a little delay in doing this would expose the whole structure to the ruinous influence of hosts of devouring animalcules.

This was done, and then the structure of the parent sponge was observed to have become fully developed (fig. 34). The skeleton structure was found to consist of a reticulated horny investment supporting bundles of the acerate spicule of the species (fig. 34, *a a*), some of which, as before mentioned, projected beyond the confines of the opaque or parenchymatous portion of the sponge so as to support the investing membrane (fig. 34, *e e*), while the whole of the inner part of the skeleton was imbedded in sarcode charged with minute cells and granules (fig. 34, *b b*), among which could be perfectly distinguished the monociliated spongozoa, isolated (probably from the force used in tearing the specimen to pieces for examination), and in the aggregated globular forms of the ampullaceous sacs of the species (fig. 36, *c*, *d*, *g*), both of which corresponded in appearance and measurement with the like in the parent sponge, which had been previously examined, measured, and sketched for this reference, and may be found among the illustrations (Pl. XXI. fig. 23).

Thus the sponge-ovule, from its first appearance to its final development into the perfect sponge, had been completely traced; and thus its apparently chaotic mass had passed into definite forms by that mysterious power whose manifestations only we can comprehend.

[To be continued.]

XL.—*On the Invertebrate Marine Fauna and Fishes of St. Andrews.* By W. C. M'Intosh.

[Continued from p. 274.]

Class CRUSTACEA.

Order Podophthalmata.

The stalk-eyed Crustacea of St. Andrews are chiefly northern in type; and though the species are not numerous, many are very plentifully represented. The most important forms here, as elsewhere, are the edible crab and the lobster. Both are caught in considerable numbers along the border of the rocks by means of the ordinary crab-pots, which are generally baited with fragments of grey gurnards and other fishes of little value. The most successful ground is off the East Rocks, though a very large lobster in the Museum of the University was procured to the north of the West Rocks. Some of the fishermen have an idea that if a lobster enters a trap first, none of the edible crabs will venture beside it, whereas a lobster will invade the crab-pot though a dozen of the former are already there. Constant attacks seem to have diminished the numbers of both species, and especially of the lobster. I have never seen any of the latter between tide-marks; but young edible crabs are common under ledges and stones, and even in the sand at low water, their presence in the latter being recognized by a depression. The common shore-crab occurs everywhere along the rocky border, both between tide-marks and in the laminarian region. This ubiquitous species lurks in the retired apertures and clefts amongst and under the rocks, especially where these have a bottom of soft sand or dark mud. In this it buries itself so as to retain moisture in the gills, while the anterior part of the carapace is uncovered, probably for quiet observation. In these situations it quite understands an attempt to capture it; and there are few examples, if any, in which, by seizing the crooked iron with its chelæ, it has allowed itself to be drawn out. On the contrary, it endeavours to escape with much effort and considerable agility. Even when quite invisible its presence may be detected by striking the rock, when the grating of the carapace is heard as the animal retreats. It is often to be found in positions which seem any thing but comfortable—amongst blackened and putrefying animal remains, in muddy and odoriferous pools tenanted by none except itself. In these circumstances the body is coated with mud, which fills up the irregularities of its conformation, and loads the abdominal feet and hairs; yet the crab is vigorous and healthy, and outlives sanitary apprehensions.

Under almost every stone within reach of the tide young specimens occur. At low water the full-grown crabs seek the hiding-places just mentioned, or shade themselves under the blades of the seaweeds in the rock-pools. Occasionally one is found adhering to the soft body of a moulting brother and, cannibal-like, devouring the branchiæ, new carapace, and other soft organs with savage pertinacity, while the old shell has not quite fallen from its victim. Moulting shore-crabs are generally found alone, as if aware of their helplessness, and dreading, with some degree of correctness, the voracity of enemies and even unscrupulous relations. Very slight injury kills them in this condition; and of course, for a time, they are incapable of defending themselves from even weak assailants.

The shore-crab is found in pools at the East Rocks where no other marine articulate of the same class occurs; and the water cannot but be brackish, since the pools are not filled by ordinary tides, and fresh streams from the crags flow in the neighbourhood. In these resorts the colour of the crab is not so pretty, being of a muddy green with pale limbs; and the specimens in the highest pools are generally small. It is not surprising, however, to find them in such places, after watching their activity in the innumerable brackish lakes of the Outer Hebrides, and their evident comfort in perambulating the muddy flats even where streams of fresh water abound.

On land, *Carcinus mænas* is, perhaps, the most active British crab, especially in regard to offence, defence, and escape. It scrambles over the rugged rocks with astonishing speed, while defending itself with its uplifted chelæ; and so fierce is it in attack, that having once seized an object with the latter the spasmodic effort is sometimes so great that the limb separates from the trunk at the base. The males frequently engage in combat; and a fatal issue would more frequently ensue, were it not for the provision whereby hæmorrhage is speedily arrested and the lost portion repaired or reproduced. Few specimens, indeed, are quite free from injury. Some have recently repaired wounds of the carapace, others have lost an eye, an antenna, or one or more limbs. They surpass most marine animals in their powers of enduring life at a distance from sea-water, and may easily be kept for several weeks in a botanic vasculum.

The shore-crab is strictly carnivorous and, as already mentioned, even relishes its fellows. It is a curious feature in its history that it suffers serious annoyance and injury from the young of the common mussel, which plant themselves in its orbits, in the sockets of the internal antennæ, in the branchial chambers, and under the tail—in the former case often destroying both eyes. It feeds with avidity on the mussel in its adult state; so that here is an instance of a helpless young form avenging the destruction of the mature. The shore-crab, again, is devoured by many fishes: thus in the stomach of a *Cottus bubalis* I have found five or six specimens, two entire and upwards of two inches across the carapace. The *Cottus*, however, unfortunately came in the way of a large frogfish, which found a place for it in its capacious stomach, though nine full-grown flounders were already present. In many parts of Britain and the continent the shore-crab is used as food by man (and this is a safe-enough practice so long as it is well boiled, internal parasites being abundant); but at St. Andrews it is only employed occasionally for bait.

Myriads of the young of this species in the zoëa-stage occur at the surface of the bay in autumn, and may easily be kept alive, so as to show the subsequent stages of development.

Besides those already mentioned, many of the other forms are very common, such as *Stenorhynchus rostratus*, *Inachus*, *Hyas*, *Portumnus variegatus*, the *Portuni*, *Pinnotheres*, *Ebalia*, and *Nephrops* in deep water, *Porcellana*, the *Paguri*, *Galathea*, and *Crangon* between tide-marks, and in both regions *Hippolyte*, *Pandalus*, and *Palæmon*. In deep water swarms of *Hyas coarctatus* for the most part take the place of *H. araneus*. As a littoral form *Palæmon squilla* is local, but in company with

Pandalus annulicornis it is abundant in deep water. The common shrimp is seldom captured by man for food. *Portumnus variegatus* is often the only form visible on the West Sands, and is very plentiful. The rarer forms are *Eurynome*, *Pirimela*, *Lithodes*, *Gebia deltura*, *Hippolyte spinus*, and *Doryphorus Gordoni*.

In contrast with the fauna of St. Andrews, we have in the mild sea of the west of Scotland the fine velvet crabs (*Portunus puber*) amongst the seaweeds between tide-marks. The common lobster is also much more abundant, though the wholesale fishing has of late years told severely on this crustacean, even on the most remote shores of the Outer Hebrides—as, for instance, off the rocks of Haskeir near the north-west point of North Uist, where the frequent inroads of the fishermen with their lobster-pots and floats have rendered even the seals less frequent in their accustomed haunts. *Xantho*, *Munida*, and the rarer species of *Crangon* and *Hippolyte* are also absent from St. Andrews. In the south of Britain, again, are the splendid spiny lobsters off the rocky shores, velvet crabs, *Pirimela*, and *Ebalia* under stones between tide-marks, *Alpheus ruber* and *Pagurus cuanensis* in littoral pools, *Pilumnus* in the crevices of the tidal rocks, *Pagurus Prideauxii* with the beautiful *Adamsia* adherent to its protecting shell, *Maia* *, *Dromia*, and *Polybius*. In the northern waters swarms of the hardy *Portunus pusillus*, *P. tuberculatus*, *Pagurus pubescens*, and *Pandalus brevirostris* are characteristic, besides the rarer *Pagurus tricarinatus*, *Crangon serratus*, and *Sabinæa septemcarinata*.

I am indebted to the Rev. A. M. Norman for kind assistance with several species of Palæmonidæ and Galatheidæ.

Suborder **STOMAPODA**.

Fam. **Mysidæ**.

Genus Mysis, Latreille.

Mysis flexuosa, O. F. Müller; Bell, Brit. Crust. p. 336 (as *M. chamæleon*).

Very abundant in rock-pools.

Mysis vulgaris, J. V. Thompson; Bell, *op. cit.* p. 339.

Occasionally with the former in rock-pools; much less common.

* It was recently stated in 'Land and Water' that *Maia squinado* had been procured near the Bell Rock; but, by the kindness of Mr. F. Buckland, who forwarded the specimen, I am enabled to observe that it was only *Lithodes maia*.

Mysis Griffithsiæ, Bell, *op. cit.* p. 342.

Not uncommon in rock-pools, and occasionally thrown on the West Sands in multitudes after storms.

Suborder **DECAPODA**.

Tribe *MACROURA*.

Fam. **Palæmonidæ**.

Genus PALÆMON, Fab.

Palæmon squilla, L.; Bell, *op. cit.* p. 305.

Common in pools beyond the Rock and Spindle and in the stomachs of cod.

Genus PANDALUS, Leach.

Pandalus annulicornis, Leach; Bell, *op. cit.* p. 297.

Abundant from the laminarian region to deep water, and also in the stomachs of cod and haddock.

Genus HIPPOLYTE, Leach.

Hippolyte varians, Leach; Bell, *op. cit.* p. 286.

Frequent in rock-pools and ranging thence to deep water; stomachs of haddock.

Hippolyte pusiola, Kröyer, Monogr. af Slægten Hippolytes Nordiske Arter, p. 319, pl. 3. f. 69–73 (*fide* Rev. A. M. Norman).

Occasionally from the coralline ground amongst shells and stones, and in pools at the East Rocks.

Hippolyte securifrons, Norman, Tyneside Nat. Field-Club Trans. vol. v. (1863), pl. 12. figs. 1–7.

Occasionally in the stomach of the flounder.

Hippolyte spinus, Sowerby; Bell, *op. cit.* p. 284.

Occasionally in the stomach of the haddock.

Genus DORYPHORUS, Bate.

Doryphorus Gordoni, Bate, Nat. Hist. Review, vol. v. (1858), p. 51.

Under a large stone in a pool near low water at the East Rocks. Rare.

Fam. **Crangonidæ.**

Genus Crangon, Fab.

Crangon vulgaris, Fab.; Bell, *op. cit.* p. 256.

Abundant off the West Sands and in sandy tide-pools, as well as on the beach after storms.

Fam. **Astacidæ.**

Genus Nephrops, Leach.

Nephrops norvegicus, L.; Bell, *op. cit.* p. 251.

Common in deep water and in the stomachs of cod.

Genus Homarus, M.-Edwards.

Homarus gammarus, L.; Bell, *op. cit.* p. 242.

Common in the laminarian region.

Fam. **Thalassinidæ.**

Genus Gebia, Leach.

Gebia deltura, Leach; Bell, *op. cit.* p. 225.

Occasionally in the stomachs of cod and haddock.

Tribe *Anomura.*

Fam. **Galatheidæ.**

Genus Galathea, Fab.

Galathea strigosa, L.; Bell, *op. cit.* p. 200.

Not uncommon in deep water and in the stomachs of cod and haddock.

Galathea squamifera, Mont.; Bell, *op. cit.* p. 197.

Very common under stones near low water, especially in pools and runlets; occasionally in the stomachs of cod.

Galathea dispersa, Bate, Proceed. Linn. Soc., Zool. vol. iii. p. 3.

Abundant in deep water, and in the stomachs of the cod, haddock, and flounder.

Fam. **Paguridæ.**

Genus Pagurus, Fab.

Pagurus bernhardus, L.; Bell, *op. cit.* p. 171.

Everywhere abundant between tide-marks and in deep water. A young specimen was lodged inside a fragment of a stalk of wheat.

This species has nine or ten branchiæ on each side, besides a rudimentary organ at the base of the first pair of foot-jaws. The latter have no branchial whips, and differ considerably from those of the Brachyura.

The first pair of foot-jaws have the inner division very much elongated, almost antenniform, and bordered with long hairs, while the external portion is small. In the next pair the inner division more closely agrees with the external in length, and the whole is not very different from the same part in *Carcinus mænas* minus the whip and branchia. The third pair is shorn of its whip and large flap, and has the middle segment * represented by a narrow pedicle. The fourth pair has a narrow shield turned over at the free edge, and, instead of the two narrow spikes below, there is a flattened organ which forks into a narrow and a broad flap at the tip. The fifth pair has its inner division broad and flattened, and its outer small, but widened at the tip; the median division has a very regular arrangement of bristles at its tip, which points or slopes inwards.

The parasitic *Peltogaster paguri* frequently occurs on the abdomen.

Pagurus cuanensis, Thompson; Bell, *op. cit.* p. 178.

Occasionally from deep water.

Pagurus ulidianus, Thompson (?); Bell, *op. cit.* p. 180.

St. Andrews Museum. I cannot speak with certainty of this form.

Pagurus lævis, Thompson; Bell, *op. cit.* p. 184.

Occasionally in the stomach of the haddock.

Fam. **Porcellanidæ.**

Genus Porcellana, Lamarck.

Porcellana platycheles, Penn.; Bell, *op. cit.* p. 190.

Abundant under stones between tide-marks, especially in

* Corresponding to *d*, fig. 3, Trans. Linn. Soc. vol. xxiv. p. 86.

runlets, and on muddy ground. A group of young forms of some size may sometimes be seen in company with their parents.

The first pair of foot-jaws have their two terminal segments furnished with the longest hairs (proportionally) yet met with in the local forms. The hairs have a double row of spikes, diminishing towards base and tip, and cease before arriving at the end of the hair, which has very fine linear serrations. The external division has a powerful triangular, and somewhat tapering, lower segment, and a delicate appendage fringed with a brush of spiked hairs at the tip. The second pair has the external division much flattened, lanceolate, and with hairs having spiked bases and serrated tips on the outer edge; the hairs also occur generally along the inner margin, and are frequently sheathed in mud and particles of all kinds. The third pair consists of three portions furnished with long branched hairs. The fourth pair has the large flat shield surrounded with branched hairs; next is a curved tapering portion with bristles having short spikes towards the tip; then come a series of flattened organs with truncate tips covered with spiked hairs. The fifth pair has three divisions—an inner irregular portion with hairs shortly branched on its free edge, a middle and somewhat club-shaped piece with rather stiff serrated hairs scantily spiked at the base, and a curiously curved and rather slender inner portion with about half a dozen finely serrated hairs on one side of its tip.

The hairs on the outer border of the chelæ are densely plumose; and hence it is exceedingly difficult to clean them from mud and sand for the cabinet.

Porcellana longicornis, L.; Bell, *op. cit.* p. 193.

As common as the former, in similar, though not muddy, situations. The embryos are found in the ova in August; and many young occur under stones in November and December.

Fam. **Lithodidæ.**

Genus LITHODES, Latr.

Lithodes maia, L.; Bell, *op. cit.* p. 165.

Not uncommon in deep water, whence it is brought by the fishing-boats.

Tribe *Brachyura.*

Fam. Leucosiadæ.

Genus Ebalia, Leach.

Ebalia tuberosa, Penn.; Bell, *op. cit.* p. 141.

Not uncommon in the stomachs of cod, and occasionally from deep water.

Ebalia Cranchii, Leach; Bell, *op. cit.* p. 148.

Occasionally in the stomach of the haddock.

Fam. Maiidæ.

Genus Inachus, Fab.

Inachus dorsettensis, Penn.; Bell, *op. cit.* p. 13.

Not uncommon in the stomach of the cod.

Inachus dorhynchus, Leach; Bell, *op. cit.* p. 16.

Occasionally under stones near low-water mark. In the stomach of one were fragments of *Ulva*, and in another the débris of a large sessile-eyed crustacean. The hairs on this species are shaped like the horn of the chamois; and some have a slight enlargement at the base.

Genus Hyas, Leach.

Hyas araneus, L.; Bell, *op. cit.* p. 31.

Abundant under ledges in rock-pools, cast ashore on the West Sands after storms, in the crab-pots, and in the stomach of the cod.

This species has eight branchial processes on each side—four lateral, two anterior, and one to each of the first two pairs of foot-jaws. Their structure resembles that described in *Carcinus mœnas.* The ova apparently of a small leech (*Pontobdella*) are often found attached to the walls of the branchial chamber.

The number and variety of parasitic growths, both vegetable and animal, on the carapace of this form are remarkable. *Balani* of two species cover the back almost with a continuous rugose pile, adhering to the limbs, the abdomen, the foot-jaws, or each other. Coils of *Serpulæ* and hard sandy tubes of *Sabellaria* interlace with these and fill up the depressions, and with the former occur on the tip of the abdomen as well as on less mobile situations. Fine tufts of *Sertularia pumila* and *Crisia eburnea* adorn the surface of the carapace in others or the parasitic algæ thereon; while *Halichondria panicea* forms a thick rugged crust, from which *Balani*, *Serpulæ*, *Anomiæ*, zoophytes, and seaweeds emerge. Even the sockets of the eyes are invaded by the sponge. Moreover young examples are not unfrequently clothed with thick tufts of *Obelia geniculata*. It would appear that it is not always on attaining full growth that moulting ceases for considerable intervals, since small specimens are found as completely covered with parasitic growths. In the rock-pools the carapace often forms a moving forest of seaweeds; and in such specimens the shell is frequently fragile, so that the extraneous covering may be of use for protection, or else had grown with unusual rapidity, even before the carapace became fully consolidated.

One old example had the internal antennæ quite fixed by a hard sand-tube of *Sabellaria*; and the young of the common mussel are occasionally found in the cavities for the eyes.

In the young females the genital apertures are small, and the abdomen less developed; while in the adult the latter becomes hypertrophied, hollowed out on its ventral surface by the bending downwards of the outer edges, and touches the bases of the legs on each side.

Hyas coarctatus, Leach; Bell, *op. cit.* p. 35.

Common in deep water, and procured in hundreds amongst the coralline débris in the fishing-boats; frequent in the stomachs of cod, haddock, and flounders.

Fam. **Leptopodiadæ.**

Genus Stenorhynchus, Lam.

Stenorhynchus rostratus, L.; Bell, *op. cit.* p. 2 (as *S. phalangium*).

Abundant in the coralline region, in the stomachs of cod and haddock, and occasionally under stones at low water. Fragments of sessile-eyed Crustacea and sand occurred in the stomachs of those examined. Males greatly preponderate.

Fam. **Parthenopidæ.**

Genus Eurynome, Leach.

Eurynome aspera, Penn.; Bell, *op. cit.* p. 46.

A few specimens were procured from the coralline ground. Rare.

Fam. **Canceridæ.**

Genus Cancer, L.

Cancer pagurus, L.; Bell, *op. cit.* p. 59.

Abundant all round the rocky border in the laminarian region, and frequent between tide-marks. In the stomach of this species are many curious parasites, such as *Tetrarhynchus* and *Echinorhynchus*, probably derived from its food. Sections of the carapace show internally tubular processes, apparently connected with the hairs.

Genus Pirimela, Leach.

Pirimela denticulata, Mont.; Bell, *op. cit.* p. 72.

Occasionally from deep water. Rare.

Fam. **Portunidæ.**

Genus Portunus, Leach.

Portunus depurator, L.; Bell, *op. cit.* p. 101.

Dredged occasionally off the West Rocks on a sandy bottom, cast ashore by storms, or found in the stomach of the cod.

Portunus marmoreus, Leach; Bell, *op. cit.* p. 105.

On the West Sands after storms. Rather rare.

Portunus holsatus, Fab.; Bell, *op. cit.* p. 109.

Not uncommon in the stomachs of cod and haddock. *Sacculina* occurs on this species occasionally.

Portunus pusillus, Leach; Bell, *op. cit.* p. 112.

Occasionally from deep water, and rather common in the stomachs of the haddock and flounder.

Genus Portumnus, Leach.

Portumnus variegatus, Leach; Bell, *op. cit.* p. 85.

Abundant on the sandy ground off the West Sands.

Genus Carcinus, Leach.

Carcinus mænas, L.; Bell, *op. cit.* p. 76.

Everywhere abundant between tide-marks and in the laminarian region. Occasionally used as bait. Swarms in the zoëa-stage occur in autumn at the surface of the water in the bay; they are almost invisible with the exception of the greenish-blue eyes.

This crustacean has nine branchiæ:—the first rudimentary, and attached to the horizontal portion of the first pair of foot-jaws; the succeeding, rather long and delicate organs, fixed to the second pair of foot-jaws on opposite sides of the horizontal portion; while six are attached to the body of the animal, four being prominent, as in allied forms. The flabellum of the first pair passes between the four prominent and larger branchiæ and the apodematous region, so as to sweep their inner surface; while the same organ of the second pair goes between the same portion of the shell and the fifth and sixth branchiæ (counting from behind), and may also affect the exposed surface of the seventh, which lies in the groove anteriorly. The long and finely curved flabellum of the third pair of foot-jaws curves externally, so as to brush all the seven. The great development of this organ, its central calcareous bow, and long hairs are thus explained. The branchial laminæ are arranged with their edges to the afferent current, which crosses the organs at right angles to their long axes, and so impinges between the plates. The action of the broad shield of the fourth pair of foot-jaws, again, affects the ingoing stream, and plays upon the large flat surface at the base of the flabellum of the third pair. It would tend thus to spread out the long hairs of the latter, and direct the current upwards over the branchial laminæ. The fifth pair as a whole would seem to be connected with the buccal rather than the respiratory apparatus; for the curiously twisted portion (*c*, fig. 6, Trans. Linn. Soc. vol. xxiv. p. 88) is nicely adapted to the deep anterior notch of the mandible, while the curved portion (*a*) enters the mouth above the chitinous tissue filling up the posterior notch of the mandible. The tuft of long hairs (*e*, *loc. cit.*), however, may render some assistance to the branchial portion of the fourth pair of foot-jaws in contact with it.

The appendage of the mandible (*a*, fig. 7, *op. cit.*) seems to have a considerable influence in the prehension and direction of the food between the maxillæ; it has lateral motion as well as flexion and extension. The flexible process filling up the gap in the underpart of the maxilla, and connected with the lip beneath the latter, would seem to prevent the escape of particles in biting and deglutition. It is attached to a firm horny basis, which has free horizontal, but little or no vertical motion, except when greatly extended.

In females bearing eggs the muscles on the external or under surface of the intestinal tract greatly increase in size at the junction of the abdomen with the cephalothorax. In males and females without ova the exterior of the gut is sparingly supplied with such tissue.

This crab affords a good example of the "commensalisme" of Prof. van Beneden. *Nemertes carcinophila* abounds on the hairs bearing ova; and the young of the common mussel and other adventitious growths are common, besides *Sacculina*; Trematode larvæ in the liver and other parts. Various abnormalities from injury also occur. The colours of the males are often remarkably bright, both on the upper and under surfaces of the carapace.

Fam. **Corystidæ.**

Genus Atelecyclus, Leach.

Atelecyclus septemdentatus, Mont.; Bell, *op. cit.* p. 153.

Frequent in the stomachs of cod.

Genus Corystes, Latreille.

Corystes cassivelaunus, Penn.; Bell, *op. cit.* p. 159.

Common on the West Sands after severe storms.

Fam. **Pinnotheridæ.**

Genus Pinnotheres, Latreille.

Pinnotheres pisum, L.; Bell, *op. cit.* p. 121.

Frequent in *Mytilus modiolus*.

[To be continued.]

XLI.—*Description of a remarkable kind of Air-bladder.* By Dr. Albert Günther, F.R.S.

[Plate XVIII.]

Among the specimens of mollusks purchased by the Trustees of the British Museum from the Collection of the late Dr. van Lidth de Jeude there was a preparation, which, on closer inspection, proved to be the air-bladder of a fish. Although there was no indication as regards its origin, I have no doubt that the species from which it had been taken belonged to the Sciænidæ, a family distinguished by the singular structure of that organ. In some degree the present specimen resembles the complicated air-bladder of *Collichthys lucida* (see Catal. Fish. ii. p. 313); but its ramifications are shorter, and do not envelope the abdominal viscera.

The organ as a whole is lanceolate, leaf-shaped, thickest along the middle, and gradually becoming very thin towards the margins. Its greatest length is $5\frac{1}{2}$ inches, and its greatest width 2 inches. In the collapsed state its thickness in the middle is about 3 lines, and may have been about 5 lines when expanded by air. On its visceral surface we distinguish the body of the organ, with a smooth, polished, pearl-white surface; it is elongate, only 7 lines wide in the middle, with its anterior extremity rounded, and with the posterior tapering into a very fine tube. The membrane is thick and stiff, and can be readily divided transversely into strips, each of which corresponds to one of the lateral branches. The body emits on each side fifty-two branches or tubes, communicating by a small opening with the cavity of the body of the air-bladder, and split into secondary and tertiary smaller branches running towards the margins of the organ. All these branches, as seen on the visceral surface, are connected by a cellular tissue, which can be easily severed with the point of a needle. On the dorsal surface nothing is visible of the main branches, but only the fine terminations of the secondary and tertiary branches appear, the whole resembling a thick network of fine fibres, of which the central ones are short, running in a backward direction, whilst the lateral are longer and diverge towards the margins.

Such is the general appearance of the air-bladder on its visceral and dorsal surfaces. However, to understand the ramification of the branches, it is necessary to isolate one or several by dissection. It is then seen that each branch forms a kind of lamina, its ramifications lying in the same plane, and being connected with one another in the same manner as the branches themselves. Each branch bifurcates immediately after its egress from the body into a visceral and dorsal stem. The visceral stem bifurcates twice or thrice again; and its terminal tubes are the longest, reaching the margin of the organ. The dorsal stem is bent over towards the median line of the dorsal surface of the organ, and emits a number of bifurcating branchlets, which are the shorter and thinner the nearer they are to the median line; and their terminations are seen in the middle part of the dorsal surface, as described above.

EXPLANATION OF PLATE XVIII.

Fig. A. Visceral surface.
Fig. B. Dorsal surface.
Fig. C. An isolated branch: *a*, dorsal stem; *b*, visceral stem.

XLII.—*List of the Species of Feline Animals* (Felidæ). By Dr. J. E. Gray, F.R.S. &c.

It will perhaps facilitate the study of the species of Feline animals to give a list of the sixty species which are contained in the British Museum, and of the two or three well-established species that are not in the Collection, but which we hope soon to acquire.

The species of Cats in the accompanying list are in every case made out by the comparison of a series of specimens of each species, which has been carefully made; and they are arranged in the Museum side by side, so that any person can verify for himself the authority for the species, which is a very different thing from the comparison of figures or descriptions.

I do not undertake to demonstrate that every kind of cat in the list is a distinct species; but I consider that they are so as far as the specimens in our collection allow us to judge. If, however, other specimens should show that what I have regarded as species are only varieties, the variations will exist between two specimens put in the same division and probably placed next to each other. Thus I will not undertake to say that all the species of Ocelots are distinct and permanent species; but they are all arranged together, and it is the same with some other groups.

Since my revision of the Cats was published, Messrs. Blyth, Jerdon, Elliot, and others of the same school of naturalists have proposed to regard several of the specimens on which I had established species as only variations of other species. I have carefully reexamined all these specimens, and compared the animals and their skulls. The naturalists above referred to seem to have overlooked the characters afforded by the latter, and I have not generally found their observations well founded.

The synonymy of the Cats is exceedingly confused; indeed it would look as if several authors had made their synonyma entirely from memory, without the comparison of specimens. The figures in Geoffroy St.-Hilaire and Cuvier's 'Histoire Naturelle des Mammifères' are generally very good, except in the tail being frequently made too long for the animal—as I have observed on a former occasion, longer than it is said to be in the descriptions that accompany the plates, as *Felis chaus* for example, where the length of the tail makes the figure more resemble the steppe-cat of Bokhara (*Chaus caudatus*) than the common jungle-cat of India, which it is named on the plate.

As an instance of inaccuracy in quotation one may cite the

"Chat de Nepaul" (*Felis torquata*) of F. Cuvier—which is said by Blyth and Jerdon to be the same as my *Felis ornata* figured in the 'Indian Zoology,' the spotted wild cat of Jerdon. Two species cannot be more unlike, the one being a cat with round spots, and the other a cat with cross bands, evidently the same as *Felis nipalensis* of Vigors and Horsfield, believed to be a hybrid between the domestic cat and some Indian wild cat. Indeed the way in which some Indian zoologists quote the figures of Geoffroy St.-Hilaire and Cuvier's 'Hist. Nat. des Mammifères' makes me very doubtful if they have the book to consult.

Most of the species cited are described in the 'Catalogue of Carnivorous Mammalia in the British Museum,' in which the skulls of many species are figured. The habitats are those attached to the specimens in the British Museum, and they give the distribution of the species from the actual comparison of specimens; sometimes, however, as in the case of Malacca, the habitat given may be only the port from which the specimen was shipped.

I. Cats. *Ears rounded, not ending in a pencil of hairs; legs moderate; tail more or less elongate.*

A. *Cheeks without any streak radiating from the back edge of the eye.*

1. Leo.

1. *Leo nobilis.* Africa; Persia; Guzerat. B.M.

2. Uncia.

2. *Uncia irbis.* Thibet. B.M.

3. Leopardus.

3. *Leopardus pardus.* India, Nepal; Senegal. B.M.
4. *L. japonensis.* Japan.
5. *L. chinensis* (*Felis Fontanierii*, M.-Edw.?). China. B.M.
6. *L. onca*, var. (*L. Hernandesii*, Gray, P. Z. S. 1857, p. 278, t. lviii., 1867, p. 402). South America. B.M.

4. Serval.

7. *Serval capensis.* North, West, and South Africa. B.M.
8. *S. rutila* (*Felis aurata*, Elliot). Senegal, Sierra Leone. B.M.
9. *S. neglecta.* Gambia. B.M.
10. *S. servalina.* Sierra Leone, Senegal. B.M.

Mr. Elliot regards *Felis rutila*, *F. neglecta*, and *F. celido-*

gaster all as the same species; but I do not think that the typical specimens in the Museum on which the species were founded sanction this theory.

5. Puma, Baird, Mamm. N. Amer. t. lxxi. & lxxiv.

11. *Puma concolor.* North America. B.M.
12. *P. jaguarondi.* Brazil, Buenos Ayres, Columbia, and Guatemala. B.M.
13. *P. eyra.* Bolivia. B.M.
14. *P. badia*, Gray, P. Z. S. 1874, t. Borneo. B.M.

B. *Cheeks with one narrow streak from the hinder angle of the eye.*

6. Pajeros, Wiegm. Archiv, 1873, t. iii. (skull).

15. *Pajeros pampanus* (*Felis passerum*, Sclater). Chili and Santa Cruz. B.M.

C. *Cheeks with two dark streaks radiating from the back of the eye.*

a. *Orbits complete; head elongate.*

7. Viverriceps, Ann. & Mag. Nat. Hist. 1874, xiv. p. 93.

16. *Viverriceps Bennettii* (*Felis himalayana*, Jardine, not Gray). Nepal, Madras, Shanghai, Malacca. B.M.
17. *V. Ellioti.* Nepal. B.M.
18. *V. rubiginosa.* Ceylon, Nellore, Malacca. B.M.

8. Ælurina, Gervais; Gray, Ann. & Mag. Nat. Hist. 1874, xiv. p. 93.

19. *Ælurina planiceps.* Sumatra, Borneo, Malacca. B.M.

b. *Orbits incomplete; skull oblong, nose rather produced.*

9. Tigris.

20. *Tigris regalis.* India, China, Mantchuria, Borneo. B.M.

10. Neofelis.

21. *Neofelis macroscelis.* India, Assam, Sumatra. B.M.
22. *N. brachyura*, P. Z. S. 1862, t. xliii. Formosa. B.M.

11. Catolynx, Blainv. Ostéogr. t. ix. (skull).

23. *Catolynx marmoratus.* Borneo, Malacca. B.M.
24. *C. Charltoni.* Nepal. B.M.

12. Pyrofelis.

25. *Pyrofelis Temminckii* (*Felis aurata*, P.Z.S. 1867, t. xxxvi.). Sumatra, Nepal. B.M.

13. Pardalina.

26. *Pardalina Warwickii* (*Felis guigna*, Molina, Wiegm. Archiv, 1873, t. ii.; *Felis Geoffroyi*, D'Orbigny, t. xxiii. & xxiv.). Paraguay, Chili. B.M.

14. Felis.

a. *Moderate-sized spotted South-American Cats.*

* *Head large; spots in lines, seldom confluent.*

27. *Felis pardalis.* South America, Guatemala. B.M.
28. *F. grisea.* Guatemala. B.M.
29. *F. melanura.* South America. B.M.
30. *F. picta.* South America. B.M.
31. *F. pardoides.* Tropical America. B.M.

** *Head large; spots scattered.*

32. *F. tigrina.* Tropical America. B.M.

*** *Head small; spots in roses, scattered.*

33. *F. pardinoides* (*F. punctulata*, Henkel; *F. Geoffroyi*, var., Elliot). Bogota. B.M.

**** *Head small; spots in lines, rarely confluent; tail elongate.*

34. *F. macroura.* Brazil, Paraguay, Veragua. B.M.

b. *Small South-American Cats with cross bands and annulated tails.*

35. *F. colocolo*, Wiegm. Archiv, 1870, t. i. & iii. Santiago.

c. *Small-sized spotted Asiatic Cats.*

* *Tail short.*

36. *F. chinensis*, Ann. & Mag. Nat. Hist. 1874, xiii. p. 53. China. B.M.
37. *F. euptilura*, P. Z. S. 1871, t. lxxvi. Siberia?, Shanghai. B.M.
38. *F. javensis.* Java. B.M.
39. *F. Jerdoni* (*F. rubiginosa*, var., Elliot). Sumatra. B.M.

40. *F. minuta.* Sumatra. B.M.
41. *F. Herschelii.* India? B.M.

** *Tail elongate.*

42. *F. wagati.* Moulmain. B.M.
43. *F. pardochroa.* Nepal, Borneo? B.M.
44. *F. tenasserimensis.* Tenasserim. B.M.
45. *F. nipalensis.* Nepal. B.M.

d. *Small-sized clouded Asiatic Cats.*

46. *F. domestica*, var. *tricolor* (*F. colocolo*, F. Cuvier & H. Smith, not Molina). Domestic. B.M.
47. *F. inconspicua.* Nepal. B.M.

e. *Small cross-striped Asiatic Cats.*

48. *F. manul.* Nepal, Kirgesen. B.M.

f. *Small clouded and marbled African Cats.*

49. *F. caligata.* Africa, North, South, and East, Madagascar; Jericho. B.M.

g. *Small clouded European Cats.*

50. *F. catus.* Germany, Scotland. B.M.

II. Lynxes. *Ears ending in a pencil of hairs; legs elongate; tail generally short.*

15. Chaus.

51. *Chaus ornatus* (*Felis torquata*, Jerdon, not F. Cuvier). India. B.M.
52. *C. Jacquemontii* (*Felis chaus*, Jerdon). India, Nepal. B.M.
53. *C. caudatus*, P. Z. S. 1874, t. vi. & vii. Turkestan. B.M.
54. *C. catolynx.* Nepal. B.M.

16. Lyncus.

* *Soles of feet overgrown with hair; animal large.*

55. *Lyncus borealis.* Sweden. B.M.
56. *L. lupulinus.* Sweden. B.M.
57. *L. canadensis.* Canada, Fort Colville, Kamtschatka. B.M.

** Cervaria. *Soles of feet nakedish; animal smaller.*

58. *L. pardinus.* Spain, Sardinia. B.M.
59. *L. isabellinus.* Thibet. B.M.

60. *L. rufus.* Charlton, U. S., California, Canada. B.M.
61. *L. maculatus.* Mexico, New Orleans. B.M.

17. Caracal.

62. *Caracal melanotis.* South, Western, and Eastern Africa. B.M.

XLIII.—*A List of Butterflies, with Descriptions of new Species, from the Andaman Islands.* By W. C. Hewitson, F.L.S.

The kindness of Mr. Higgins has enabled me to give the following list of butterflies, and to add the new species to my collection. They were sent to him by Captain Wimberley, and are in excellent condition.

Papilio Charicles, n. sp.
—— Mayo. A very distinct and beautiful species, figured and described by Mr. W. S. Atkinson in the 'Proc. Zool. Soc.' for 1873.
—— Eurypilus.
—— Agamemnon.
—— Pammon.
—— Antiphates.
—— Coon, var. Doubledayi.
Pieris Nadina.
Hebomoia Glaucippe.
Eronia Valeria.
Callidryas Chryseis.
—— Crocale.
—— Pomona.
Terias Hecabe.
—— Harina.
Thestias Pyrene.
Euplœa andamanensis. Figured by Mr. Atkinson on the same plate as *P. Mayo.*
Danais Aglea.
Hestia Agamarschana. All the examples in this collection are much darker than Felder's figure.
Cynthia Deione.
Messaras Erymanthis.
Atella Alcippe.
Cirrhochroa Tyche.
Cethosia Biblis. There is a very interesting female variety of this species, with a large white spot on the anterior wing; the posterior cream-colour.
Vanessa cardui.
Junonia Œnone.
Cyrestis Cocles. For delicacy of colour these are some of the most beautiful things I have ever seen.
Neptis aceris.
—— Pampanga.
—— Cnacalis, n. sp.
Diadema Bolina.
Adolias Teuta.
—— Acontius, n. sp.
—— Cibaritis, n. sp.
Minetra Sylvia.
Kallima Philarchus.
Doleschallia Bisaltide.
Amathusia Phidippus.
Discophora Ogina.
Cyllo Leda.
Melanitis Cottonis, n. sp.
Eurytela Horsfieldii.
Mycalesis Samba.
Amblypodia Amytis.
Aphnæus Lohita.
Loxura Atymnus.
Anops Thetis.
Lycæna Elpis.
Ismene Chromus.

Papilio Charicles.

Upperside. *Female* dark brown. Anterior wing semitransparent, brown-white, palest below the median nervure: the margins, the base (which is marked by a triangular carmine spot), longitudinal rays in the cell, the nervures, and lines between them dark brown. Posterior wing marked before the middle by five white spots—one (the largest) in the cell, one between it and the costal margin, two between it and the inner margin, and one (the fifth) below the cell: the inner margin, which is marked by a black spot, and a series of six spots on the outer margin all dull carmine: the outer margin dentate, deeply sinuated between the nervures; the tail spatulate, its outer half white, tinted with carmine.

Underside as above, except that the posterior wing has four red spots at the base and seven white spots before the middle.

Exp. 5 inches.

This singular species, although reminding one at first sight of *P. Coon*, is so like *P. Memnon* (var. *Achates*, Cramer) that but for the long and narrow posterior wing it might easily be mistaken for that species.

Neptis Cnacalis.

Upperside dark brown. Anterior wing with the longitudinal spot from the base orange, unusually long, reaching considerably below the middle of the wing, unbroken: crossed beyond the middle by six spots of orange, the middle two spots minute, and outside of this by a narrow band of lilac-white. Posterior wing crossed before the middle by a broad band of white.

Underside. Anterior wing as above, except that the band and spots are much larger and rufous white, the apex grey-white, and that there are some grey spots near the costal margin. Posterior wing with the base brown, undulated with grey: below the band lilac-grey, traversed by two bands of brown; the outer margin brown.

Exp. $1\frac{1}{20}$ inch.

On the underside this species resembles *N. Hordonia*; its anterior wing is unusually prolonged at the apex.

Adolias Acontius.

Upperside. *Female* dark rufous brown. Anterior wing with the usual spots in the cell: crossed from the middle of the costal margin to a little beyond the first median nervule (towards the anal angle) by a band (broader as it proceeds) of seven white spots—the first minute, the last, which is below the median nervule, small: a band of three spots, commencing nearer the apex, joins the band just described at its fourth spot: crossed towards the outer margin by a series of black pyramidal spots, bordered inwardly (between them and the white band) by lilac; the last black spot near the anal angle bordered on both sides with lilac. Posterior wing crossed beyond the middle by a broad lilac band, irrorated with white and bordered outwardly by a series of lunular black spots, which have below them hastate lilac spots.

Underside lilac-white. Anterior wing with the bands as above, bordered by pale ochreous brown. Posterior wing with five subbasal spots, bordered with black; the transverse band indistinct, except near the costal margin, where it has a rufous border on both sides.

Exp. $3\frac{1}{10}$ inches.

Adolias Cibaritis.

Upperside. *Female* dark rufous brown. Both wings with the usual spots in and below the cell: both crossed beyond the middle, from the costal margin of the anterior wing to the anal angle of the posterior wing, by a broad band of white divided by the nervures, sinuated deeply on its inner margin at its fourth spot, bordered outwardly by a series of hastate black spots crowned with lilac. Anterior wing with a small white spot between the band and the apex.

Underside pale green. Both wings with the bands and spots as above, bordered inwardly with black.

Male like the female, except that the white band of the posterior wing is narrower, and on the underside bordered on both sides with black spots.

Exp. ♂ $2\frac{17}{20}$, ♀ $3\frac{1}{2}$ inches.

This is the largest known species of the *Trigerta* group, to which it belongs.

Melanitis Cottonis.

Upperside. *Male* dark red-brown. Both wings with the outer margins rufous. Anterior wing with the costal margin lilac-blue.

Underside as above, undulate with grey, the outer margins broadly undulate with grey and brown. Anterior wing with a large triangular grey spot, undulate with brown near the apex. Posterior wing with a white spot near the middle of the costal margin.

Female like the male, except that it is much larger and paler, and that the anterior wing has on its upperside some grey spots on the costal margin.

Exp. ♂ $2\frac{1}{2}$, ♀ $3\frac{1}{10}$ inches.

I prefer to consider this a distinct species rather than to place it as a variety of *M. undularis.* Both sexes are alike, are without spots, and have a broad rufous margin.

XLIV.—*Description of a Butterfly from Madagascar forming a new Genus, from the Collection of Henley Grose Smith and (by his benevolence) of W. C. Hewitson.* By W. C. Hewitson, F.L.S.

SMERINA, n. gen.

Body of moderate size, half the length of the posterior wing. Anterior wing produced at the apex, slightly sinuated on the outer margin. Posterior wing produced at the anal angle.

Head large. Eyes hairy. Palpi large, *spatulate*, twice as long as the head, covered with hair, the last joint minute. Antennæ long, distinctly clubbed.

Anterior wing with the costal nervure half the length of the wing: subcostal with four branches—two before the end of the cell, *two near together* halfway between the end of the cell and the apex: the cell two fifths the length of the wing, closed in a regular curve; the first discocellular nervure minute, the second and third of equal length.

Posterior wing with the cell short, scarcely a third the length of the wing, closed obliquely.

Fore legs (male) of moderate length, the femur, tibia, and tarsus (which is covered with long hair) of equal length.

Four hind legs very long: the femur (which is covered with hair) and the tibia of equal length; the tarsus longer, covered beneath with spines.

Smerina Vindonissa.

Upperside. *Female* ferruginous. Anterior wing with two linear spots in the cell and one at the end of the cell, a large spot from the costal margin beyond its middle, the costal margin, the apex, and outer margin (where it is broad), and three spots near its inner border, all dark brown. Posterior wing crossed beyond the middle by a series of four or five black spots, and by two submarginal undulate bands of the same colour: the outer margin dark brown.

Underside pale brown. Both wings crossed from the costal margin of the anterior wing, beyond its middle, to the anal angle of the posterior wing by a common narrow dark-brown band, bordered outwardly with silver-lilac: both wings crossed beyond this by a series of brown spots and by two submarginal indistinct bands of the same colour. Anterior wing with two silver spots within the cell: a black line on each side of the discocellular nervures, and a band from the middle of the costal margin, which joins the central band and encloses a pale glossy pink spot: three small apical spots and one near the anal angle silver. Posterior wing with a series of linear spots above the central band: irrorated with silver at the anal angle.

Male like the female, except that it is brick-red on the underside.

Exp. ♂ $2\frac{1}{20}$, ♀ $2\frac{4}{10}$ inches.

Hab. Madagascar (*Crossley*).

In colour and form this species resembles *Atella Sinha*, but without the tail.

XLV.—*On a Collection of Hemiptera Heteroptera from Japan. Descriptions of various new Genera and Species.* By John Scott.

[Continued from p. 304.]

Family **Urostylidæ.**

Genus Urostylis, Westwood.

Urostylis striicornis.

Testaceous or drab, black-punctured. *Antennæ* yellow; first joint with a fuscous streak exteriorly; third entirely, and apical half of the fourth and fifth black. *Membrane* pale, with four dark fuscous streaks between the nerves, extending from the base to the apex.

Head testaceous or drab, unpunctured. *Antennæ* yellow; first joint exteriorly with a fuscous streak, becoming paler towards the apex; third entirely, and apical half of the fourth and fifth black. *Rostrum* yellow; apex black.

Thorax.—*Pronotum* testaceous or drab, very sparingly clothed with fine, erect, pale hairs; lateral margins narrow, paler than the disk, the latter irregularly black-punctured. *Scutellum* irregularly black-punctured. *Elytra* testaceous or drab. *Clavus* with two rows of black punctures, viz. one along the scutellar margin, the other along the inner margin of the nerve; between the latter and the suture frequently three or four black punctures. *Corium* with a row of black punctures next the claval suture; disk irregularly black-punctured, more sparingly than on the pronotum. *Membrane* pale; base between the second exterior and the inner nerve broadly fuscous, the four spaces between the third exterior and inner nerve fuscous. *Sternum* yellow or drab. *Legs* yellow or drab: *tibiæ*, knees of all the pairs black.

Abdomen entirely yellow or drab; last genital segment of the male, when viewed from behind, with an external spoon-shaped process.

Length $5\frac{3}{4}$–6 lines.

Dr. Stål, who has seen this insect, says it is allied to his *U. flavomaculatus*, with which I have no means of comparing it. But as several of the species of this genus are so similar in colour and puncturing as to be scarcely distinguished from each other in life, setting aside description, I was for some time puzzled how to get over the difficulty, until it at last struck me to examine the genital segments of the male, in which evidently the easiest mode of separation lies, as may be judged from the three species now described.

I have only seen two male examples of this species.

Urostylis annulicornis.

Yellowish or somewhat ochreous, black-punctured, sparingly clothed with short, erect, fine pale hairs. *Antennæ* yellow; third joint entirely, and apical half of the fourth and fifth black. *Membrane* pale, with the inner margin and four streaks between the nerves, extending from the base to the apex, fuscous.

Head yellow, unpunctured. *Antennæ* as in *U. striicornis*, except the fuscous streak on the first joint. *Rostrum* yellow, apex black.

Thorax.—Pronotum yellowish or somewhat ochreous, irregularly black-punctured, the punctures somewhat more thickly disposed than in *U. striicornis*, and finest next the anterior margin. *Scutellum* and *elytra* yellowish or somewhat ochreous, irregularly black-punctured, the puncturing similar to *U. striicornis*. *Membrane* pale; base between the two exterior and inner nerve fuscous; inner margin and the four spaces between the third exterior and the inner nerve fuscous, generally the two outer darkest. *Sternum* yellowish white, unpunctured. *Legs* yellow: *thighs* darker than the *tibiæ*; knees of all the pairs black.

Abdomen entirely yellow; posterior margin of the last genital segment above thickly clothed with long pale hairs; external process, viewed from behind, broad, flat, slightly dilated at the apex.

Length $5\frac{1}{2}$–$5\frac{3}{4}$ lines.

Very similar to *U. striicornis*; but the difference in the process attached to the last genital segment will at once determine the species.

There are two males and one female example which I can with certainty refer to the above.

Urostylis Westwoodii.

In colour similar to both the preceding, but not so thickly punctured. *Antennæ*, ♂, yellow or red; first joint at the base exteriorly with a small fuscous black spot; second very narrowly black at the base; third entirely, and apical half of the fourth and fifth black. *Membrane* pale, with a short piceous or fuscous dash on the inner nerve at the base; between the first and second exterior nerves two piceous or fuscous streaks, that at the base triangular, the other next the apex linear, and, in the two spaces between the second and fourth near the base, an inverted, somewhat clavate fuscous streak.

Head yellow or ochreous, sometimes with a slight orange tinge, unpunctured. *Antennæ* yellow or red; first joint at the base exteriorly with a small fuscous-black spot; second at the base very narrowly black; third, except a very narrow ring at the base, and apical half of the fourth and fifth black. *Rostrum* yellow, apex black.

Thorax.—*Pronotum* more sparingly punctured than in the two foregoing species; hinder angles, within the margin, fuscous or brown. *Scutellum* punctured similar to both the foregoing species. *Elytra*: *corium*-disk between the exterior nerve and the claval suture very sparingly black-punctured posteriorly. *Membrane* pale, with a short piceous or fuscous dash on the inner nerve at the base, another somewhat triangular between the first and second exterior nerves, and three others in the spaces between the first and fourth nerves. *Sternum* yellow, unpunctured. *Legs* yellow or red; *tibiæ*, knees black: *tarsi* yellow or red; apex of the first and third joints brown.

Abdomen yellow; spiracles black; process attached to the last genital segment aculeate and clothed with short, fine pale hairs.

Length, ♂ $4\frac{3}{4}$, ♀ 6 lines.

Easily distinguished from either of the foregoing species by the narrow black base to the second joint of the antennæ, the black spiracles, and the different shape of the process attached to the last genital segment.

There are four specimens in the collection, viz. two males and two females.

Family **Homœoceridæ.**

Genus Homœocerus, Burm.

Homœocerus striicornis.

Dusky ochreous; thickly and finely punctured. *Antennæ* red; first and second joints exteriorly with a longitudinal black line. *Elytra* with a slight reddish tinge.

Head yellow, next the base of the antennæ reddish. *Antennæ* red; first and second joints exteriorly with a longitudinal black line; apical joint pale yellow, apical half brown. *Eyes* dark brown. *Ocelli* clear red. *Rostrum* yellow; apex black.

Thorax.—*Pronotum* ochreous, shining, crenulate, punctate; lateral margins with a fine black line; posterior angles faintly and finely black-punctured. *Scutellum* ochreous, unpunctured, finely wrinkled transversely. *Elytra* pale brown or brownish yellow, with a slight reddish tinge, irregularly distributed and more or less distinct in different individuals. *Clavus* finely punctured, yellowish or brownish yellow; base ochreous; scutellar margin black. *Corium* pale brown or brownish yellow, thickly and finely punctured; anterior margin pale brownish yellow; base ochreous, between the margin and the first nerve black; first nerve frequently clear yellow; apex red or reddish. *Membrane* fuscous. *Sternum* yellow, middle whitish. *Legs* ochreous.

Abdomen above ochreous, slightly sordid, with a red blotch on the sides of each segment; fifth segment with a dark red-brown longitudinal line at the margin; sixth with a black 7-shaped patch; beneath ochreous or ochreous white, down the middle more or less broadly whitish; second segment, in a line with the coxæ of the third pair of legs are three punctures placed triangularly, the apex pointing to the centre of the base; third with three punctures placed triangularly; the apex inverted. *Connexivum* above dusky ochreous.

Length 9–10 lines.

Family **Anisoscelidæ**.

Genus Plinachtus, Stål.

Plinachtus bicoloripes.

Brown, thickly and finely black-punctured, producing a dull chestnut-brown hue. *Thighs* yellow at the base, apex brown.

Head.—*Antennæ* dark brown, thickly and finely granulated, except the last joint, which is pale brownish yellow. *Rostrum* black; first joint yellow; apex of the third brownish yellow.

Thorax.—*Pronotum*, lateral margins nearly black; down the centre a somewhat interrupted narrow brown line. *Scutellum*, apex narrowly black and transversely wrinkled. *Elytra* brown, thickly and finely black-punctured: *corium*, nerves clear and unpunctured; anterior margin, from the base to about the middle, narrowly yellow. *Membrane* fuscous, nerves somewhat darker. *Sternum* yellow, clear-punctured. *Legs* yellow: *thighs*, apical third brown or red-brown, internally black: *tibiæ* brown or red-brown: *tarsi* red-brown, apical joint and *claws* pitchy black.

Abdomen above orange-red, beneath yellow, with a black spot on each segment along the sides, *except* the third. *Connexivum* above clear ochreous; apical half of each segment black, beneath yellow, with a black spot next the apex of the outer margin.

Length $6\frac{1}{2}$ lines.

Family **Coreidæ.**

Subfamily *Alydina*, Stål.

Genus Paraplesius*.

Linear.

Head horizontal: *face*, central lobe narrow, depressed before reaching the apex, where it curves down, leaving the side lobes projecting with rounded obtuse extremities. *Antennæ*, first, second, and third joints subequal, fourth longest; first joint slightly thickened at the apex. *Eyes*, viewed from above, almost semicircular. *Rostrum* reaching to the base of the third pair of coxæ; first joint shorter than the head.

Thorax.—*Pronotum* slightly shorter than the head, widest across the posterior margin. *Scutellum* elongate, somewhat narrow. *Elytra*: *clavus* with a distinct flexible suture. *Membrane* multinervose, each nerve separate at the base and curved inwardly, except next the apex of the corium, where a small group diverge from a common centre. *Legs* somewhat long, without spines or teeth: *thighs*, all the pairs thickest at the apex: *tarsi*, first joint about one third longer than the second and third together.

Closely allied to *Micrelytra*, Lap., but easily separated from that genus by the shape of the head and the difference in the lengths of the joints of the antennæ.

Paraplesius unicolor.

Fulvous or grey-yellowish, thickly and delicately punctured.

Head above very finely and thickly punctured, here and there with a slight fuscous shade: *face*, from the base of the central lobe to in a line with the anterior margin of the eyes, a narrow black channel; base of the former with a minute black spot on each side. *Antennæ* grey-yellowish; first joint more or less distinctly black-punctured; second and third

* *παρὰ*, near; *πλησίος*, a neighbour.

narrowly black or piceous at the apex; fourth, basal third, except a narrow black ring at the base, yellow or yellowish white, apical two thirds black. *Eyes* reddish or chestnut. *Ocelli* red. *Rostrum* yellow, apex black, beneath finely punctured, with a longitudinal black central line, and a short one of the same colour on either side of it at the base.

Thorax.—Pronotum, lateral margins and the apical two thirds of the disk very delicately black-punctured; posterior angles elevated into a callus, which is piceous; down the centre a slightly elevated unpunctured yellowish line; at its termination before reaching the anterior margin two (sometimes four) minute black spots. *Scutellum* finely black-punctured. *Elytra* more coarsely and sparingly punctured than the previous portions: *clavus* with a row of fine, more or less black, punctures next the suture, and another along the inner margin; disk irregularly and very sparingly punctured: *corium*, first nerve on both sides and the inner nerve on the inside with a row of fine black punctures; disk more sparingly and coarsely punctured; apex, and generally the inner posterior angle, piceous or black. *Membrane* pale, between the nerves pale piceous. *Sternum* fulvous or grey-yellowish, punctured on the sides; the punctures sometimes blackish; down the centre broadly black. *Mesosternum* with a deep longitudinal channel, widest posteriorly; adjoining the base of the first and second pair of legs is a black spot. *Legs* fulvous or yellowish: *coxæ* anteriorly with a piceous spot at the base: *thighs* finely black-punctured, the punctures somewhat disposed in longitudinal rows; *tibiæ* sparingly and finely black-punctured; *tarsi* yellowish, apex of the first, second, and third joints black.

Abdomen above black, with a broad yellowish streak down the centre, widened at the posterior margin of each segment, so that on each segment the streak appears I-shaped; beneath fulvous or grey-yellowish, with a longitudinal black central line, and another on either side, composed of black punctures. *Connexivum* above yellow; posterior margin of the three or four terminal segments narrowly black.

Length 6–6$\frac{3}{4}$ lines.

[To be continued.]

XLVI.—*Descriptions of new Species of* Sesia *in the Collection of the British Museum.* By Arthur Gardiner Butler, F.L.S., F.Z.S., &c.

Sesia Grotei, n. sp.

Wings above hyaline, veins black; primaries with costa black; outer margin broadly chocolate-brown, broad on costa

(5 millimetres) and narrowing gradually to external angle ($1\frac{1}{2}$ millimetre), strongly dentated internally between the nervures, as in *S. fuscicaudis* (*Hæmorrhagia fuscicaudis* of Grote); a reddish diffused apical subcostal streak upon external border; interno-basal area dark chocolate-brown, clothed at the base with testaceous hair-scales; secondaries with the base and abdominal margins broadly dark chocolate-brown, the costa smoky brown; outer margin rather broadly bordered with dark chocolate-brown, denticulated internally: wings below nearly as above, but paler: head and thorax clothed above with sordid testaceous hair-scales; abdomen dark chocolate-brown, basal segments clothed with testaceous hair-scales; the two preanal segments yellow [the upper one slightly, the lower one distinctly brownish in the centre *]; anal tuft blackish; antennæ black; palpi above black, below pale sulphur-yellow; pectus pale sulphur-yellow; legs black; venter black; two preanal segments with a yellow tufted patch on each side.

Expanse of wings about 48 millimetres.

Hab. Texas (*Belfrage*). Type, B.M.

Allied to *S. axillaris*, Grote and Robinson, and *S. radians*, Walker.

Sesia alternata, n. sp.

Wings above hyaline, nervures black; primaries with costa and interno-basal area black, clothed with testaceous hair-scales; outer margin broadly chocolate-brown, twice as wide at costa as at external angle, strongly dentate-strigate internally, the dentes being even more developed than in *S. radians*; secondaries with costa greyish testaceous, yellowish at base; base and abdominal margin dark brown, varied with testaceous hair-scales; outer margin chocolate-brown (1 millimetre wide), an interno-median decreasing streak projected from anal margin: wings below with the brown borders redder than above; internal margin of primaries cream-coloured: head and thorax densely clothed with yellowish olivaceous hair-scales; eyes encircled with white: abdomen clothed with bright testaceous hair-scales, becoming yellowish tawny towards the middle; two central segments black-brown, with a sprinkling of tawny scales internally †; anal tuft tawny testaceous in the centre, blackish varied with testaceous at the sides; palpi above dark brown, below yellowish

* I think it possible that this may be due to staining; but it looks natural enough.

† In the type there is a dorsal brown streak; but as it disappears irregularly on the antepenultimate segment, I believe it is due to rubbing.

creamy; pectus, femora, and tibiæ yellowish cream-coloured, tarsi chocolate-brown; basal half of venter clothed with red-brown and whitish hair-scales, anal half with yellowish creamy scales; anal tuft brown.

Expanse of wings 50 millimetres.

Hab. Hakodadi (*Whitely*). Type, B.M.

Undoubtedly the Japanese representative of *S. radians*, from which, however, it is readily distinguished by its smaller size, paler and duller colouring, the absence of orange colouring on the secondaries, the testaceous scaling on costa and interno-basal area of primaries, the testaceous scales mixed with the brown scales at the sides of the anal tuft, and the cream-coloured femora and tibiæ below.

Sesia Whitelyi, n. sp.

♂. Wings above hyaline, with lilacine reflections, veins black; primaries with costa and interno-basal area black, clothed with sordid testaceous hair-scales; outer margin rather broadly dark chocolate-brown (4 millimetres at costa, $1\frac{1}{2}$ at external angle), undulated between the nervures internally; fringe brown, with a pale internal line; secondaries with costa, base, and inner margin grey; outer margin dark chocolate-brown (1 millimetre wide), an interno-median decreasing streak projected from anal margin: wings below with the base and costal margins pale ochraceous; outer margins red-brown, paler externally; inner margin of primaries cream-coloured, of secondaries dark brown; interno-median streak of secondaries dark brown: head above clothed with sordid testaceous hairs; thorax and abdomen clothed with stramineous hair-scales, inclining to tawny on collar, at base of pterygodes, on centre of thorax, and towards the centre and anal segments of abdomen; two central segments of abdomen blackish *; sides of anal tuft blackish brown; pectus and palpi below cream-coloured; legs dark brown, cream-coloured on their lower margins; venter dark brown, scattered all over with testaceous hair-scales, a central white spot on preanal segment; anal tuft dark brown, varied with dull creamy hair-scales.

Expanse of wings 49 millimetres.

♀. Larger and altogether more brightly coloured than the male.

Expanse of wings 60 millimetres.

Hab. Hakodadi, ♂ ♀ (*Stephens*); Japan, ♂ (*Fortune*). B.M.

Apparently the Japanese representative of *S. fuciformis*.

* There appears to be a blackish dorsal streak; but it may be due to rubbing.

XLVII.—*Descriptions of new Species of Fishes in the British Museum.* By Dr. Albert Günther, F.R.S. &c.

Crenidens macracanthus.

D. $\frac{12}{10}$. A. $\frac{3}{10}$. L. lat. 48. L. transv. 5/11.

Very similar in form to *C. Forskalii*; but with much stronger spines in the vertical fins, and with somewhat larger scales. Of the dorsal spines the fourth, fifth, and sixth are the longest, not much less than one half of the height of the body, and two thirds of the length of the head. The second anal spine exceedingly strong, as long as the head without snout. Incisors very broad, twelve in the upper as well as in the lower jaw*. Three series of scales on the cheek. Coloration uniform silvery.

Madras (Surgeon-Major F. Day). Length of specimen $6\frac{1}{3}$ inches.

Chelmo trochilus.

D. $\frac{11}{27}$. A. $\frac{3}{18}$. L. lat. 55.

Body as high as long, head and caudal fin excluded. The length of the snout is contained twice and one third in that of the head. Anterior part of the soft dorsal and anal produced into an acute point, the hind margins of these fins being vertical. Caudal fin truncated. Silvery; head and body with five black transverse bands: the first is the ocular band, much narrower than the orbit, extending from the nape to the interoperculum, above the eye it is edged with white; the second, rather broader than the first, runs from the three anterior dorsal spines over the operculum across the chest, in front of the ventrals; the third, twice as broad as the second, from the sixth, seventh, and eighth to the abdomen; the fourth between the pointed angles of the dorsal and anal; the fifth narrow, round the middle of the free portion of the tail. An indistinct and incomplete cross band between the first and second, and another between the second and third bands. Some irregular blackish spots in the interspaces. Hind margin of the dorsal and anal blackish. Caudal uniform reddish. Ventrals black, with yellowish spine.

Australia (purchased). Seven inches long.

* To judge from other Sparoid fishes, it is possible that also in this genus the width of the incisors changes with age, young examples having generally comparatively broader incisors.

Equula elongata.

D. $\frac{8}{16}$. A. $\frac{3}{14}$.

The height of the body is nearly one fifth of the total length (without caudal), the length of the head one fourth. Eye nearly as long as the snout and as the postorbital part of the head. A minute spine above the anterior margin of the orbit; præopercular margins not serrated. Caudal fin deeply emarginate. Upper half of the body greenish, irregularly marbled with darker; two brown spots at the root of the caudal. Lower half silvery.

North Celebes (Dr. A. B. Meyer). Length $2\frac{3}{4}$ inches.

RHAMPHOCOTTUS (g. n. Cottid.).

Head exceedingly large, compressed, with the snout produced into a short, narrow beak, the feeble lower jaw being received within the upper. Eyes lateral. Body small, compressed, covered with prickles. Two dorsal fins, of moderate height; pectorals with nearly all the rays simple. Ventrals thoracic, three-rayed. Jaws and vomer with villiform teeth; no teeth on the palate.

Rhamphocottus Richardsonii.

D. 6 | 13. A. 7. C. 11. P. 14. V. 3.

The head is as long as the body without caudal fin; it is nearly entirely covered with bone or rough hard skin. The narrow pointed snout is twice as long as the eye, the diameter of which is contained five times and a half in the length of the head. The upper surface of the head is narrow, concave, with a swollen edge on each side. Its armature consists of a pair of small spines on the snout, in front of the eye, of a small superciliary spine above the hind margin of the orbit, an obtuse occipital spine, a rather long spine at the angle of the præoperculum, and a scapulary spine.

The jaws are feeble, the lower fitting within the upper; the cleft of the mouth lateral, not extending to the front margin of the orbit.

The entire body is covered with prickles vertically projecting, and terminating in two or three minute hooklets.

Dorsal fins rather low, and the spines of the first very feeble; caudal rounded, of moderate length. Pectorals large, but not quite extending so far backwards as the ventrals, which reach beyond the anterior anal rays.

Light brownish, marbled with darker; several brown cross bands, edged with whitish on the crown of the head.

A single specimen, $2\frac{1}{2}$ inches long, and 11 lines high at the nape of the neck, from Fort Rupert, North America. Obtained by purchase.

Notothenia Veitchii.

D. 6 | 32. A. 28. L. lat. ca. 88.

The length of the head is contained three times and a half in the total (without caudal), the height of the body five times and one third. Head elongate, like the body, with the snout pointed, and rather longer than the eye, the diameter of which is two ninths of the length of the head. Lower jaw slightly projecting beyond the upper; maxillary reaching beyond the front margin of the orbit. Dorsal spines feeble. Upper parts densely marbled with dark brown, lower yellowish.

Several specimens, $3\frac{1}{2}$ inches long, were obtained in the Chonos Archipelago by one of the collectors of Harry Veitch, Esq., who presented them to the British Museum.

Agonostoma globiceps.

D. 4 | $\frac{1}{9}$. A. $\frac{3}{10}$. L. lat. 43. L. transv. 14.

The height of the body is contained thrice and three fourths in the total length (without caudal), the length of the head four times and a half. Snout very short, obtuse and rounded, once and a half as long as the small eye, the diameter of which is one fifth of the length of the head. Orbit surrounded by a narrow adipose eyelid. Forehead very broad and convex. The maxillary extends somewhat beyond the front margin of the eye. Upper jaw with a narrow band of fixed teeth; the lower with a broader band, which is interrupted in the middle; vomerine teeth forming a large triangular patch; palatine teeth in a narrow band. *Lower lip with trenchant margin.* The first dorsal spine strong, compressed, two thirds as long as the head; its root is midway between the end of the snout and the last anal ray. Caudal fin emarginate. Coloration uniform.

One specimen from Myzantla (Vera Cruz), $10\frac{1}{2}$ inches long. Purchased.

Fundulus Bermudæ.

D. 14. A. 12. L. lat. 35. L. transv. 13.

The height of the body is one fourth of the total length (without caudal), the length of the head rather less than two sevenths. Snout short, not longer than the eye, with the lower jaw ascending and projecting beyond the upper. The width of the interorbital space is contained twice and one third in the length of the head, the diameter of the eye four times. The origin of the dorsal fin is opposite to the sixteenth scale of the lateral line, and midway between the root of the caudal and the præopercular margin. The first anal ray corresponds to the fourth or fifth of the dorsal fin. Anal fin much higher than long. Brownish olive, with numerous dark greenish indistinct cross bands (in the male).

A single male specimen, 3 inches long, has been sent by J. Matthew Jones, Esq., from the Bermudas.

Mollienesia Jonesii.

D. 12. A. 10. L. lat. 29. L. transv. 9.

Female. The height of the body is two sevenths or one fourth of the total length (without caudal), the length of the head one fourth. The diameter of the eye is rather shorter than the snout, one fourth of the length of the head, and one half of the width of the interorbital space. The length of the dorsal fin is one fourth of the distance between the eye and root of the caudal; it is much longer than high. Anal fin small, opposite to the middle of the dorsal. Lateral line none. Brownish, each scale with a deep-black hind margin; a black band between the eye and scapula; a round black spot on the upper half of the root of the caudal. Dorsal fin with two or three series of black spots; anal with a black line behind and along each ray; the other fins immaculate.

This species was discovered by T. M. Rymer Jones, Esq., in a volcanic lake, Alcohuaca, near Huamantla, in Mexico, 8000 feet above the level of the sea. Several specimens were presented by him to the British Museum: all are females; and the largest exceeds somewhat the length of 3 inches.

XLVIII.—*Final Note on* Eozoon canadense. By William B. Carpenter, M.D., LL.D., F.R.S.

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

Gentlemen,

As it is obviously impossible to carry on any discussion without some common basis of agreement, and as Profs. King and Rowney have now made it clear that no such basis can exist between them and myself, it is not my intention to trouble you with any reply to their last Paper.

For (1) my opponents deduce, from their examination of a few specimens of a single Foraminiferal type, what they affirm to be "Foraminiferal impossibilities;" and (2) under the preconception thus formed they refuse to credit my statement of an objective fact, viz. the existence of an unmistakable "nummuline tubulation" in a specimen of *Eozoon* which they have not examined.

On the other hand (1) a study of *Foraminifera*, now prolonged over nearly thirty years, having convinced me (as a like study has convinced others) that to no group in the whole Animal Kingdom is Prof. Huxley's phrase "There is no end to the possibilities of Nature" more applicable, I cannot give up this conviction at the bidding of the Galway Professors. Many of the new types I have myself described would, according to their doctrine, have been *impossibilities* "from a Foraminiferal point of view" *; and I have many more in my possession (as yet undescribed) which are equally unconformable to any types previously known.

Again (2), being fully conscious of my own fallibility, I should be quite ready to believe that I see the "nummuline tubulation" in my specimen of *Eozoon* with my *mind's* eye rather than with my *bodily* eye (as Dr. Martin Barry saw "spirals" everywhere), if I were to find other experienced Microscopists, after "comparison of actual specimens," disagreeing with me. But having submitted this specimen, with a section of a recent Nummuline shell (*Cycloclypeus*), to a score or so of competent observers †, and having received their entire assent to the correctness of my description and of Mr. George West's delineation, I cannot surrender our unanimous conviction of this objective reality, because Profs. King and Rowney, who have *not* seen the specimen, consider it a "Foraminiferal impossibility."

As I should now no more think of attempting to convince the Galway "infallibles," than of trying to convert the Pope, I leave them in triumphant possession of the field. Your readers, perhaps, may claim the exercise of "private judgment" in the matter. Your obedient servant,

William B. Carpenter.

London, Oct. 17, 1874.

* Thus, of the gigantic arenaceous *Parkeria* of the Cambridge Greensand, I had to say (Philos. Transact. 1869, p. 734):—"The strongly marked dissimilarity between the fabric of *Parkeria* as now described, and that of any Foraminifera previously known, whether recent or fossil, renders it impossible to predicate with certainty what was the precise relation of the animal to its arenaceous 'test.'" And yet I was able to append in a note, as that Paper was passing through the press:—"Since the above was written, I have obtained from the Deep-sea Dredgings of the 'Porcupine Expedition' (1869) a complete confirmation of the view taken in the text. For on examining the internal structure of the largest Nautiloid *Lituolæ*, I find, though in a rudimentary condition, a labyrinthic structure whose relation to the chamber it surrounds is essentially the same as in *Parkeria*."

† As Profs. King and Rowney may possibly give the credit to the impartial attestation of their own colleagues and friends, which they refuse to my statements, I would refer them to Prof. Cleland of Galway, Prof. Redfern of Belfast, Prof. Greene of Cork, and Prof. Perceval Wright, Dr. Macalister, and Mr. Archer of Dublin.

XLIX.—*Description of a remarkable new Pheasant from Borneo.* By R. Bowdler Sharpe, F.L.S., F.Z.S., &c., Senior Assistant, Zoological Department, British Museum.

The subject of the present notice will rival the remarkable discoveries of pheasants for which Mr. Swinhoe and Père David have been noted during the last few years, and will be a fit companion for *Calophasis*, *Tetraophasis*, and the other beautiful new genera which have lately enriched the family Phasianidæ. I have no hesitation in referring the bird just received by the Museum to a totally new and distinct genus, which I shall call *Lobiophasis*, on account of the long pendent lobes which ornament the sides of the throat. The metallic plumage allies it to no other genus in particular, though it approaches *Euplocamus* more than any pheasant in the form of the tail and arrangement of the plumage; but it is distinguished from this genus by its bare head, which reminds one of *Numida*. The tail is quite peculiar, all the outer feathers having stiffened shafts, devoid of web for some distance. Like *Calophasis*, this pheasant seems to be a mixture of several genera hurled into one form; but I consider the following short diagnosis sufficient to distinguish it:—

Lobiophasis, gen. n.

Of the general form of *Euplocamus*; but distinguished by the metallic endings to the dorsal and breast-feathers, and especially by the bare head, which is ornamented on each side of the throat by long pendent wattles. The type is

Lobiophasis Bulweri, sp. n.

Above brown, all the feathers terminally margined with metallic purple, of a harsh texture; the neck-hackles similarly coloured; but here, owing to the individual plumes being divided, the general appearance of the metallic colouring is more spotted than on the back and upper tail-coverts, where the terminal metallic margins produce a somewhat barred appearance; wing-coverts uniform with the back, and having the same metallic spots; quills light brown, the outer primary with a pale whity-brown margin; the secondaries darker, and the innermost terminally margined with the same metallic colour as the back; lower back and rump-feathers uniform with rest of back, but the greater upper tail-coverts *white, like the whole of the tail*; head *bare*, with a large horn or wattle on each side of the occiput, and with a long pendent wattle on each side of the throat; round the hind neck a collar of dull maroon, all the feathers obscurely margined with metallic purple; chest also dull maroon, similarly obscured by purplish margins, which become broader and more distinct on the breast, which is black like the rest of the under surface, the metallic margins disappearing on the flanks and abdomen; under wing-coverts also dull brown, like the inner margin of the wing. Total length 28 inches, wing 11·5, tail 16·5, tarsus 3·4, pendent lobes 1·25.

Hab. Mountains of Lanos, Northern Borneo.

The unique specimen from which the above description has been taken has been presented to the Trustees of the British Museum by His Excellency H. E. Bulwer, C.M.G., Governor of Labuan. The wattles and ornaments on the face are stated to have been bright ultramarine in life.

MISCELLANEOUS.

Notes on the Varieties of the Western-American Weasels. By Dr. J. E. Gray, F.R.S. &c.

The British Museum has lately received several specimens of these animals. They show the variation in colour and markings that occur in the same species and in specimens from the same locality.

Mustela brasiliensis.

There are specimens from Veragua, Guatemala, and Costa Rica, which generally have a white spot on the forehead between the eyes, and an oblique white streak from the back of the orbit to the front and underside of the ears; these spots and streaks vary in breadth. One specimen, from Veragua, has the head blackish brown, and with only a very indistinct white spot in front of the ears; and another, from Columbia, has only the small white spot on the forehead just between the eyes, and none on the side of the head. In another, large one, from Costa Rica, the head is entirely blackish, without any white spot or streak whatever. The specimens vary in the width of the yellow on the abdomen. In general the underpart of the thighs is yellow; but in one from Costa Rica the yellow part of the abdomen is narrow, and the whole underpart of the thighs is dark brown.

None of the specimens with the abdomen and the inner side of the thighs yellow has the yellow spot on the front upper margin of the thigh as represented in Taczanowski's figure of *Mustela macrura* from Central Peru (P. Z. S. 1874, pl. xlviii.), which is otherwise very like a variety of *Mustela brasiliensis*; and as the quantity of yellow seems to vary in the specimens of that species, it may be only an individual variety. There is a specimen of this species from Mexico which is of a much lighter colour, and whiter beneath than the generality of the specimens; but this may arise from the animal having been exposed to the light.

Mustela xanthogenys from California.

These animals are known from the black-faced weasel (*M. brasiliensis*) by their pale brown colour, with the head of the same colour or only darker brown.

The first specimen described had only two small white spots on the forehead between the eyes, and some white hairs in front of the ears; but in a specimen lately received the head is darker brown, with a large square pale spot on the forehead between the eyes, a broad white spot on the upper lip under the eyes, and an oblique white streak on the side of the head at the back of the eyes and extending in front of the ears. The throat and the underside of the body a bright reddish yellow. The tail is short; but this may depend on the manner in which it was skinned.

Mustela affinis.

There is in the British Museum a large specimen of a weasel from New Granada, of a dark brown colour and rather darker head, which has a white streak on the side of the head in front of the ears, but no white mark on the forehead. It is most probably a distinct species; but its characters want confirmation.

It has been regarded as a large specimen of *M. aureoventris*, but is very different from it. It may be a variety of *M. brasiliensis.*

On the Encystation of Bucephalus Haimeanus. By M. A. Giard.

Von Baer long ago (1826) noticed a singular parasite of *Anodonta*, which he named *Bucephalus polymorphus*. This parasite was subsequently better investigated by Steenstrup and Von Siebold, who assigned it to its true place in the system.

In 1854 M. de Lacaze-Duthiers made known another species of the same genus, *Bucephalus Haimeanus*, which he obtained in the Mediterranean, and which lives as a parasite in the genital glands of the oyster (*Ostrea edulis*) and cockle (*Cardium rusticum*), causing them to be sterile. The *sporocysts* and the *cercarian* form of this Trematode were carefully figured in a fine memoir published in the 'Annales des Sciences Naturelles.'

Claparède has since found this curious Trematode at Saint Vaast-la-Hougue, on the coast of Normandy*. It was by fishing in the open sea with the towing-net that he procured the *Bucephalus* pretty frequently. The individuals figured by Claparède differ a little from those represented by M. de Lacaze-Duthiers; but this difference, which relates principally to the form of the lamellar appendages,

* Beobachtungen über Anatomie &c. an der Küste von Normandie, 1863.

did not seem to the Genevese naturalist of sufficient importance to necessitate the establishment of a new species. Notwithstanding his energetic researches, Claparède was no more successful than his predecessor in ascertaining the ulterior destiny of the *Cercaria Haimeana*.

Bucephalus Haimeanus also occurs at Etaples and in the neighbourhood of Boulogne-sur-Mer. Guided by certain theoretical notions, the result of investigations of the parasitic Crustacea, I have been more fortunate than my talented predecessors, and I have been able to ascertain the encystation of the *Bucephalus*.

My observation was made upon the garfish (*Belone vulgaris*, Val.). This fish (called the *maquereau d'été* at Boulogne, and *bécassine de mer* at Abbeville) comes commonly into the market at Boulogne during the months of May and June and the beginning of July. The viscera of the fish, especially the liver, the genital glands, and the peritoneum, are frequently filled with little cysts, affecting a cylindrical form, terminated at one extremity by a ball slightly drawn out into a point, like a thermometer in course of construction. By tearing carefully a certain number of these cysts, the *Bucephalus*, not yet transformed, will be found in some of them.

My anatomical researches, interrupted in the month of July, could not be carried so far as I wished. However, I must say that, like Claparède, it is impossible for me to accept the opinion of M. de Lacaze-Duthiers, when he says of the *Bucephalus*, "we observe in it a general cavity which may be regarded as a digestive cavity." The arrangement of the apertures and their physiological offices also appear to me to require being studied afresh.

What does the encysted *Bucephalus* become? Does it arrive at maturity in the body of the garfish, or does it undergo a new migration? In the latter case, which seems most probable, is this migration active or purely passive? This is what we have to discover. Claparède several times found the *Cercaria Haimeana* attached to *Sarsiæ* or *Oceaniæ*; on one occasion the *Cercaria* had lost its two long appendages, but it was still destitute of reproductive organs. From this Claparède concludes that this fact was accidental, and that the Medusæ are only momentary hosts for the *Bucephalus*. I have myself met with an adult Trematode in the cœlenteric cavity of *Cydippe pileus*, which, in the spring, is sometimes thrown up in abundance on the beach at Wimereux; but there is nothing to lead me to suppose that there exists any genetic connexion between this Trematode and *Bucephalus Haimeanus*.

According to Von Siebold, *Bucephalus polymorphus* is converted into *Gasterostomum fimbriatum* in the digestive tube of *Perca fluviatilis* and *P. lucioperca*; it is also found encysted in *Cyprini*. It seems therefore more probable to suppose that the *Bucephalus Haimeanus* encysted in *Belone vulgaris* becomes metamorphosed into a species of the genus *Gasterostomum* in the intestine of some large fish to which the garfish serves as food. Lacépède informs us, in fact, that when the garfish quits the deep water to go and spawn near the shores, it becomes the prey of the sharks and dog-fish, the large species of *Gadus*, or other voracious and well-armed inhabitants of the sea. Lastly, as a *Bucephalus* has also been met with in the livers of *Paludinæ*, and *Gasterostoma* in the intestines of the pike, the eel, and other fishes, and even of the duck, I cannot help thinking that the freshwater species belonging to this group of Trematodes are more numerous than has hitherto been thought. The differences mentioned above between the marine *Bucephalus* of the ocean and that of the Mediterranean may also perhaps acquire greater value when a complete and comparative study of these animals has been made.—*Comptes Rendus*, August 17, 1874, vol. lxxix. p. 485.

Note on the Enemies of Difflugia. By J. Leidy.

Prof. Leidy remarked that in the relationship of *Difflugia* and *Amœba* we should suppose that the former had been evolved from the latter, and that its stone house would protect it from enemies to which the *Amœba* would be most exposed. The *Difflugia* has many enemies. I have repeatedly observed an *Amœba* with a swallowed *Arcella*, but never with a *Difflugia*. Worms destroy many of the latter, and I have frequently observed them within the intestine of *Nais*, *Pristina*, *Chætogaster*, and *Æolosoma*. I was surprised to find that *Stentor polymorphus* was also fond of *Difflugia*, and I have frequently observed this animalcule containing them. On one occasion I accidentally fixed a *Stentor* by pressing down the cover of an animalcule-cage on a *Difflugia* which it had swallowed. The *Stentor* contracted and suddenly elongated, and repeated these movements until it had split three fourths the length of its body through, and had torn itself loose from the fastened *Difflugia*. Nor did the *Stentor* suffer from this laceration of its body; for in the course of several hours each half became separated as a distinct individual.—*Proc. Acad. Sci. Philad.* 1874, p. 75.

On the Colour of the Kittens of the Species of Cats (Felidæ). By Dr. J. E. Gray, F.R.S. &c.

The British Museum received a very young specimen of a jaguar from M. Verreaux in 1860, labelled *Leopardus onca*, Mexico. The body and head are $8\frac{1}{2}$ inches long, the tail $4\frac{1}{2}$ inches long. It is of a nearly uniform brown colour, without any indications of darker spots. The head, neck, and front of throat are rather paler than the rest of the body, the hinder part and the feet being rather darker. The upper lip is whitish, with a spot on each side of the front, just under the nostrils. It is somewhat like the young of the hunting leopard (*Gueparda guttata*) in the British Museum, described and figured P. Z. S. 1867, t. xxiv., but very different from it.

The young leopard, or panther (*Leopardus varius*), which was born in the Zoological Gardens, has, like its mother, numerous spots or roses on all parts of the head, body, and limbs; but the tail is much longer compared with the size of the body and comparatively slenderer.

The kittens of the greater number of variegated feline animals are spotted or striped like the adult; but the very young kittens of the hunting leopard (*Gueparda guttata*) and of the jaguar (*Leopardus onca*) are brown and not spotted; and the young pumas, while their mothers are of a uniform dark brown colour, are pale whitish brown, with large, dark, roundish, regularly disposed blotches, the blotches being more distinct in the younger specimens and gradually becoming more indistinct as the animal grows.

Dr. Baird describes a pair of kittens from Fort Steilacoom which he thought "probably belonged to this species" (Mam. North America, p. 84), which well agree with the young we have in the British Museum, born at the Zoological Gardens, and figured by Mr. Bartlett (P. Z. S. 1861, pl. 22) from a drawing by Wolff. The adult lion is of a uniform colour; but the young kitten of a Barbary lion in the British Museum, which was littered in the Zoological Gardens in 1853, is of a nearly uniform whity brown colour, but has some very indistinct darker spots on the outside of its hind legs and tail.

The tails of the kittens of several cats, as the lion and the common domestic cat, appear to be shorter compared with the body than in the adult, which is probably universal in all the species of cats.

A Scarlet Ear Shell, probably Artificial. By Dr. J. E. Gray, F.R.S. &c.

Many years ago I purchased of Mr. George Sowerby, the elder, a very beautiful specimen that he had purchased of a Frenchman, who informed him that it had been described and figured as a new genus of shells, I forget by whom; and I have never been able to discover where it was published, if it ever was. It has the appearance of a very irregular, corrugated, suborbicular, ear shell, with an irregular outer lip. It is of a bright scarlet colour, and is without the usual series of holes over the gills of the animal, in this respect resembling *Stomatia*. The shell is of a uniform appearance and colour, and has no external opaque or internal pearly coat, which is found in the ear shells and their allies, and, having been accidentally broken across the fracture, shows a uniform texture very different from an ear shell.

After examination I determined (and I believe Mr. Sowerby agreed with me) that it was a model of a shell carved out of the expanded part at the base of a red coral.

I have given the specimen to the British Museum collection; for if it is a model, it is very interesting and curious, being executed with great elaboration and attention to the minute details by a person who must have had a very intimate knowledge of the formation and growth of shells: though the outer surface is so irregularly formed, the irregularities are just such as would occur in a shell which has such an irregular outline to the outer lip, and the spiral grooves on the outer surface follow these irregularities just as they would in a natural shell which had been distorted in its growth.

This is not only the case with the external surface, but the inner surface of the cavity is equally accurate, polished, and marked with spiral grooves which exactly agree with the spiral ridges on the outer surface, which are interrupted by the irregularities of the malformed corrugated shell, but placed just as they would be in an ear shell with such an irregular surface. The external spiral apex is well exhibited; and the cavity within the spire most accurately represents the cavity that would be found in an ear shell of that shape.

Some conchologists to whom I have shown the specimen think it is a real shell. I think it doubtful; but they may be right: time only will show.

Descriptions of two new Species of Fishes from the Bermuda Islands. By G. Brown Goode.

In a collection of fishes, including some seventy species, made at the Bermudas in the spring of 1872 I find two forms apparently undescribed, descriptions of which are given below. As the marine life of the Bermuda group is essentially West-Indian in its character, these species may be regarded as additions to the ichthyological fauna of the West Indies.

1. *Diapterus Lefroyi*, sp. n.

This species belongs to the genus *Gerres* as defined by Dr. Günther. It is distinguished from all other members of the genus and family by its relatively greatly elongated form. The body is fusiform, compressed, its greatest height, at the thoracic region, being a little less than one fourth (·23) of the total length, and a little more than one fourth (·27) of the length without caudal (·89): in *Diapterus aprion*, the most elongated of the species hitherto described, the greatest height is one third of the length. The height of the body is uniform under the spinous portion of the dorsal, sloping gently and at a nearly uniform angle above and below to the middle of the caudal peduncle; the height of the body behind the dorsal (·10) is less than one half, the least height of the tail (·06) is one fourth of the greatest height of the body.

The scales are large, measuring ·03 and ·04 in height, and ·02 and ·03 in length; they form about forty-five oblique transverse rows between the head and the caudal, four and a half longitudinal rows between the back and the lateral line, and ten between the lateral line and the belly.

The length of the head (·22) equals the greatest height of the body, and is double the greatest width of the head (·11); the height at the pupil (·14) is double the width of the interorbital space (·07). The length of the snout (·06) equals the length of the operculum (·06); when the mouth is protruded the length of the snout is doubled (·12), and when retracted the posterior extremity of the intermaxillary process extends to the vertical through the centre of the pupil. The nasals are very prominent, and the nostrils are nearer to the orbit than to the extremity of the jaw.

The orbit is circular, its diameter (·08) one third the length of the head. The origin of the dorsal is slightly behind that of the ventrals, its distance from the snout (·31) twice the length of its base (·16). The dorsal spines are graduated nearly in the proportion I.=·02, II.=·12, III.=·11, IV.=·10, V.=·09, VI.=·085, VII.=·0725, VIII.=·05, IX.=·04. The notch between the spinous and soft portions is very deep, and the connecting membrane barely perceptible. In the soft dorsal the fifth ray is the longest (·09) and equals the fifth spine, the succeeding rays diminishing regularly to the last, which equals the ultimate spine (·04); the length of its base (·20) is greater than that of the spinous dorsal. The anal begins behind the centre of the body (·56); the first spine is very short (·01), one fifth the length (·05) of the second, which is slender; the first ray is the longest (·08), the succeeding rays regularly diminishing in length to the last (·03). The lobes of the caudal are equal, the outer rays in length (·21) five times the inner ones (·04). The extremity of the pectoral reaches the vertical from the last dorsal spine; its distance from the snout at the axilla (·25) is nearly equal to the height of the body. The ventral spine resembles the fifth dorsal spine in shape and size; the length of the longest ray (·11) slightly exceeds one third of the distance from the snout to the ventral axilla (·30); the axillary appendage consists of four lanceolate scales, the first and longest as long as the last ventral ray.

Colour silvery, with a bluish tint above; axils of the pectorals and extremity of snout brownish.

Radial formula:—D. IX. 10. A. II. 8. P. 12. V. I. 5. C. 3, 9, 9, 3.

The unit of measurement used above is one hundredth of the total length, which in an average specimen is 7·29 inches (M. 0·185). The species is common in the protected inlets about the islands in company with the "shad" (*Diapterus gula*), from which it is distinguished by the name "long-boned shad;" they are in demand for bait, and are easily seized in large quantities. I take pleasure in dedicating the species to his Excellency Major-General J. H. Lefroy, F.R.S., Governor of the Bermudas, who, while doing so much for the social and political welfare of the islands, is taking an active part in adding to our knowledge of their natural history.

2. *Engraulis chœrostomus*, sp. n.

This species closely resembles *Engraulis surinamensis* (Blkr.) Gthr., differing from it, however, in several respects.

The height of the body (·16) is a little more than two thirds of the length of the head, and is contained six times in the total length and a little more than four times in the length to end of middle caudal rays (·90); the height of the ventrals is less (·13). The scales are large, in thirty-eight oblique rows between the head and the caudal.

The length of the head (·22) is less than one fourth of the total, and is double its height at the pupil (·11); its greatest width (·08) is about one third of its length. The orbit is nearly circular, and its diameter (·05) equals the length of the snout (·05) and the width of the interorbital area (·05). The snout projects far beyond the lower jaw, whose extremity just passes the vertical from the anterior margin of the orbit. The maxillary is dilated above the mandibular joint, rather tapering behind, and extends to the gill-opening. The gill-rakers are fine, setiform, not longer than the eye (·05), about twenty-five on the lower branch of the outer branchial arch.

The origin of the dorsal fin is in front of the middle of the body (·45 from snout), and directly above the extremities of the ventrals; the length of the first ray (·06) is half that of the second (·12), which nearly equals the length of the base (·11).

The origin of the anal is at the middle of the body (·51 from snout) and below the posterior dorsal rays; its greatest height (·11) nearly equals that of the dorsal.

The length of the middle caudal rays (·08) is two fifths of the outer rays (·20). The length of the pectorals (·11) equals the length of base of dorsal (·11), the extremities reaching to the origin of the ventrals. Length of ventrals ·09, distance from snout ·35.

Colour: back and sides brownish, belly white; a broad, clearly defined lateral band of silver as wide as the diameter of the orbit (·05).

Radial formula:—D. 13–14. A. 23–24. Length 2·68 inches (M. 0·068).

Common in shoals in Hamilton Harbour, where it is taken for bait in cast-nets. Its enormous mouth has given it the name of "hog-mouth fry."

The types of these descriptions are preserved in the United-States' National Museum in Washington and the University Museum in Middletown, Conn.—*Silliman's American Journal*, August 1874.

On the Embryogeny of the Rhizocephala. By M. A. Giard.

In a former communication ('Comptes Rendus,' tome lxxvii. p. 945) I submitted to the Academy the principal results of my researches upon the Cirripedia Rhizocephala; and I have since been able to continue the investigation of those curious parasites, and to verify on other species the exactitude of my first observations. *Pagurus bernhardus* is common at Wimereux, where it inhabits by preference the shells of *Buccina*, *Naticæ*, and *Purpuræ*. About a third of the *Paguri* collected in this locality bear a large *Peltogaster*, evidently *P. paguri* of authors. Singularly enough this parasite is entirely wanting on the shores of Roscoff and Saint-Pol-de-Léon, where *Pagurus bernhardus* is nevertheless exceedingly common. The *Peltogaster* of Roscoff, which I had named *Peltogaster paguri*, from the old very imperfect descriptions, is quite new, and may bear the name of *Peltogaster Prideauxii*. It is found exclusively upon *Pagurus Prideauxii*, but it is rare and always solitary, whilst *P. paguri*, although much larger, often occurs to the number of two upon the same *Pagurus*.

The rearing of the larvæ of Crustacea is well known to present great difficulties. It is by capturing with the net and comparing with each other larvæ of different ages that in general the curious transformations of these animals have been discovered. Spence Bate, in giving an account of the admirable researches of Fritz Müller on the nauplian form of *Peneus*, expresses himself as follows:—"The difficulty of preserving the life of these delicate creatures has not yet been overcome. The newly hatched larva from the commonest and, we might assume, the hardiest crabs has not been preserved beyond the second stage; and the link between what is termed the larva and the pupa stages of the cirriped has not been demonstrated. It is therefore not to be demanded that Dr. Müller should succeed beyond the step at which others have stopped."

The demonstration thus called for by Spence Bate I have been able to obtain for the Cirripedia Rhizocephala, and, indeed, by a very simple experimental process. All that is necessary is—(1) not to change the water in which the embryos are living, and (2) to prevent these embryos from coming to dry themselves against the wall of the aquarium which is exposed to the light. This latter inconvenience is avoided by raising the level of the liquid from time to time, and by covering the troughs so as to prevent evaporation.

The numerous broods that I have been able to rear by this process, not only at Wimereux, but even at Lille, enable me to correct some errors, which it is the more important to indicate because they emanate from very conscientious and experienced observers. In a letter addressed to M. P. van Beneden, and published in the 'Bulletin de l'Académie de Belgique' (2e série, tome xiii. 1862), M. Gerbe announces as follows one of the results of his investigations on the animals now under our consideration:—"What has struck me most," he says, "is a *constant* difference between the embryos or larvæ of the same species, *a difference which can only be referred to sex*. In my opinion the male and female of the *Peltogasters* when just hatched are already perfectly distinct. The male has that part of him which I shall call *abdominal* less developed than the female, and the two appendages situated at the posterior extremity are broader and more elongated in the latter than in the former; but are the internal genital organs appreciable in the two sexes? This I cannot yet assert. Nevertheless *I should almost venture to regard as an ovary*, in the individuals which I believe to be females, an organ situated above the mass which for me represents the liver. This organ, in fact, contains small, spherical, very transparent vesicles, like primitive eggs, and granular like these. If future researches should confirm these appreciations, a corner of the mystery relating to these singular animals may have been lifted from them."

1. I have shown that, the Rhizocephala being hermaphrodites, the

males could only be complementary males, the existence of which is by no means probable.

2. The difference noticed between the embryos of the same species is due to the fact that the embryo when scarcely hatched undergoes a first metamorphosis. Sometimes, even, this metamorphosis is accomplished so rapidly that embryos of two different forms are expelled simultaneously from the maternal organism in which the incubation has taken place. As the differences between the embryo just issuing from the egg and that which has undergone a first moult are altogether very slight, this moult has passed unobserved. It is, on the contrary, very manifest in the Cirripedes proper, as in *Lepas*, where the difference is enormous and very curious.

The supposed primitive ovary indicated with doubt by M. Gerbe, and with certainty by M. Balbiani, is, as I have formerly pointed out, a mass of cells, which after the second moult becomes differentiated to form the six pairs of natatory feet, homologous with the cirri of the Cirripedes.

An error similar to that of M. Gerbe has been made by Professor Semper, who describes as furnishing a larva of a very peculiar form a *Peltogaster* of the Philippine Islands, of which he has evidently observed the embryos only after the first moults, when they already affected the Cypridine form (Zeitschr. für wiss. Zool. xiii. pl. 38. fig. 3).

I may add that the larvæ of the Rhizocephala are very imperfectly known. I can nowhere find a description of their trilobate rostrum, comparable to that of the embryos of Cirripedes (an acute median lobe and two rounded lateral lobes). M. E. van Beneden, who has recently paid attention to these animals, does not notice this apparatus; nor does he mention the voluminous frontal glands, the product of secretion of which traverses a canal opening at the trifid extremity of the lateral anterior appendages of the carapace. He is equally silent respecting the organs situated on each side of the middle part of the animal, and generally coloured yellow or red (primitive kidneys ?). He denies the existence of the muscles; and yet nitric acid brings to view most distinctly striped muscular fibres, the arrangement of which is interesting to study. On the other hand, he admits the existence of a mouth situated very far back. This mouth does not exist in any of the species examined by me (*Sacculina carcini*, *Peltogaster paguri*, and *P. Prideauxii*). It is possible that this organ exists in other types, especially in the *Sacculina* of *Xantho florida*, in which M. Gerbe asserts that he has met with a pretty highly organized digestive tube.—*Comptes Rendus*, July 6, 1874, p. 44.

Notice of some new Freshwater Rhizopods. By J. Leidy.

Prof. Leidy remarked that, besides the ordinary species of *Amœba* which he had observed in the vicinity of Philadelphia, he had discovered what he suspected to be a new generic form. It has all the essential characters of *Amœba*, but, in addition, is provided with tufts of tail-like appendages or rays, from which he proposed to name the genus *Ouramœba*.

The rays project from what may be regarded as the back part of the body, as the animal always moves or progresses in advance of the position of those appendages. The rays are quite different from pseudopods, or the delicate rays of the Actinophryens; they are not used in securing food, nor is their function obvious. The *Ouramœba* moves like an ordinary *Amœba*, and obtains its food in the same manner. The tail-like rays are not retractile, and they are rigid and coarse compared with those of Actinophryens. They are simple or unbranched, except at their origin, and they are cylindrical, of uniform breadth, and less uniform length; when torn from the body they are observed to originate from a common stock attached to a rounded eminence.

Several forms of the *Ouramœba* were observed; but it is uncertain whether they pertain to one or to several species. One of the forms had an oblong ovoid body about $\frac{1}{8}$ of a line long and $\frac{1}{12}$ of a line broad. The tail-like rays formed half a dozen tufts, measuring in length about the width of the body. The latter was so gorged with large diatoms (such as *Navicula viridis*), together with desmids and confervæ, that the existence of a nucleus could not be ascertained. The species may be distinguished by the name of *Ouramœba vorax*.

A second form, perhaps of a different species, moved actively and extended its broad pseudopods like *Amœba princeps*. When first viewed beneath the microscope it appeared irregularly globular, and about $\frac{1}{14}$ of a line in diameter; it elongated to $\frac{1}{6}$ of a line, and moved with its tail-like appendages in the rear. These appendages formed five tufts about $\frac{1}{25}$ of a line long. The interior of the body exhibited a large contractile vesicle and a discoid nucleus. This second form may be distinguished by the name of *Ouramœba lapsa*.

Another *Ouramœba* had two comparatively short tufts of rays; and a fourth, of smaller size than the others, had a single tuft of three moniliform rays.

It is possible that *Ouramœba* is the same as the *Plagiophrys* of Claparède, though the description of the latter does not apply to it. *Plagiophrys* is said to be an Actinophryen, furnished with a bundle of rays emanating from a single point of the body; but the rays are described as of the same kind and use as those of *Actinophrys*. *Plagiophrys* is further stated to be provided with a distinct tegument like *Corycia* of Dujardin or *Pamphagus* of Bailey; but the body of *Ouramœba* is as free from any investment as an ordinary *Amœba*, and the rays are fixed tail-like appendages, with no power of elongation or contraction.

The species of *Ouramœba* were found among desmids and diatoms, on the surface of the mud at the bottom of a pond, near Darby Creek, on the Philadelphia and West-Chester Railroad.

Two of the commonest species of *Difflugia* of our neighbourhood I had until recently confounded together as *D. proteiformis*; and perhaps the two forms may be included under the latter name in Europe. In one the mouth is deeply trilobed, and the animal is usually green with chlorophyl-globules. In the other the mouth is crenulate, usually with six shallow crenulations, and the animal is devoid of chlorophyl. The former is usually the smaller, and may be distinguished by the name of *D. lobostoma*; the latter may be named *D. crenulata*.

In an old brick-pond, on the grounds of Swarthmore College, Delaware County, among *Difflugia pyriformis*, *D. spiralis*, *D. corona*, *D. acuminata*, and others not yet determined, there occurs an abundance of a large species, apparently undescribed. It is sometimes the fourth of a line in length, and is compressed pyriform; but is quite variable in its relation of length to breadth and in the shape of the fundus of the shell. This is often trilobate; but, from the non-production of one or more or all the lobes, differs in appearance in different individuals. The animal is filled with chlorophyl-grains, from which it might be named *D. entochloris*.

Another large *Difflugia*, allied to *D. lageniformis*, is not unfrequent about Philadelphia. The shell is beautifully vase-like in shape; it has an oval or subspherical body, with a constricted neck and a recurved lip to the mouth; the body of the shell opposite the mouth is acute and often acuminate. The animal contains no chlorophyl. One shell measured $\frac{1}{6}$ of a line long by $\frac{1}{8}$ of a line broad; another measured $\frac{1}{4}$ of a line long by $\frac{1}{7}$ of a line broad. The species may be named *D. amphora*.

A Difflugian, found in a spring on Darby Creek, is interesting from its transparency, which allows the structure of the animal to be seen in all its details. The investment is membranous and apparently structureless; the soft granular contents occupy about one half of the investment, and are connected with this by long threads; the pseudopods are protruded in finger-like processes. The form of the animal is compressed ovoid, with the narrow pole truncate and forming the transversely oval mouth. It is probably the species *Difflugia ligata*, described by Mr. Tatem, of England. Its length is about $\frac{1}{33}$ of a line. The character of the investment is so different from that of ordinary Difflugians that the species may be regarded as pertaining to another genus, for which the name of *Catharia* would be appropriate.—*Proc. Acad. Sci. Philad.* 1874, p. 77.

On the Skull of the Leopard (Leopardus pardus). By Dr. J. E. Gray, F.R.S. &c.

The skulls of the leopard in the British Museum, from different localities, vary very much in size, and I think will probably, if they are carefully studied, prove to belong to more than one species when specimens, obtained from well-ascertained localities, are accompanied by the skins of the animals from which they are obtained.

The skulls received from Southern Africa are much the largest. The specimens from Continental India are of intermediate size; and a series of skulls which were formerly contained in M. Lidth de

Jeude's Museum in Holland, and therefore probably from the Dutch colonial possessions, are all of a much smaller size, not half the size of those from South Africa (see figure of *Felis pardus sumatranus*, Blainv. Ostéogr. *Felis*, t. viii.), which seems to represent a small specimen of this latter variety. Blainville represents a smaller skull, still under the name of *Felis pardus barbarus*, from Barbary, North Africa (t. viii.).

The leopards have a narrow opening at the back of the palate, and a tooth-like prominence on the front edge. This character seems common to all the leopards, but is more marked in some than in others.

They seem to vary in the width of the opening to the posterior nostrils. In some it is very narrow, and in others broader; this is, perhaps, a sexual character.

The puma, the skull of which very much resembles that of the leopards, differs from the leopard in having the front edge of the hinder opening of the nostrils simply rounded.

On the Ethology of Sacculina carcini. By M. A. Giard.

Cancer mænas, like all those animals which are very common and capable of suiting themselves to very varied conditions of existence, is subject to the attacks of a multitude of parasites and commensals belonging to the most various groups of the animal kingdom. Among these parasites one of the most interesting is unquestionably *Sacculina carcini*, the curious metamorphoses of which we have recently studied.

The *Sacculina* is very common at many points of the coasts of Brittany; it becomes rare on the shores of the Boulonnais and of Flanders, from Cape Gris-Nez to Dunkirk. On the other hand, it is excessively abundant at Ostend, where it was long ago noticed by M. P. van Beneden, and where I have myself found it by hundreds this summer.

As the *Sacculina* inevitably causes the sterility of the crab which bears it, at first mechanically and afterwards histologically, *Cancer mænas*, notwithstanding its prodigious fecundity, would soon become rare upon the shores on which an equally fertile parasite swarms, if many causes did not cooperate to limit the excessive multiplication of this curious Rhizocephalon.

At Ostend we often find under the tails of crabs which bear *Sacculinæ* small tufts of Bryozoa and strings of young mussels, which appear to hamper considerably the development of the parasite under consideration. At Wimereux, where the edible mussel is also very common, the same fact is frequently observed; but as the mussel can rupture its byssus and quit its place at pleasure, when it finds itself inconveniently confined, it does not constitute a great danger for its neighbour the *Sacculina*.

This, however, is not the case with *Molgula socialis*, the active larvæ of which often take up their abode under the tail of *C. mænas* when this is raised by the *Sacculina*. These Ascidia, as they are developed, gradually compress the body of the *Sacculina* and finally cause it to perish, after hindering its multiplication for some time.

For one crab bearing a *Sacculina* in good health, we find four or five loaded with a bundle of agglutinated mussels and *Molgulæ*. On removing these foreign bodies we constantly find either the flabby and half-destroyed skin of the *Sacculina*, or merely a chitinous ring, the last vestige of the presence of the parasite.

Molgula socialis is rendered the more formidable because it retains among its aggregations the mussels, calcareous sponges (*Sycortis quadrangulata*), Bryozoa, &c. fixed under the tail of the crustacean.

From these facts we may deduce:—1, the existence of a urodelous larva in *Molgula socialis*, which is verified by experimental embryogeny; 2, the presence of *Cancer mænas* in the laminarian zone, which the ascidian in question inhabits; 3, the possible coexistence of the *Molgula* and *Cancer mænas*, and even a sort of mutual dependence of these animals upon each other; and, 4, the incorrectness of the opinion of those zoologists who have supposed that the absence of a certain species of *Molgula* in the zone of *C. mænas* was due to the presence of that crustacean.

On the shores of Brittany, where it has not to dread the presence of *Molgula socialis*, the *Sacculina* is very common, and the numerous companions that it may have do not seem to incommode it much. We find, in fact, under the tails of the Crabs infested by it:—1. Synascidia (*Botryllus violaceus*, *Polyclinum sabulosum*); 2. Bryozoa (*Pedicellina*, *Tubulipora serpens*, *Cellepora pumicosa*); 3. Annelides (*Spirorbis*); 4. Calcispongiæ (*Sycandra coronata* and *ciliata*); and, 5. Vorticellæ and numerous and varied Infusoria.

In the interior of the mantle we frequently meet with Copepod Crustacea, nearly allied to those which frequent the branchia of the Ascidia, and especially a species related to *Lichomolgus*, and remarkable for the dilatation of the prehensile antennæ of the male.

But the most interesting parasite of the *Sacculina* is an Isopod Crustacean of the family Bopyridæ, and of the genus *Cryptoniscus*, F. Müller. Two species of this genus are already known, viz. *Cryptoniscus pygmæus* (*Liriope pygmæa*), Rathke, parasitic on *Peltogaster paguri* (in the European seas), and *Cryptoniscus planarioïdes*, F. Müller, parasitic on *Peltogaster purpureus* (in the seas of America). The *Cryptoniscus* of *Sacculina*, which I propose to call *C. larvæformis*, differs greatly from the preceding in external form, at least as regards the female sex. The male, which is met with in the ovigerous cavity of the *Sacculina*, closely resembles those of the other *Cryptonisci*. The female is fixed to the base of the peduncle of the *Sacculina*. Externally it presents the appearance of the hinder part of the body of the larvæ of the Lamellicorn Coleoptera. It is more than 1 centimetre in length; its colour is whitish; the integument is slightly diaphanous, and shows in its interior a yellowish red mass. This reddish mass is regarded by F. Müller as a liver in *Cryptoniscus planarioïdes*; but as it is greatly developed before oviposition, and much reduced, on the contrary, when the ovigerous sac is full, it appears to me to have some relation to the generative functions, and may perhaps act the part of a vitelligene, or accessory gland of the ovary.

The ventral lobes are concealed by a lamella, which does not seem to exist in *Cryptoniscus planarioïdes*. These lobes are the homologues of the respiratory plates of the pleon of the Bopyridæ, and especially of *Phryxus*. It is, moreover, with these animals that *Cryptoniscus* presents the closest affinities; and I cannot accept the opinion of Spence Bate, who proposes the union of the genus *Cryptoniscus* with *Cryptothiria*, which includes animals parasitic upon *Balani*. The presence in the latter of a by no means degraded cephalic part, the arrangement of the ovaries and oviducts, and the absence of respiratory plates upon the pleon appear to militate against this combination.

The passage from the *Cryptonisci* to the other Bopyridæ is effected by the *Phryxi*, and especially by *Phryxus* (*Bopyrus*) *resupinatus*, F. Müller, which lives parasitically upon *Peltogaster purpureus*. The most nearly allied type in the European seas is *Phryxus phyllodes*, which lives upon the *Pagurus Prideauxii* of the shores of the English Channel.—*Comptes Rendus*, July 27, 1874, pp. 241–243.

A Record of Geological Literature.

A work has been undertaken by some of the most zealous of our younger geologists, the satisfactory execution of which will be of great importance to many of our readers. This is a 'Record of Geological Literature,' intended to be a classified general index to the contents of the multitudinous books and memoirs published on Geology properly so called, Mineralogy, and Palæontology during each year, somewhat after the model of the 'Record of Zoological Literature.'

That the work will be one of great labour and difficulty no one at all acquainted with the subjects to be thus treated can doubt; and we can only wish the editor, Mr. Whitaker, of the Geological Survey, and his able staff of assistants, good speed in their arduous undertaking. At the same time we hope that they may meet with a higher degree of success than has hitherto attended the efforts of their fellow-labourers of the 'Zoological Record;' and we think that this happy consummation may be attained, for two reasons: in the first place, they have not to contend against a long-established rival like the "Berichte" in Wiegmann's 'Archiv,' seeing that the notices in the 'Jahrbuch für Geologie' &c. can by no means pretend to give a complete abstract of geological literature; and, secondly, a great number of people in this and other countries have a *professional* interest in keeping up with the progress of geology, and it may be expected that a fair proportion of these, at any rate, will purchase the new 'Record.'

The 'Geological Record,' if well executed, which, from the names of the contributors, there is every reason to expect, will prove of the greatest value to all geologists and palæontologists; and the low price at which it is proposed to publish it ought to ensure it a wide circulation. The 'Record' of geological doings in 1874 is now in course of preparation, and will be issued about the middle of next year. The editor will be happy to receive the names of intending subscribers.

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L.—*Development of the Marine Sponges from the earliest recognizable Appearance of the Ovum to the Perfected Individual.* By H. J. Carter, F.R.S. &c.

[Concluded from p. 337.]

Development of the Embryo of the Calcareous Sponges.

For this purpose I must confine myself entirely to *Grantia compressa*, which, growing much above low-water mark and chiefly on the branches of the little delicate seaweed *Ptilota sericea* as it festoons the ledges of the overhanging rocks, exists in a most convenient position for examination, inasmuch as, by cutting off the branch of *Ptilota*, we can reduce the foreign object on which the sponge grows to a very minute size without interfering with the sponge itself; added to which, the bent club-shaped form of its surface-spicule (Plate XX. fig. 20) is so peculiar that, even in the minutest forms, the species can be determined by its presence.

The walls of this little purse-shaped sponge are, in the months of March, April, and May, charged with the embryos of the species, as well as ova, from their earliest recognizable form up to the matured state of the embryo just before its exit. Here I might observe that in the months of June and July, after the embryos have been issuing from this sponge for some time in great abundance, they may be found fully developed and in groups of all sizes on the branches of the *Ptilota*, immediately around the parent, where, although the largest have a branched tubular form very different from the compressed one of the parent, yet their position in proximity to the adult, together with the presence of the club-shaped surface-spicule (Pl. XX. fig. 20), at once identifies them as belonging to it. And it seems worth remarking that while the cavity of the parent is almost always occupied by a minute shrimp-like crustacean devouring not only the fat young embryos, but the whole substance of the sponge itself (especially in captivity), the young individuals, which at this time have nothing of the kind in them to attract these animals, are left untouched.

Having then cut off a few of the branches of the *Ptilota* bearing adult specimens of *Grantia compressa*, they were placed in a glass vessel in fresh sea-water on the 12th of August, where they remained undisturbed for seven days, when they were taken out, and the residue at the bottom, after the greater part of the water had been carefully drawn off by a siphon, was placed in a flat glass vessel under an inch compound power for examination. In this residuum several specimens of the embryo in its *active* state were observed (Pl. XX. fig. 13), together with others that had become *passive*, on their way to become developed into the perfect sponge (figs. 16 & 17), and specimens of the latter also (figs. 18 & 19). These were successively taken out with the pipette, as before mentioned, and transferred to a slide for examination with a much higher compound power, viz. that of $\frac{1}{4}$-inch focus.

Of the early part of the development of the ovum I need say nothing beyond what has already been mentioned in the "First Period," viz. that it becomes attached to the surface of the excretory canal, and that in the "Second Period" it undergoes segmentation, as shown by Häckel. We shall therefore go at once to the others, viz. the Third and Fourth Periods.

Third Period.

The embryo of *Grantia compressa*, commencing almost in a globular form, still remains encapsuled in the parent until fully prepared for an independent existence, when it breaks through its capsule and leaves the parent somewhat elongated (Pl. XX. fig. 13).

It is now cylindrical, a little longer than broad, obtusely conical at one end (fig. 13, *a*), and roundly truncated at the other (fig. 13, *d*). The surface is covered with a layer of minute monociliated cells (fig. 13, *b*), which cells being much longer than they are broad, and more or less wedge-shaped, form (in juxtaposition) a crust of columnar structure, radiating perpendicularly all over the body of the embryo, except at its posterior or truncated end (fig. 13, *f*).

This layer of monociliated cells is, as before stated, only represented *generally* in the embryo of *Halisarca lobularis* (Pl. XX. fig. 11), and omitted for convenience in the rest, or rather reduced to a mere line of marginal dots. The cilia are separated at the apex (fig. 13, *c*), and, from this, slope in opposite directions, more or less backward, to the posterior end, which presents a group of large nucleated cells that are naked or unciliated (fig. 13, *d*), as in *Halichondria simulans*. Lastly, there is a brownish-yellow-coloured globular cavity in the centre (fig. 13, *e*). The embryo progresses in the direction of the apex, with the truncated end behind, and rotates from left to right, as shown by the arrows respectively on the figure of the embryo of *Halichondria simulans*, attaching itself in the same way to the bottom of the glass or foreign objects by the bunch of large cells at the posterior end, which, thus evidencing signs of being polymorphic and prehensile, I have regarded as a temporary development for rooting or fixation. At this time its total length is about 1-360th inch, with a little less transverse diameter, thus contrasting strongly, in point of size, with the embryo of *Halichondria simulans*, which, as before stated, is 1-30th inch long by 1-90th inch wide. Such is the embryo of *Grantia compressa* when it has issued naturally from the parent after the manner mentioned.

If we now compress this embryo under a glass cover, in order to examine its composition with a much higher compound power, viz. that of $\frac{1}{4}$-inch focus, we shall observe that the cavity in the centre assumes a conical truncated form (fig. 14, *a*), that the body between this and the ectodermal layer of cells is composed of sarcode charged with cells which are double the size of the latter, viz. 1-6000th inch in diameter (fig. 14, *b*), together with granules, and that the root-cells, each of which is charged with granular plasma, including a distinct nucleus and nucleolus, are again five times as large as the body-cells—that is, 5-6000ths inch in diameter (fig. 14, *c*). But as yet, although the embryo is matured and has left the parent, there is *not the least trace of spicules* (fig. 14).

Lieberkühn (Archiv f. Anat. u. Phys. 1859, p. 379, pl. ix. fig. 7), in describing and figuring this embryo with the cells above mentioned, alludes to the brown (*braune*) colouring-matter about the central cavity.

In a still more advanced state, probably, this cavity appears to become elongated and elliptical (fig. 15, *a*); and it is worthy of remark that, while the brown colouring-matter seen about the cavity in the embryo of *Grantia compressa* has the same appearance as that about the bunch of root-cells at the base of the embryo of *Halichondria simulans*, the root-cells of the embryo of *Grantia compressa* first make their appearance in this part of the embryo, and hence have been called by Häckel the "endodermal layer"—erroneously, I think, because the real endodermal mass or layer appears to consist of the sarcode charged with cells and granules which I have stated to exist between the brown-coloured cavity and the ectodermal layer (see also Lieberkühn's figure for this, *l. c.*).

Whether the root-cells in the embryo of *Halichondria simulans* make their first appearance in the centre of this body I cannot pretend to say, on account of its opaqueness at maturity and during its previous stages; but that they do so in the embryo of *Halisarca lobularis* its transparency enables one to see distinctly, as our illustration will show (Pl. XX. fig. 12, *c d*).

Fourth Period.

On account of the microscopic size of the embryo of *Grantia compressa* when it leaves the parent (Pl. XX. fig. 13), compared with that of *Halichondria simulans* (Pl. XXI. fig. 21), which may be seen with the unassisted eye, I could not treat the former in the same way as the latter to follow its development through the *first part* of this period, and therefore was obliged to have recourse to the examination of objects in the residuum mentioned, which might perchance afford these stages. This was not difficult, so far as the young *Grantia compressa* when fully developed was concerned, as there were many specimens of it in the residuum as well as on the dried pieces of *Ptilota* bearing the young and old forms together, which, only being a trifle larger than the embryos in their bodies respectively, as may be seen by the illustrations (Pl. XX. figs. 13 and 18), might be assumed to be the earliest form of the perfected sponge.

I, however, was so fortunate as to meet with two specimens where the respective stages between the fixation of the embryo and the fully developed sponge were amply represented; in one of which (fig. 16), the dermal membrane (*a*) still retained its even, round continuity, while the interior only contained *four* triradiate spicules (fig. 16, *b*) in the midst of a mass consisting of sarcode charged with cells of a uniform size, viz. about 2·6000ths inch in diameter, and granules (fig. 16, *c*), but with no appearance now of the larger "root-cells."

In the other specimen (fig. 17) the triradiate spicules were more numerous (fig. 17 *b*), and there were several of the characteristic club-shaped spicules present (fig. 20), which, having their free points in contact with the dermal (ectodermal) membrane, had forced the latter outwards so as to destroy the even continuity of its surface and thus render it monticular (fig. 17, *c c*) ; so that, of these two instances, we have in one (fig. 16) the retraction of the dermal cilia and the development of the first spicules *before* the latter begin to push outward the dermal membrane, and in the other (fig. 17) an increase of the triradiates with the addition of the club-shaped surface-spicules *after* the latter have begun to push out the dermal membrane —respectively analogous to similar stages of development in the embryo of *Halichondria simulans*, described under the "Fourth Period."

Here it should be added that, on crushing the latter specimen (fig. 17) for more minute examination, not only did the soft contents come out in the state of sarcode charged with cells of uniform size like the last, viz. about 2-6000ths inch in diameter (fig. 17, *d d*), but many of these cells, which were isolated, were also monociliated (fig. 17, *f*), and others appeared in an aggregated, pavimental form as fragments of the ampullaceous sacs (fig. 17, *a*), while after a short time many of the isolated cells began to put forth pseudopodia and creep about the slide after the manner of *Amœbæ* (fig. 17, *g*). But in no part was there any appearance of the root-cells, any more than in the former specimen. Thus it was evident that, at this period, the spongozoa and ampullaceous sacs, although still very soft and delicate in structure, had been developed.

Afterwards it was easy, as before mentioned, to find specimens of the fully developed young *Grantia compressa*; and, from observing that the triradiate spicules were confined to the body and the club-shaped ones to the surface in these specimens, together with the triradiates appearing first and by themselves in the previous stage mentioned, it was not unreasonable to infer that the triradiates of the body were the spicules first developed. The fully developed young *Grantia compressa* (figs. 18 & 19) now measured in the *body* (fig. 18, *a*) 7 by 4-1800ths of an inch in its greatest diameters, while that of the ciliated active embryo (fig. 13) at the time of leaving the parent measured $5\frac{1}{2}$ by 4-1800ths of an inch. Still we have to add to the former the distance of the *ends* of the club-shaped surface-spicules from the surface of the *body* (fig. 18, *c*), as the dermal membrane must have covered them when they were first developed, and have only left them naked when the sarcodal contents withdrew themselves inwards to form the purse-like body. If, then, we add this distance, it will raise the measurement of our fully developed or embryonal *Grantia* *compressa* to 12 by 8-1800ths of an inch (fig. 18); and this will bring it nearer to the size of the two specimens found in the preceding stages (figs. 16 & 17), although then the latter will appear very large. Still, that they do represent the earlier stages of this period of development in *Grantia compressa*, their composition demonstrated beyond doubt.

Hence, with the exception of following the active embryo of *Grantia compressa* to its state of fixation and the withdrawal of the cilia, which, from its microscopic minuteness, would be very difficult if possible, the whole of the development of the embryo of *Grantia compressa*, from the earliest recognizable appearance of the ovum to the fully developed sponge, has thus been described and illustrated.

Observations.

When we compare the embryo of *Grantia compressa* with that of *Halichondria simulans* at their exit from the parent respectively, we can hardly come to any other conclusion than that their development into the true form of the respective parents must follow a similar course—since, although this form may differ in these two particular sponges, it does not so generally; for there are tubular and sessile spreading forms of both calcareous and siliceous sponges, and in some instances even the same species of either may appear under both these forms.

In the first place, the shape of the embryo in the sponges just mentioned is conical, with a pointed and a truncated end; the body is covered by a layer of minute monociliated cells (the ectoderm), whose cilia slope in opposite directions from the apex, and are more or less inclined backwards towards the obtuse end, where there is a bunch of larger cells *un*covered by cilia; the embryo progresses with its pointed end foremost, and rotates from left to right; and both embryos attach themselves to the bottom of the glass vessel and foreign objects respectively by the posterior extremity or bunch of large cells, which thus appear to possess a plastic prehensile property.

On the other hand, internally, the body is composed of sarcode charged with cells (of different sizes) and granules, among which the largest of the former far exceed in size the dermal cells; while the bunch of large cells at the posterior end may be seen in the embryo of *Grantia compressa* to originate from its centre, thus having the body-substance (which appears to be the endoderm or substance in which the spicules, horny skeleton, and ampullaceous sacs are developed) *between* it and the ectodermal layer (Pl. XX. figs. 13 & 15).

Under these circumstances we cannot help concluding that the embryo of *Grantia compressa* (although this has not actually been witnessed) does attach itself, to the body (viz. the branch of *Ptilota*) on which it becomes developed, by the bunch of cells at the base of the cone, and therefore that these are especially provided for *rooting* the embryo.

Of the whole of the development of the embryo of *Grantia compressa*, this, as before stated, on account of the minuteness of the former at this period, has not been seen; but that the embryo does become fixed in this way, and that the pointed end becomes the mouth (*osculum*) or aperture of the cavity of the body in the young *Grantia compressa*, and not the obtuse unciliated end, may be reasonably concluded from the comparison between the embryos of *Grantia compressa* and that of *Halichondria simulans* just instituted.

Every thing too, after this, points to the same kind of development in the fourth period as that presented by the embryo of *Halichondria simulans* in passing into the form of the parent sponge; so that to make an exception of the mode of attachment because we have not actually seen it in *Grantia compressa* seems to me, under such circumstances, most unreasonable.

Lieberkühn, who, as before stated, described and figured this embryo in 1859 ('Archiv f. Anat. u. Phys.' p. 379, pl. ix. fig. 7), and Schmidt, who did the same in 1866 ('Spong. adriat. Meeres,' 2nd suppl. p. 5, pl. i. fig. 6), have considered the truncated, unciliated end the *hinder* portion; yet Häckel (in 1870), in opposition to these distinguished spongologists, has turned it upside down ('Die Kalkschwämme,' vol. i. pp. 336–8, Atlas, pl. xiii. figs. 5 & 6, and pl. xx. figs. 3 & 4 &c.).

Now, supposing that Häckel had not studied the development of the ovum into the perfect sponge in the siliceous species, and therefore had not the analogy to go by that we have, but had really seen the embryo of the calcareous sponges after it had left the parent in a natural way (that is, not by forced expulsion under the tearing to pieces of the body of the parent on a slide, but, by cutting off a branch of the *Ptilota* on which the sponge might be growing, and treating it in the way above mentioned), he ought to have observed that its progression was with the pointed or ciliated end (Pl. XX. fig. 13, *a*) foremost, that the cilia of the ectoderm (fig. 13, *b*) were thus more or less inclined towards the posterior or truncated unciliated end (fig. 13, *d*), and that it attached itself to the glass vessel and foreign bodies by this end; under which circumstances it seems to me that he might have at once concluded that, on becoming fixed, the bunch of large cells at the posterior end (fig. 13, *d*), being *without* cilia and endowed with a plastic nature and prehensile property, would be more likely to serve as a temporary *rooting* development than the upper or *ciliated* end, which thus appears to be at first entirely developed for locomotion, as the retraction of the cilia proves when it becomes fixed or stationary.

But with the analogy of the development of the embryo of the siliceous sponges this does not seem to admit of doubt.

If Häckel followed the development of the *embryo* of the calcareous sponges (which he terms "*gastrula*") through its transformations into the perfect sponge, he has given no illustrations of it in his work. Nothing of this kind is to be found in his 'Atlas' between the figure of the embryo (Taf. xxx. figs. 8 & 9 &c.) and the coloured diagrams (Taf. xx. figs. 3 & 4 &c.) which are intended to illustrate his theory; while his figures of the embryo of the calcareous sponges that he examined at Lesina (*op. cit.* Atlas, Taf. xxx. figs. 8 & 9 &c.) bear upon them a feature which, although it may suit Häckel's theory, is not in accordance with fact. I allude to the direction of the cilia, which are all made to flow "backwards" or *from* the obtuse or unciliated end, as if the embryo progressed with this end foremost. (Lieberkühn has done the same; but Schmidt not so, *l. c.*) I need hardly add that this is not the case (Pl. XX. figs. 13 & 15). Living cilia always lie in the opposite direction to that of the progress of the body of which they are the locomotive organs.

What position these cilia may occasionally have when the embryo is obtained by forced expulsion after the manner mentioned, I am not prepared to say, beyond the fact that, even in such immature embryos, I have never seen the cilia in the position figured by Häckel. When, therefore, I stated in the 'Annals' (1874, vol. xiv. p. 98) that "Häckel's illustrations could hardly be too highly praised" &c., I had merely studied the embryo of the calcareous sponges by scratching it out on a slide in sea-water from a *Grantia compressa* which was then pregnant with them, not having seen until lately (that is, since I have followed the development of the ovule in the siliceous sponges) the necessity of viewing it as it leaves the parent in the *natural way*. Hence my opinion of the correctness of Häckel's illustrations has undergone much modification; for, beautiful as they must be admitted to be in an artistic point of view, I cannot now help stating respecting them, that "pictures are not always proofs!"

Moreover, by accepting Häckel's views at that time, I took for the endoderm of the embryo in the calcareous sponges that which (now I have had the opportunity of following the development of the embryo in the siliceous sponges) must, I think, be regarded as a temporary production of *rooting cells* (Pl. XX. figs. 13 & 15, *d*). I allude to the bunch of large cells at the posterior extremity, which originally comes from the centre of the embryo (see that of *Halisarca lobularis*, Pl. XX. fig. 12, *d*), and has, as before stated, the real ectoderm (in which the spicules and skeleton-structure, together with the spongozoa and ampullaceous sacs, are developed) *between* it and the ectodermal layer.

That these naked plastic cells should be engaged in rooting the embryo, and not the monociliated cells of the ectodermal layer, which has for its part at the commencement the locomotion alone of the embryo, seems to me to be by far the most probable conclusion, even if we had not the fact analogically demonstrated by the development of the embryo in *Halichondria simulans*.

As regards the cavity presented by the purse or bottle-like forms of the calcareous sponges, ex. gr. *Grantia compressa*, *Grantia ciliata*, &c., called by Dr. Bowerbank the "cloaca," into which the excretory canals empty themselves, this is nothing more than the dilated extremity of the excretory canal-system modified, and as common in the tubular or hollow digital forms of the siliceous sponges as in the calcareous ones; while the more common form, in which the excretory canal-system is accompanied by no such cloacal termination, renders this structure in the calcareous sponge *Leuconia nivea* &c., identical with that of the sessile spreading form of *Halichondria simulans*.

Thus, when we consider the resemblance in form that exists between the embryo of the calcareous and that of the siliceous sponges, ex. gr. *Halichondria simulans*, and that the papilla at the end of the latter becomes the vent of its excretory canal-system, which in form is identical with the excretory canal-system of the calcareous sponge *Leuconia nivea*, and, but for its presenting the purse-like tubular modification in *Grantia compressa*, is in the latter equally identical, it is difficult to conceive that in the embryo of the calcareous sponges this system is developed in any way different from that in the embryo of the siliceous sponges.

How the excretory canal-system is produced I am not prepared to say. It may be by an inversion or extension inwards of the ectodermal layer. But whatever this may be, to reverse the embryo in the calcareous sponges for this purpose, as done by Häckel, seems to me to be utterly unsupported. I have already stated that the microscopic minuteness of the embryo of the calcareous sponges, when it issues from the parent, precludes the possibility of following it to its place of settlement previous to further development, as may be done with that of the embryo of *Halichondria simulans*, which, from its great size and opaque white colour, may be seen even with the unassisted eye. But the facts of the great resemblance between the two, and their habit of attaching themselves now and then to the bottom of the glass vessel or to foreign objects by the truncated or *un*ciliated end while in locomotion, and the latter having been actually seen to fix itself by the truncated end for further development, while the subsequent developments are the same in both cases (that is, into the respective parent structures), render it more than probable that the settling down and disappearance of the cilia, which is the *only* point in the development of the calcareous sponges that has not been observed, is also the same as that of the siliceous sponges.

Since the above was written, I have seen a short article, with illustrations, on the development of the embryo of the Calcispongiæ by E. Metschnikoff, in Siebold and Kölliker's 'Zeitschrift für wissensch. Zoologie' (Band xxiv., erstes Heft, p. 1, Taf. i., published on the 12th of February last), wherein I am pleased to find that the author has inserted what Häckel has omitted, and that my own views and figures on this subject have been anticipated, but so much more sequentially and completely given that they are of far more consequence to the student than my own. Not less so the second part of the article, which is devoted to a sharp criticism on Häckel's statements in 'Die Kalkschwämme,' and, coming from such high and practical authority as Metschnikoff, merits a confidence which even the uninspired Historian of the Creation fails to command; that is, it is *res non verba*!

From the almost identity of Metschnikoff's single figure of a "*Reniera*-Larve," obtained in the Crimea, with mine of *Halichondria simulans* = *Reniera palmata*, Sdt. (?), found here, it is just possible that both came from the same species of sponge.

Embryos of Halisarca lobularis.

Returning to *Halisarca lobularis*, there are yet two figures of the embryo of this sponge among the illustrations which, as before stated, I have purposely omitted to notice, since at the time of describing the development of the ovum in this sponge up to the ultimate degree of duplicative subdivision, or to the end of the second period of development, it was desirable not to go further.

The first of these figures (Pl. XX. fig. 11) represents the embryo at that stage in which the spheroidal ovum has become elongated into an ovoid shape, covered throughout by the ciliated ectoderm (fig. 11, *a*), whose cilia in the anterior two thirds (fig. 11, *b*) are much longer than those of the posterior one, and, although still somewhat inclined backwards, stand out from the surface in a bristly form (much like the cilia on some of the embryos of the calcareous sponges), contrasting strongly with those which cover the posterior third (fig. 11, *c*), which, on the other hand, appear much shorter, or, at all events, are much more inclined backwards, and thus lie closer together, ending in a kind of tuft a little longer than the rest, where they meet each other from opposite directions at the posterior extremity of the body (fig. 11, *d*). The embryo is now coloured red-violet, like that of the spongozoa in the parent, but most strongly over the posterior third, where the colour-margin appears to be somewhat pressed inwards laterally, and thus, by its form and deeper colour, distinctly marks this portion.

The other figure (12) represents another embryo (of which there were forty or fifty swimming about the glass in which the parent sponge was placed, for nearly a fortnight), of the same kind as the foregoing, but with a papillary eminence on the anterior extremity separating the cilia in front (fig. 12, *b*), and a group of large *un*ciliated cells projecting from behind in the midst of the "tuft" of longer cilia just mentioned (fig. 12, *c*). By lowering the focus, these cells were observed to be part of a group filling the centre of the embryo (fig. 12, *d*), after the manner of those presented by the earlier stages of the embryo of the calcareous sponges, and indicating in the same way the existence of a body-substance between them and the ectodermal layer. Like the embryos of the other sponges, these swim with the pointed end foremost and present a rotatory motion from left to right, indicating, as before stated, that the cilia are arranged over the body in a spiral direction. Of course such cilia always lie, as before stated, in the opposite direction to the progress of the body of which they are the locomotive organs—that is, backwards.

All the embryos had left the parent naturally, and averaged in size about 16 by 10-1800ths inch in their greatest diameters, or about 1-112th inch long—therefore much smaller than the embryo of *Halichondria simulans*, and much larger than that of *Grantia compressa*. The most remarkable feature about them is their deep red-violet colour; and although they remained alive and active for several days, as before stated, and I placed objects in the glass vessel for them to become fixed upon, this was not successful even in a single instance; hence I had not the opportunity of following their further development as in *Halichondria simulans*.

Comparison of the Development of the Sponge developed from the embryo of Halichondria simulans *with that of* Spongilla *developed from the seed-like body.*

On comparing the development of the sponge from the embryo of *Halichondria simulans* after it has become stationary or fixed (viz. the Fourth Period) with that developed from the seed-like body of *Spongilla*, one cannot help being struck with the facts that the appearance of the latter at first in an opaque unciliated mass, as it issues from the hiliform opening of the seed-like body, followed by the extension of a homogeneous-looking sarcode, denticulated at the margin like the pseudopodia of an *Amœba*, then the projection from this substance of spicules which thus raise and angulate the previously round surface, afterwards the shrinking inwards of the opaque or parenchymatous portion while the dermal layer is still left upon the points of the spicules in the form of the "investing membrane" and its "cavity" (the intermarginal cavity of Bowerbank) beneath, together with the exit from the seed-like body of its transparent spherical germiniferous cells *entire* and their subsequent appearance in the general mass as ampullaceous sacs ('Annals,' 1849 & 1857 respectively, *locc. citt.*), are all identical with what we have observed in the development of the embryo of *Halichondria simulans* during the Fourth Period. But here the identification ends, inasmuch as there are no spicules already formed in the seed-like body as there are in the embryo of *Halichondria simulans* even before the latter leaves the parent, while the contents of this body chiefly consist of the transparent spherical cells, which already contain the cell-germs of the spongozoa, preparatory to their passing into the form of the ampullaceous sac the moment they get into the general mass which grows out from the hiliform opening of the seed-like body; so that, in fact, while the spicules are already developed at a very early period in the embryo of *Halichondria simulans*, and the groups of spongozoa, which finally form the ampullaceous sacs, do not appear before the sponge is fully developed, the reverse is the case with the sponge-substance which issues from the seed-like body of *Spongilla*, where at first there are no spicules present, but the ampullaceous sacs are already foreshadowed by the transparent spherical germiniferous cells, each of which measures at this time 1-800th inch in diameter.

Now it so happens that in the embryo of *Halichondria simulans* there are many cells in the body-substance about 1-3000th inch in diameter, which, being evidently filled with cellulæ (Pl. XXI. figs. 21, *c*, & 22, *c*), I have before suggested might be the early forms of the ampullaceous sacs; and if this be the case, then these sacs are also here foreshadowed, which would account for their great number and full development in the perfected sponge into which the embryo of the species ultimately passes.

Again, should this be right, and we have thus, in the embryo of *Halichondria simulans*, something analogous to the transparent cells in the seed-like body of *Spongilla*, we shall have to regard the latter as a single ovum, modified in form to meet the circumstances of the case (that is, for preserving the germinative or reproductive substance by a horn-like covering during the dry weather); whereas the "swarm-spore" of *Spongilla*, first described and figured by Lieberkühn ('Archiv f. Anat. u. Phys.' 1856, pl. xv. fig. 35), being like the soft ciliated embryo of *Halichondria simulans*, would be for immediate reproduction.

On referring to the sizes of the seed-like bodies in my description of the five species of freshwater sponges in the island of Bombay ('Annals,' 1849, vol. iv. p. 1), I observe that the diameter of the largest spheroidal form is the same as the long diameter of the embryo of *Halichondria simulans*, viz. about 1-30th of an inch, while that of the other species is much smaller, and that of *Spongilla plumosa*, whose seed-like body is elliptical, is, in its largest diameter, 1-22nd part of an inch. Again, the embryos of the marine sponges *Tethya cranium* and *Tethya zetlandica*, which I described and figured (*loc. cit.* pl. xxii. figs. 4 & 10), were, before leaving the parent, respectively 1-24th and 1-16th of an inch in diameter.

If, then, the contents of the embryo of *Halichondria simulans* can contain and develop a great number of ampullaceous sacs *at once*, we do not wonder that the seed-like body of *Spongilla* should contain a great number of transparent spherical germiniferous cells which also *at once* pass into the young *Spongilla* and become ampullaceous sacs—only that they are in the latter developed in advance of the spicules, while in the former the spicules are developed in advance of them.

Thus, then, my conclusion respecting the "real import" of the seed-like body of *Spongilla*, at the end of my observations on the subject ('Annals,' 1874, vol. xiv. p. 100)—viz. that it was tantamount to an ovary of which each transparent spherical germiniferous cell was equal to an ovum, and thus immediately passed into an ampullaceous sac as the new sponge-substance issued from the seed-like body in the form of the young *Spongilla*—becomes untenable, as well as the conclusion that "Häckel's gastrula developed *in situ*" was only equal to one of these ampullaceous sacs.

I must therefore fall back upon the term "ovum" for the seed-like body of *Spongilla*, as it was called in my paper "On the Identity in Structure and Composition of the so-called Seed-like Body of *Spongilla* with the Winter-egg of the Bryozoa" ('Annals,' 1859, vol. iii. p. 331, pl. viii.), as first suggested by Meyen (Microscop. Journ. vol. i. p. 42, *ap.* Johnston, footnote p. 154, B. S. 1842), and view it now again as a *simple* ovum with modified form to meet the requirements of the case—thus equal, as a whole and after this manner *only*, to the "gastrula" of Häckel—that is, our embryo of *Grantia compressa.*

Lastly, it becomes a matter for consideration what the nature of the perfectly developed sponge is—if, in the end, the single ovum comes out with a great number of ampullaceous sacs, composed of a still greater number of spongozoa. And this brings us back to the point from which we started, viz. where we found the earliest appearance of the ovum but a little larger than a single spongozoon (Pl. XX. figs. 2, *a*, & 3, *a*). Thence the question whether this ovum was previously put forth singly, as the product of a single spongozoon, or in plurality, as the product of its ovary—and, finally, the question whether the whole of the perfected sponge has not been evolved from an ovule probably much smaller, in the first instance, than the spongozoon itself. If so, then the spongozoon (Pl. XX. fig. 2, *a*). must, *ipso facto*, be considered the expression of the Sponge, in so far that it represents the stomach and the generative apparatus aided by the rest of the body, which thus becomes analogous to such accessories in the highest animals, although the *plurality* of spongozoa scattered through the mass may more nearly resemble in this respect the flower-buds of a plant. Such, then, appears to be the nature of a sponge.

Not only do the seed-like bodies of *Spongilla* vary in size in the different species, but, as may be seen by my illustrations, this is strikingly the case with the embryos respectively of *Halisarca lobularis*, *Grantia compressa*, and *Halichondria simulans* among the marine sponges, while the size of the embryo itself also differs greatly in the same individual. Lastly, the constitution of the embryo, its colour, and ultimate development also differ in different species; so that here, as well as everywhere else in connexion with the sponges, their protean character is sustained by varieties and peculiarities which must necessitate the examination of every species from the ovule to the parent before we can hope for a satisfactory generalization.

Having now premised the development of the sponge—which, but for the pecuniary aid (from the Government grant) kindly given to me by the Royal Society, I should never have accomplished)—I hope to put forth that classification of the sponges generally which has chiefly resulted from my examination and arrangement of the collection in the British Museum.

EXPLANATION OF THE PLATES.

N.B. All the figures in Plates XX. and XXI., with the exception of the first and a little minor detail in figs. 14 & 17 which will be otherwise mentioned, are drawn, as near as possible, to the scale of 1-12th to 1-1800th of an inch, in order that their relative sizes may be at once appreciated.

The first figure, although drawn to a much smaller scale, viz. 1-48th to 1-1800th of an inch, has its detail also drawn to this scale.

Plate XX.

Fig. 1. *Halisarca lobularis*, Schmidt, vertical section (diagrammatic) of an oviparous portion, with detail relatively magnified to the scale of 1-48th to 1-1800th of an inch or thereabouts: *a a*, sponge reduced to a thin layer, covering a heap of ova in different stages of development; *b b*, ova; *c c*, surface of the rock on which they rest; *d*, ampullaceous sacs, or groups of spongozoa, of a red-violet colour; *e e*, layer of cilia on the surface of the sponge; *f*, osculum or vent, provided with a sphinctral diaphragm of sarcode; *g*, sac-like membrane common to the heap of ova, opening (?) at the vent; *h h h*, spheroidal ova in different stages of development, showing the segmentation of the yelk; *i*, elliptical embryo, whose ciliated ectoderm is marked by the dotted line; *k*, its capsule.

N.B. Each ovum, although spheroidal, and, for convenience, represented without capsule, has nevertheless its proper one, and gradually passes from this form into the elliptical one of the embryo.

Fig. 2. The same, vertical section of the ampullaceous sac, showing the position of the pavement-layer of spongozoa: *a*, separate spongozoon. Scale 1-12th to 1-1800th of an inch.

Fig. 3. The same, ova at an early period: *a*, ovum when first recognizable, in a passive or spheroidal form, 1-3000th of an inch in diameter; *b*, ovum when further advanced, viz. 6-6000ths inch in diameter, showing distinctly the yelk, nucleus, nucleolus, and germinal vesicle, together with the polymorphic locomotive envelope *c*.

Fig. 4. The same, ovum in which the yelk has undergone the first duplicative division, now 31-6000ths of an inch in diameter: *a*, capsule; *b*, membrane of the yelk; *c*, line dividing the yelk into two equal parts or cells; *d d*, nuclei.

Figs. 5, 6, 7, 8, 9, & 10. The same, showing the second, third, fourth, fifth, sixth, and seventh degrees of duplicative subdivision in the ovum respectively. The nuclei are omitted in all of these for reasons mentioned in the text.

Fig. 11. The same, embryo: *a*, ectodermal layer, represented by the dots over the surface of the body; *b*, long cilia; *c*, short cilia; *d*, tuft at posterior extremity.

N.B. After this the monociliated cells which compose the ectoderm will be *only* represented by the dotted line at the margin of the embryo.

Fig. 12. The same, embryo more advanced: *a*, ectodermal layer; *b*, papillary projection at the anterior extremity; *c*, group of root-cells at the posterior extremity, produced from *d*, the same kind of cells in the centre of the embryo.

Fig. 13. *Grantia compressa*, embryo as it issues from the parent. Assumed vertical section, showing: *a*, the conical form of its body; *b*, monociliated ectoderm; *c*, opposite direction of the cilia at the apex; *d*, group of root-cells at the posterior extremity; *e*, central cavity; *f*, line indicating the inner boundary of the crust of monociliated cells on the surface, or ectoderm.

Fig. 14. The same, embryo under pressure of a glass-cover, showing the same as the foregoing, but with:—*a*, a conical truncated form of the central cavity; *b*, specimen of cells and granules of the body between the central cavity and the ectoderm, magnified on a larger scale, viz. 1-24th to 1-6000th of an inch; and *c*, specimen of the root-cell on the same scale, showing the nucleus and nucleolus.

Fig. 15. The same, embryo slightly more advanced (?). Assumed vertical section, showing the same as fig. 12, but with the central cavity (*a*) larger and elliptical in shape.

Fig. 16. The same, embryo at the commencement of the Fourth Period of development, after it has become fixed, the cilia withdrawn, and a few of the triradiate spicules have been formed: *a*, dermal membrane or ectoderm; *b*, triradiate spicules; *c*, sarcode charged with cells and granules, filling the interior.

Fig. 17. The same, embryo more advanced, where the triradiate spicules have increased in number and the club-shaped surface-spicules have begun to appear and push outward the dermal membrane: *a*, dermal membrane or ectoderm; *b*, triradiate spicules; *c c*, club-shaped surface-spicules; *d d*, sarcode charged with cells and granules; *e*, specimen of the "cells" of the body on a larger scale, showing that they are spongozoa, and come from fragments of the ampullaceous sacs; *f*, monociliated spongozoon; *g*, spongozoa putting forth pseudopodial processes.

Fig. 18. Young individual of *Grantia compressa* only a little larger than the embryo from which it has been developed: *a*, body; *b*, triradiate spicules; *c*, club-shaped surface-spicules.

Fig. 19. Young individual of *Grantia compressa* taken from a branch of *Ptilota sericea*, on which old and young specimens abounded: *a*, *b*, *c*, the same as before; *d*, foreign body to which it is attached.

Fig. 20. Magnified view of the club-shaped or characteristic form of surface-spicule of the same, to show its form in figs. 18 & 19.

Plate XXI.

Fig. 21. *Halichondria simulans*, Johnston, active locomotive embryo on issuing from the parent naturally: *a*, body; *b*, spicules, cells, and granules with which the sarcode of the body is charged; *c*, cells with cellulæ in their interior, either undergoing endogenous cell-formation or foreshadowing the ampullaceous sacs; *d*, monociliated layer of ectodermal cells; *e*, papillary projection at the anterior extremity of the body not covered with cilia; *f*, root-cells forming a brownish-yellow ring round the truncated or posterior end, also not covered with cilia; *g*, ring of large long cilia along the line of demarcation between the root-cells and the body; *h*, arrow showing the direction in which the embryo swims; *i*, arrow showing the direction in which the body rotates.

N.B. The arrows in this figure also represent the directions of progress and rotation respectively in the embryos of *Halisarca lobularis* and *Grantia compressa*.

***Fig.* 22.** The same, active locomotive embryo a day or two after issuing from the parent, showing the shortening and widening which take place previous to its becoming stationary; also the more general form of the brownish-yellow mass of root-cells (*a*), and an eccentric position of the papilla at the apex (*b*). Other detail the same as in the foregoing figure.

***Fig.* 23.** The same, vertical section of the ampullaceous sac of adult, showing its globular form and the position of its pavimental lining of monociliated spongozoa: *a*, separate spongozoon.

***Fig.* 24.** The same, specimen of the spicule of adult.

***Fig.* 25.** *Esperia ægagropila*, Cart. (variety, see p. 333. *Loc.* Budleigh-Salterton), spheroidal form of embryo, obtained by forcible expulsion from the parent, showing that it is encapsuled, ciliated, and composed internally of sarcode charged with cells of different sizes, granules, and *all* the forms of spicules peculiar to the species: *a*, cells bearing cellulæ; *b*, skeleton-spicules; *c*, *d*, *e*, forms of flesh-spicules respectively, viz. anchorate, bihamate, and tricurvate; *f*, monociliated layer of the surface or ectoderm; *g*, capsule.

***Fig.* 26.** The same, tricurvate spicule from the substance of the adult, showing its linear, almost straight form, and entire enclosure in a mother cell: *a*, spicule; *b*, mother cell; *c*, nucleus of cell.

Fig.* 27.** *Microciona armata*, Bk. (?) (see description p. 457), tricurvate spicule, curved suddenly in the centre, elongated at the ends which are spined: *a*, spicule; *b*, mother cell; *c*, nucleus; ***d, more magnified view of spined extremity.

Plate XXII.

N.B. All the figures in this Plate, with the exception of the last, are drawn to the scale of 1-12th to 1-830th of an inch—that is, to a scale a little less than half the size of the foregoing.

***Fig.* 28.** *Halichondria simulans*, embryo at the commencement of the fourth period of development, showing that it has become fixed and attached by the posterior extremity to the surface of the pebble; the body somewhat contracted, and the cilia of the ectodermal cells withdrawn, while those forming a ring round the base are still moving languidly: *a*, body; *b*, papillary eminence at the apex; *c*, ring of large cilia and expanded base (the latter formed by the root-cells?); *d*, surface of pebble; *e*, position of the spicules in the embryo.

***Fig.* 29.** The same, more advanced stage, showing the expansion of the ectoderm laterally into a kind of denticulated foot (*a a*), and the opaque body (*b*) in the centre erect and conical, with the papilla, now become a depression, at the apex (*c*). Lateral view.

***Fig.* 30.** The same, still more advanced stage, showing that the smooth surface has become monticular or angulated (*a*), and the aperture of the vent or osculum more prominent and excavated (*b*). Upper view.

***Fig.* 31.** The same, embryo, lateral view, but with the foot a little retracted.

Fig. 32. The same, more advanced stage, showing that the opaque portion or body has withdrawn itself within the dermal membrane or ectoderm, leaving the latter suspended on spicules, which project in bundles from the former, and thus producing the angulated surface first seen in fig. 30, now extend nakedly a little beyond it, leaving a cavity or open interval between it and the opaque body: *a a*, opaque portion or body; *b b*, bundles of spicules; *c c*, dermal membrane or ectoderm; *d d*, its cavity.

Compare this and the following figures with my illustrations to the paper "On the Ultimate Structure of *Spongilla*" ('Annals,' 1857, vol. xx. p. 21, plate i.), in which it will be seen that this dermal membrane is my "investing membrane," and the interval between it and the opaque body its "cavity," in *Spongilla*, also that the pores are situated in the former.

Fig. 33. The same, lateral view: *a*, vent, osculum, or termination of the end of the excretory branched canal-system, now fully developed.

Fig. 34. The same, embryo torn to pieces in sea-water on a glass slide, and placed under $\frac{1}{4}$-inch compound power; showing that the skeleton-structure, now consisting of the spicules bundled together and held in position by cornified sarcode, is fully developed into the form of that of the parent, the dermal membrane or sarcode, and also the spongozoa and ampullaceous sacs: *a a*, skeleton-structure; *b b*, sarcode of the opaque or parenchymatous body charged with fully developed ampullaceous sacs, separate spongozoa, cells of different sizes below these, and granules; *c c*, ampullaceous sacs; *d*, spongozoon separate; *e e*, dermal or "investing" membrane; *f f*, its cavity; *g*, more magnified view of monociliated spongozoa.

LI.—*Description of a new* Helix *from Southern India.* By W. T. Blanford, F.R.S.

An immature specimen of a very fine species of snail allied to *Hemiplecta basileus* (Bs.) was sent to me some years since by Colonel Beddome, to whom we owe so many discoveries amongst the numerous and peculiar molluscan forms inhabiting the forests of the Southern Indian hill-ranges. I named the species after the discoverer, but on further examination resolved not to describe it, as the characters taken from the young shell approached so closely to those of *H. basileus* and *H. Chenui* that there must have been difficulty in recognizing it. Recently Colonel Beddome has shown me a full-grown specimen, which he has presented to the British Museum; and from this I have taken the following description:—

Hemiplecta Beddomei, sp. n.

H. testa aperte perforata, convexo-depressa, tenuiuscula, oblique striata lineisque impressis spiralibus decussata, sulcis brevibus obliquis subspiralibus rugata; subtus læviore, nitidula, striis radiantibus sulcisque parvis subspiralibus decussata; albido-cornea, fascia lata fusco-castanea infra peripheriam cincta, epidermide fulva induta; spira convexa, apice perobtuso, sutura lineari, antice vix impressa; anfr. $4\frac{1}{2}$ planiusculis, sensim accrescentibus, ultimo antice haud descendente, ad peripheriam obtuse angulato, subtus convexo; apertura obliqua, subovato-lunata, intus opalina, fascia lata castanea infra peripheriam conspicua; peristomate recto, tenui, ad umbilicum breviter reflexo. Diam. maj. 50 millim., minor 41, axis 24; apertura 27·5 lata, 21·5 oblique alta.

Hab. ad latus occidentale montium in provincia 'Travancore' dicta, Indiæ australis.

This shell perhaps resembles the Ceylonese *H. Chenui* more than any Indian shell; but it is much more openly perforate, the aperture somewhat differently shaped, and the sculpture, though very similar, shows marked distinctions; the shell is larger and far more angulate at the periphery, especially near the mouth.

From the young shell of *H. basileus* the present form may be recognized by its very different sculpture, its much shorter axis and lower spire, by the last whorl being far less inflated below, and consequently by the lower margin of the peristome being less convex; it is a much thinner shell, and the coloration is much browner.

The sculpture is peculiar: the striæ of growth are crossed by impressed spiral lines, and by short, shallow, oblique furrows at right angles to the striæ, and meeting the spiral lines at an acute angle.

The locality at which alone this shell has been found is south of Peermede and on the west side of the Travancore hills, in Southern India.

LII.—*Notes on the Ægeriidæ, with Descriptions of new Genera and Species.* By Arthur Gardiner Butler, F.L.S., F.Z.S., Senior Assistant, Zoological Department, British Museum.

Ægeria, Fabr.

Dr. Staudinger, in his 'Catalog der Lepidopteren' (1871), has omitted Walker's species, *Æ. agathiformis*, Cat. Lep. Het. viii. p. 34. n. 54 (1856). Even supposing this species to be identical with any other previously described, it ought not to have been left out of a professedly complete catalogue of European Lepidoptera; he has also omitted to place *Æ. agri-*

liformis, Walker, *l. c.* p. 16. n. 7, as a synonym of *Æ. anthraciformis* of Rambur.

Æ. pleciæformis and *Æ. emphytiformis* of Walker appear to me to be better placed in the genus *Tarsa*, the antennæ being much more pectinated than in the other species of the genus.

Æ. tryphoniformis, *Æ. plectisciformis*, and *Æ. ischniformis* (all from Pará only) are identical.

Æ. porizoniformis comes only from Pará; specimens quoted from Tapajos and Villa Nova are referable to distinct species.

Æ. panurgiformis occurs at Santarem, Tapajos, and Villa Nova, but not at Pará, specimens quoted from the latter locality being referable to distinct species.

Æ. leiæformis may be referred to the genus *Tinthia* of Walker.

Æ. cryptiformis might be placed in *Sannina* of Walker, of which *Æ. exitiosa*, Say (*uroceriformis*, Walk.), is the type.

Æ. crassicornis, Walker, Lep. Het. Suppl. i. p. 7 (1864), would be better placed in *Sincara* of Walker; it differs, however, from the type, in its tufted hind legs, which (unless a sexual character) would entitle it to be ranked as the type of a new genus.

Æ. cupreipennis would be better placed in *Tinthia*, with which it agrees structurally.

Æ. gravis and *Æ. bicincta* are referable to the section *Sciapteron*, considered by Staudinger to be a distinct genus.

Ægeria modesta, n. sp.

Wings above hyaline; veins, outer margin, and fringes black-brown; primaries rosy-tinted, with dark green costal margin; inner margin coppery brown; discoidal cell brown: head black, with greenish reflections; antennæ black above, ferruginous below; palpi testaceous, with blackish central line above; eyes bordered internally by a silvery white streak: thorax above purplish black, below steel-blue, spotted and streaked at the sides with gold; femora of legs greenish steel-colour, tibiæ of first pair blackish externally, golden internally, of second pair dark greenish, terminating in three golden spines, of hind pair dark purplish blue above, stramineous, banded with purple below; two central and three terminal golden spines; tarsi black above, golden below: abdomen above uniform steel-colour, below testaceous; anus with golden tuft: wings below with the dark margins replaced by golden cupreous.

Expanse of wings 17 millimetres; length of body 9 millimetres.

Espiritu Santo (*Higgins*). Type, B.M.

Not nearly allied to any other species; perhaps best placed near *Æ. unicolor*, Walk.

Ægeria deceptura, n. sp.

Wings above hyaline, veins black; primaries with costal margin purplish black; inner margin, a band crossing the wing at end of cell, and a broad outer marginal border bronzy brown; secondaries with a linear bronzy brown marginal border; fringe pale brown: head above black, crest green, below silvery white; palpi creamy white, ferruginous towards the tips; antennæ clay-coloured, club black: thorax above dark green; pterygodes edged internally with gold, below shining cream-coloured; femora of first pair of legs cream-coloured (tibiæ and tarsi ?), of second and third pairs steel-colour, varied with purple; tibiæ and tarsi of second pair cream-coloured, of third pair purplish blue, banded with cream-colour; spines as in preceding species, but cream-coloured: abdomen above and below dark green, encircled by three equidistant creamy-golden bands, and between them by two indistinct coppery bands; an oblique lateral golden streak at base; anal tuft brown, purplish in some lights, tipped with white at the sides.

Expanse of wings 16 millimetres; length of body 9 millimetres.

Santa Marta (*Bouchard*). Type, B.M.

Allied to *Æ. porizoniformis*, Walk.

The *Æ. basalis* (♀) of Walker, from Ega, is a distinct species, and probably referable to his genus *Sincara*, the antennæ being very short and thick and the abdomen distinctly fusiform and differently coloured from that of the male; but, as we have at present only one example of each sex, I hesitate to separate them generically; I shall therefore content myself with proposing for the female the name of *Æ. confusa.*

Euryphrissa, n. gen.

Secondary wings and body broader than in *Ægeria*; second pair of legs densely clothed with long scales, but scarcely plumose, with two robust long diverging terminal spines; hind pair of legs rather short; tibiæ densely clothed with long scales, elongated beyond the middle on the outer margin into a large wide brush 2 millimetres in length; two long central and two shorter terminal spines.

Type *Ægeria plumipes*, Walker, from Ega.

TARSOPODA, n. gen.

Wings with fringe longer than in *Ægeria*; palpi more porrect; tibiæ and tarsi of second and third pairs of legs densely clothed to the end with broad compressed fan-shaped scale-plumes.

Type *Tarsopoda remipes*, n. sp.

Wings above hyaline, veins black; primaries rosy-tinted, with costal margin purplish black; a band crossing the wing at end of cell and a linear outer and inner marginal border bronzy brown; fringe pale brown; secondaries with a linear outer marginal border and fringe as in primaries: body above and below bronzy brown; palpi and collar white; coxæ of front pair of legs steel-blue; femora, tibiæ, and tarsi missing; femora of second and third pairs of legs clay-colour, with steel-blue reflections; tibiæ steel-blue at base, clothed with a dense brush of bronzy brown hair-scales tipped with white at the centre of the joint, and broadly golden yellow at termination of tibia in hind leg; tarsus of second pair steel-blue at base, densely clothed with a compressed tuft of long bronzy brown hair-scales, barred with white at base; tarsi of hind legs with a similar tuft of hair-scales, but golden yellow at base: wings below with all the dark portions bronzy golden.

Expanse of wings 15 millimetres; length of body 8 millimetres.

Villa Nova (*Bates*). Type, B.M.

MELITTIA, Hübner.
(*Eumallopoda*, Wallengren.)

Melittia latimargo, n. sp.

Melittia cyaneifera (part.), Walker, Lep. Het. viii. p. 67. n. 4 (1856).

Wings hyaline, nervures black; primaries above with the costa, a band crossing the wing at the end of the cell, a broad apical-marginal border, and the inner margin black-brown; fringe pale brown: secondaries with a linear black-brown external border; fringe pale brown; interno-basal area clothed with greenish testaceous scales: body above clay-colour, becoming ochraceous towards the head; antennæ blackish above, ferruginous below: pectus and first pair of legs ochreous; second pair brown, varied internally with ochraceous; femora of hind pair testaceous; tibiæ and tarsi clothed with long remiform brown scales, varied above by a few red hair-scales; tibiæ below with a patch of pale greenish scales and two terminal cream-tipped black-brown tufts.

Expanse of wings 40 millimetres; length of body 20 millimetres.

Rio Janeiro (*Stevens*). Type, B.M.

The above differs from *M. cyaneifera* in its greater size, clay-coloured body (that of *M. cyaneifera* being much browner), the entirely different colouring of the legs, the broader transverse band and outer border of primaries, and the absence of blue scales at the base of secondaries.

Melittia indica, n. sp.

Melittia bombyliformis (part.), Walker, Lep. Het. viii. p. 69. n. 8 (1856).

Differs from *M. bombyliformis* (which we have from Moulmein and Java) as follows:—Primaries with the margins black-brown, not varied with ferruginous; fringe darker; secondaries with abdominal area dark brown, speckled with pale greenish-blue scales; fringe darker: thorax more uniformly fulvous, palpi darker; front legs black-brown, testaceous internally; second pair black-brown, tibiæ varied with white below; third pair densely clothed with black-brown hair-scales, with two testaceous tufts below (slightly opaline at their extremities) and a few radiating testaceous and whitish hairs externally above; pectus and centre of venter testaceous.

Expanse of wings 33 millimetres; length of body 17 millimetres.

N. India (*James*). Type, B.M.

M. phorcus of Westwood is also clearly distinct from *M. bombyliformis.*

Melittia natalensis, n. sp.

Primaries above and below dark chocolate-brown; secondaries hyaline, the veins black; costa, outer margin, and fringe dark chocolate-brown; head and thorax above greenish testaceous; abdomen slaty brown, the segments margined with greenish-white scales; antennæ black above, with the external half of the club ferruginous, below ferruginous: palpi, pectus, front legs, and femora of second pair bright ochreous; tibiæ of second pair ferruginous, tarsi black; hind pair chocolate-brown, tibiæ clothed with long remiform scales, brown above, ferruginous on the external side and below, a few white scales below; tarsi fringed with white scales.

Expanse of wings 35 millimetres; length of body 17 millimetres.

Port Natal (*Higgins*). Two specimens, B.M.

Allied to, but very distinct from, *M. tibialis*, Fabr.

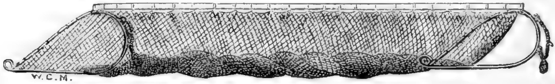
LIII.—*On the Invertebrate Marine Fauna and Fishes of St. Andrews.* By W. C. M'Intosh.

[Concluded from p. 349.]

Subkingdom *VERTEBRATA.*

Class PISCES.

Contrasted with the extreme shores of Britain the fish-fauna of St.-Andrews bay exhibits certain interesting differences, though of course its features are common to many other parts of the north-east coast. There are, for instance, no shoals of young wrasses (chiefly Jago's goldsinny) gliding amongst the seaweeds, or swarms of grey mullets, as in the tide-runs of the sandy flats and inland seas of the western shores; no large rock-fish (Ballan wrasse) hiding like dark shadows under the tangles, groups of black gobies between tide-marks, or of young congers breaking the border of the flowing tide into a seething expanse, as in the quiet bays of the southern parts—just as the "schulls" of glittering pilchards do on the surface of the open water. The curious *Hippocampi*, exquisite red mullets, and the splendid conger-fishing also belong to the latter region, together with the abundance of the smaller sharks in-shore. The sandy western shores of England are also distinguished by the greater variety of large Pleuronectidæ, and the frequent occurrence of red gurnards, angel-fishes, and spotted rays. The adjoining bay, moreover, does not present that richness of finny life—from the little bimaculated sucker nestling beside its ova in the hollows of the gigantic tangles to the fine cod and coal-fish of the Zetlandic seas, which also possess the rarer *Chimæra*. While it is thus vain to look for the vast variety or the gorgeous colours of the species which a few hours' fishing off the shores of Guernsey brings before the investigator, or for the plenitude of large forms which in the north soon fill the boat to overflowing, yet there is sufficient success to reward exertion, either in deep water or off the sea-margin. Good white and flat fish occur in the bay, the latter especially abounding on the sandy flats off the West Sands, which thus form a rich ground for the trawlers, who are for the most part strangers. The trawl in



common use (see accompanying figure) consists of a beam of wood about 28 feet long, borne on the top of the bulbous ends of two pear-shaped iron structures. A large bag-net is fixed to the apparatus, which is dragged behind the boat by ropes attached to the convex portion of the iron supports. The under surface of the latter is flattened, and the point of the apex (which is posterior) turned upwards—the whole thus forming a kind of subaqueous sledge, which glides over the sand and embraces in its progress every thing loose. Young coal-fishes occur all round the rocks and harbour; occasionally a sea-trout is captured off the former; sand-eels frequent the sand near low water; and the salmon-nets are often very productive. In the rock-pools swim hundreds of little two-spotted gobies, swarms of the beautifully coloured young of the lumpsucker, and strings of young sand-eels sport in the sunshine amongst the fringes of seaweeds like flashes of silvery light—affording with other littoral forms, such as shannies and blennies, ample food for the aquatic birds that frequent the beach.

The rarer forms include the lancelet, gar-fish, doree, opah, oar-fish, and bonito.

In the following list the arrangement adopted is that of Dr. A. Günther in his valuable and laborious 'Catalogue of Fishes in the British Museum.'

Subclass I. TELEOSTEI.

Order I. Acanthopterygii.

Fam. **Gasterosteidæ.**

Genus Gasterosteus, Artedi.

Gasterosteus aculeatus, Albert. Mag.; Günther, Catalogue of Fishes in the British Museum, vol. i. p. 2.

Frequent on the West Sands after storms.

Gasterosteus spinachia, L.; Gthr. *op. cit.* i. p. 7.

Abundant in the rock-pools.

Fam. **Sparidæ.**

Genus Pagellus, Cuv. & Val.

Pagellus centrodontus, De la Roche; Gthr. *op. cit.* i. p. 476.

Not uncommon in the bay.

Fam. **Triglidæ.**

Group *Cottina.*

Genus Cottus, Artedi.

Cottus scorpius, Bloch; Gthr. *op. cit.* ii. p. 159.

Common in the rock-pools. Small sucking-fishes, shrimps, *Terebellæ*, and fragments of green algæ occur in the stomach of this form.

Cottus bubalis, Euphrasen; Gthr. *op. cit.* ii. p. 164.

Frequent in the rock-pools. Distomes are common in this species.

Genus Trigla, Artedi.

Trigla pini, Bloch; Gthr. *op. cit.* ii. p. 199.

Occasionally procured in the bay.

Tigla hirundo, Bl.; Gthr. *op. cit.* ii. p. 202.

Rare. A single specimen occurs in the University Museum.

Trigla gurnardus, L.; Gthr. *op. cit.* ii. p. 205.

Abundant at all seasons.

Group *Cataphracti.*

Genus Agonus, Bl.

Agonus cataphractus, L.; Gthr. *op. cit.* ii. p. 211.

Fine specimens are common on the West Sands after storms.

Fam. **Trachinidæ.**

Group *Trachinina.*

Genus Trachinus (Artedi), Cuv.

Trachinus draco, L.; Gthr. *op. cit.* ii. p. 233.

Frequent on the West Sands after storms.

Trachinus vipera, Cuv. & Val.; Gthr. *op. cit.* ii. p. 236.

Not uncommon in the same locality, and brought in by the fishermen.

Fam. **Scombridæ.**

Group *Scombrina.*

Genus Scomber, Artedi.

Scomber scomber, L.; Gthr. *op. cit.* ii. p. 357.

Common.

Genus Thynnus, Cuv. & Val.

Thynnus pelamys, L.; Gthr. *op. cit.* ii. p. 364.

A fine specimen, about 3 feet long, was procured by Dr. Moir, of St. Andrews, from a salmon-net near the mouth of the Kenley Burn in July 1873, and described by Mr. R. Walker in the 'Scottish Naturalist' for January 1874.

Group *Cyttina.*

Genus Zeus (Artedi), Cuv.

Zeus faber, L.; Gthr. *op. cit.* ii. p. 393.

Rather rare.

Group *Coryphænina.*

Genus Brama (Schneid.), Risso.

Brama Raii, Bl.; Gthr. *op. cit.* ii. p. 408.

A specimen occurs in the University Museum.

Genus Lampris, Retzius.

Lampris luna, Retzius; Gthr. *op. cit.* ii. p. 416.

Rare. A single specimen from the bay exists in the University Museum.

Fam. **Carangidæ.**

Group *Carangina.*

Genus Trachurus, Cuv. & Val.

Trachurus trachurus, L.; Gthr. *op. cit.* ii. p. 419.

Not uncommon.

Fam. **Gobiidæ.**

Group *Gobiina.*

Genus Gobius, Artedi.

Gobius niger, L.; Gthr. *op. cit.* iii. p. 11.

Mr. Robert Walker states that he has found this species. It has not occurred in my collection.

Gobius Ruthensparri, Euphrasen; Gthr. *op. cit.* iii. p. 76.

Common in the rock-pools and in the stomachs of cod and haddock.

Group *Callionymina.*

Genus Callionymus, L.

Callionymus lyra, L.; Gthr. *op. cit.* iii. p. 139.

Common in deep water, and in the stomach of the cod.

Fam. **Discoboli.**

Group *Cyclopterina.*

Genus Cyclopterus, Artedi.

Cyclopterus lumpus, L.; Gthr. *op. cit.* iii. p. 155.

Frequent on the West Sands after storms, and occasionally in the stomach of the cod. The young abound in the rock-pools in autumn.

Group *Liparidina.*

Genus Liparis, Artedi.

Liparis vulgaris, Flem.; Gthr. *op. cit.* iii. p. 159.

Occasionally.

Liparis Montagui, Donov.; Gthr. *op. cit.* iii. p. 161.

Abundant in rock-pools, in the laminarian region, and in deeper water, as well as in the stomachs of cod and haddock.

Fam. **Pediculati.**

Genus Lophius, Artedi.

Lophius piscatorius, L.; Gthr. *op. cit.* iii. p. 179.

Common off the West Sands, and frequently captured in the salmon-nets. One of the specimens had acute pericarditis.

Fam. **Blenniidæ.**

Genus Anarrhichas, Artedi.

Anarrhichas lupus, L.; Gthr. *op. cit.* iii. p. 208.

Frequent in deep water. The stomach of this form contains fragments of *Echinus esculentus*, *Buccinum undatum*, *Trochi*, *Nassa incrassata*, *Natica*, *Mya*, starfishes, *Stenorhynchus rostratus*, and *Galathea.*

Genus Blennius, Artedi.

Blennius pholis, L.; Gthr. *op. cit.* iii. p. 226.

Abundant between tide-marks in moist crevices and rock-pools. Feeds on *Balani*, small littoral shells, and sessile-eyed crustaceans.

Genus Blenniops, Nilss.

Blenniops Ascanii, Walbaum; Gthr. *op. cit.* iii. p. 284.

Not uncommon in deep water, and occasionally in the stomach of the cod.

Genus Centronotus, Bl.

Centronotus gunellus, L.; Gthr. *op. cit.* iii. p. 285.

Abundant between tide-marks and on the West Sands after storms. The food of this form includes *Hippolyte*, sessile-eyed Crustacea, annelids, starfishes, and small Mollusca (*Rissoa*, *Skenea*, &c.).

Genus Zoarces, Cuv.

Zoarces viviparus, L.; Gthr. *op. cit.* iii. p. 295.

Not uncommon between tide-marks and on the West Sands after storms. Sessile-eyed Crustacea and small starfishes occur in its stomach; but in confinement it swallows its fellows.

Fam. **Trachypteridæ.**

Genus Regalecus, Brünn.

Regalecus Banksii, Cuv. & Val. (?); Gthr. *op. cit.* iii. p. 309.

An imperfect specimen, 7 feet 2 inches long, occurred amongst the West Rocks, and was described by Mr. R. Walker *.

Fam. **Atherinidæ.**

Group *Atherinina.*

Genus Atherina, Artedi.

Atherina presbyter, Cuv.; Gthr. *op. cit.* iii. p. 392.

A specimen in the University Museum. Rare.

* Ann. & Mag. Nat. Hist. July 1862.

Fam. **Mugilidæ.**

Genus Mugil, Artedi.

Mugil capito, Cuv.; Gthr. *op. cit.* iii. p. 439.

Not uncommon in the bay.

Fam. **Gobiesocidæ.**

Genus Lepadogaster, Gouan.

Lepadogaster bimaculatus, Flem.; Gthr. *op. cit.* iii. p. 514.

Occasionally in the laminarian region, and in the stomachs of the cod and haddock.

Order II. Acanthopterygii Pharyngognathi.

Fam. **Labridæ.**

Group *Labrina.*

Genus Labrus (Artedi), Cuv.

Labrus maculatus, Bl.; Gthr. *op. cit.* iv. p. 70.

Occasionally brought from deep water. Many young examples occur in the rock-pools in autumn.

Genus Crenilabrus, Cuv.

Crenilabrus melops, L.; Gthr. *op. cit.* iv. p. 80.

Not common.

Order III. Anacanthini.

Suborder **ANACANTHINI GADOIDEI.**

Fam. **Gadidæ.**

Genus Gadus, Artedi.

Gadus morrhua, L.; Gthr. *op. cit.* iv. p. 328.

Common. It is hard to find an inhabitant of the sea that is not swallowed by this fish.

Gadus æglefinus, L.; Gthr. *op. cit.* iv. p. 332.

Common.

Gadus merlangus, L.; Gthr. *op. cit.* iv. p. 334.
Frequent.

Gadus minutus, L.; Gthr. *op. cit.* iv. p. 335.
Common.

Gadus luscus, L.; Gthr. *op. cit.* iv. p. 335.
Not uncommon.

Gadus pollachius, L.; Gthr. *op. cit.* iv. p. 338.
Occasionally from deep water.

Gadus virens, L.; Gthr. *op. cit.* iv. p. 339.
Abundant.

Genus Molva, Nilss.

Molva vulgaris, Flem.; Gthr. *op. cit.* iv. p. 361.
Common.

Genus Couchia, Thomps.

Couchia argentata, Reinh.; Gthr. *op. cit.* iv. p. 363.
A single specimen in the stomach of a cod.

Genus Motella, Cuv.

Motella mustela, L.; Gthr. *op. cit.* iv. p. 364.
Common in rock-pools. Feeds often on sessile-eyed Crustacea.

Motella cimbria, L.; Gthr. *op. cit.* iv. p. 367.
In a rock-pool at West Rocks. Rare.

Genus Raniceps, Cuv.

Raniceps trifurcus, Walb.; Gthr. *op. cit.* iv. p. 367.
Not uncommon. The specimens have chiefly been procured from the West Sands after storms.

Genus Brosmius, Cuv.

Brosmius brosme, O. F. Müller; Gthr. *op. cit.* iv. p. 369.
Not common.

Fam. **Ophidiidæ.**

Group *Ammodytina.*

Genus Ammodytes, Artedi.

Ammodytes lanceolatus, Lesauvage; Gthr. *op. cit.* iv. p. 384.

Frequent in the débris of storms on the sands, as well as in the latter near low-water mark. Bands of young occur in the tidal pools in May.

Ammodytes tobianus, L.; Gthr. *op. cit.* iv. p. 385.

Occasionally with the former.

Suborder **ANACANTHINI PLEURONECTOIDEI.**

Fam. **Pleuronectidæ.**

Genus Hippoglossus, Cuv.

Hippoglossus vulgaris, Flem.; Gthr. *op. cit.* iv. p. 403.

Not rare. The parasitic *Epibdella hippoglossi* is often seen. On the *Caligus* of this fish, *Udonella caligorum* also is common.

Genus Rhombus, Klein.

Rhombus maximus, Will.; Gthr. *op. cit.* iv. p. 407.

Common. In the abnormal examples, which swim on their edges, both dextral and sinistral surfaces are coloured, and each has an eye.

Rhombus lævis, Rondel.; Gthr. *op. cit.* iv. p. 410.

Abundant.

Rhombus megastoma, Donov.; Gthr. *op. cit.* iv. p. 411.

Occasionally.

Rhombus punctatus, Bl.; Gthr. *op. cit.* iv. p. 413.

Not common.

Genus Pleuronectes (Artedi), Cuv.

Pleuronectes platessa, L.; Gthr. *op. cit.* iv. p. 440.

Abundant. The gulls are fond of emptying the stomachs of those thrown on the sands after storms.

Pleuronectes limanda, L.; Gthr. *op. cit.* iv. p. 446.
Not uncommon.

Pleuronectes microcephalus, Donov.; Gthr. *op. cit.* iv. p. 447.
Common.

Pleuronectes flesus, L.; Gthr. *op. cit.* iv. p. 450.
Abundant.

Genus Solea (Lacép., sp.), Cuv.

Solea vulgaris, Quensel; Gthr. *op. cit.* iv. p. 463.
Frequent.

Solea minuta, Rondel.; Gthr. *op. cit.* iv. p. 470.
Common.

Order IV. Physostomi.

Fam. **Salmonidæ.**

Genus Salmo, Artedi.

Salmo salar, L.; Gthr. *op. cit.* vi. p. 11.
Many are caught in the stake-nets on the West Sands, and also off the East Rocks.

Salmo trutta, L.; Gthr. *op. cit.* vi. p. 22.
Common.

Genus Osmerus (Artedi), Cuv.

Osmerus eperlanus, L.; Gthr. *op. cit.* vi. p. 166.
Not uncommon. Large numbers are also caught in the Tay.

Fam. **Scombresocidæ.**

Genus Belone, Cuv.

Belone vulgaris, Flem.; Gthr. *op. cit.* vi. p. 254.
Occasionally thrown on the West Sands after storms.

Genus Scombresox, Lacép.

Scombresox saurus, Walbaum; Gthr. *op. cit.* vi. p. 257.
Not uncommon.

Fam. **Clupeidæ.**

Group *Clupeina.*

Genus Clupea (Artedi), Cuv.

Clupea harengus, L.; Gthr. *op. cit.* vii. p. 415.

Abundant.

Clupea sprattus, L.; Gthr. *op. cit.* vii. p. 419.

Common.

Clupea alosa, L.; Gthr. *op. cit.* vii. p. 433.

Not uncommon. In the stomach of a large specimen caught in the Tay were *Confervæ*, Desmids, and a quantity of vegetable débris.

Fam. **Murænidæ.**

Subfamily *Murænidæ Platyschistæ.*

Group *Anguillina.*

Genus Anguilla (Thunberg), Cuv. Règne Anim.

Anguilla vulgaris, Turt.; Gthr. *op. cit.* viii. p. 28.

Abundant in the streams joining the sea, and occasionally between tide-marks; but the latter occurrence is rare in contrast with the western and southern shores.

Anguilla latirostris, Risso; Gthr. *op. cit.* viii. p. 32.

Not uncommon in similar localities. A curious instance of the fatal effects of the voracity of this fish was found in the Swilken burn. A specimen about 20 inches long had seized the head of another not much shorter than itself, and attempted to swallow it. In its struggles the victim's tail also entered the mouth of the larger, and passed out at the left gill-slit, so that several inches were free. The body of the victim thus formed a large loop which could not be swallowed, while the impaction of the head and tail, and the direction of the teeth of the large specimen, prevented the ejection of the prey. The marauder became exhausted, and was captured at the edge of the stream at the sands.

Genus Conger, Cuv.

Conger vulgaris, Cuv.; Gthr. *op. cit.* viii. p. 38.

Abundant in deep water.

Order V. Lophobranchii.

Fam. **Syngnathidæ.**

Genus Syngnathus, Artedi.

Syngnathus acus, L.; Gthr. *op. cit.* viii. p. 157.

Occasionally seen on the beach after storms.

Genus Nerophis (Rafinesque), Kaup.

Nerophis æquoreus, L.; Gthr. *op. cit.* viii. p. 191.

Not uncommon on the West Sands after storms.

Nerophis lumbriciformis, Willughby; Gthr. *op. cit.* viii. p. 193.

Often caught by the hand-net amongst the seaweeds bordering pools and rocks as the tide enters; on the West Sands after storms.

Order VI. Plectognathi.

Fam. **Gymnodontes.**

Group *Molina.*

Genus Orthagoriscus, Bl.

Orthagoriscus mola, Bl.; Gthr. *op. cit.* viii. p. 317.

Occasionally caught in the bay. A fine specimen occurred in October 1862, measuring 4 feet 8 inches from the tip of the dorsal to the tip of the anal fin, and 3 feet 4 inches from the snout to the posterior margin of the body. Externally there were several specimens of *Tristoma coccineum*; and two wounds existed in the caudal region (from which it was stated the fishermen pulled two animals like leeches, probably specimens of *Pontobdella*). Numerous examples of *Gymnorhynchus horridus* were found in the muscles on dissection. The intestine measured 10 feet 6 inches; and the liver weighed 3½ pounds.

Subclass III. GANOIDEI.

Order Chondrostei.

Fam. **Acipenseridæ.**

Genus Acipenser, Artedi.

Acipenser sturio, L.; Gthr. *op. cit.* viii. p. 342.

Occasionally caught in the salmon-nets.

Subclass IV. CHONDROPTERYGII.

Order II. Plagiostomata.

Suborder **SELACHOIDEI**.

Fam. **Carchariidæ**.

Group *Carchariina*.

Genus Carcharias, Cuv.

Carcharias glaucus, L.; Gthr. *op. cit.* viii. p. 364.

Not uncommon in the bay. Captured by the fishermen in the salmon-nets.

Genus Galeus, Cuv.

Galeus canis, Rondel.; Gthr. *op. cit.* viii. p. 379.

Frequently caught in the bay.

Group *Mustelina*.

Genus Mustelus, Cuv.

Mustelus vulgaris, Müll. & Henle; Gthr. *op. cit.* viii. p. 386.

Not uncommon.

Fam. **Scylliidæ**.

Genus Scyllium, Cuv.

Scyllium canicula, L.; Gthr. *op. cit.* viii. p. 402.

Not uncommon in the bay.

Fam. **Spinacidæ**.

Genus Acanthias, Risso.

Acanthias vulgaris, Risso; Gthr. *op. cit.* viii. p. 418.

Often caught on the deep-sea lines of the fishermen.

Genus Læmargus, Müller & Henle.

Læmargus borealis, Scoresby; Gthr. *op. cit.* viii. p. 426.

Occasionally caught off the bay, near the estuary of the Forth.

Suborder **BATOIDEI.**

Fam. **Rajidæ.**

Genus RAJA, Artedi.

Raja clavata, L.; Gthr. *op. cit.* viii. p. 456.
Frequent.

Raja radiata, Donov.; Gthr. *op. cit.* viii. p. 460.
Not uncommon on the sandy flats.

Raja circularis, Couch; Gthr. *op. cit.* viii. p. 462.
Not uncommon.

Raja batis, L.; Gthr. *op. cit.* viii. p. 463.
Common.

Raja lintea, Fries; Gthr. *op. cit.* viii. p. 466.
This and the following are entered on the authority of Mr. R. Walker, Librarian of the University.

Raja fullonica, L.; Gthr. *op. cit.* viii. p. 467.
Occasionally seen.

Subclass V. CYCLOSTOMATA.

Fam. **Petromyzontidæ.**

Genus PETROMYZON, Artedi.

Petromyzon marinus, L.; Gthr. *op. cit.* viii. p. 501.
Not uncommon. One was captured by attaching itself to a boat.

Fam. **Myxinidæ.**

Genus MYXINE, L.

Myxine glutinosa, L.; Gthr. *op. cit.* viii. p. 510.
Occasionally on the cod.

Subclass VI. LEPTOCARDII.

Fam. **Cirrostomi.**

Genus BRANCHIOSTOMA, Costa.

Branchiostoma lanceolatum, Pall.; Gthr. *op. cit.* viii. p. 513.
Rare. Two specimens occurred in the stomach of a cod.

LIV.—*On a Collection of Hemiptera Heteroptera from Japan. Descriptions of various new Genera and Species.* By JOHN SCOTT.

[Concluded from p. 365.]

Family **Lygæidæ.**

Genus AROCATUS, Spin.

Arocatus melanostoma.

Red, clothed with very fine depressed yellowish hairs.

Head red: *crown* with a large round black spot; *face*, apex of the side and central lobes black. *Antennæ* and antenniferous tubercle black. *Eyes* black, sometimes reddish. *Rostrum* black.

Thorax.—Pronotum red, deeply punctured, and with a broad Λ-shaped black patch not reaching to the anterior or posterior margin. *Scutellum* black, with a strongly raised red central keel. *Elytra* red, unpunctured, somewhat shagreened: *clavus* black, base and the margin at the apex next the scutellum red: *corium* black; anterior and posterior margins broadly red, apex of the latter narrowly black. *Membrane* piceous. *Sternum* black, deeply punctured, clothed with very fine, depressed, yellowish hairs; orifice of the odoriferous sac red. *Legs* black.

Abdomen above red; beneath red, with a broad black streak along the sides; last segment, as also the genital segments, black. *Connexivum* red.

Length 3–3½ lines.

Genus ISCHNODEMUS, Fieb.

Ischnodemus spinicaput.

Head and *pronotum* dull black, thickly punctured, the former with two spines at the base of the face, longer in the male than the female; an acute tubercle in front of each eye, and (in the male) the side lobes of the face testaceous, produced in front, flattened, separate. *Elytra* pale testaceous.

Head black, thickly punctured: *crown* convex: *face* at the base with two long stout spines, and in front of each eye an acute tubercle; side lobes testaceous, produced in front to about in a line with the basal fourth of the second joint of the antennæ. *Antennæ* black, stout, thickly punctured. *Eyes* purplish. *Ocelli* deep red.

Thorax.—Pronotum dull black, thickly punctured; anterior margin frequently brown; posterior margin and hinder angles broadly brown or brownish testaceous, more sparingly punctured than the disk. *Scutellum* black or pitchy black, punctured, with a transverse and apical longitudinal keel, forming a T-shaped character; apex narrowly brown. *Elytra* pale testaceous: *clavus* and *corium*, margins and nerves on both sides punctured, in the latter the space between the inner margin and the nerve pale, almost transparent. *Membrane* pale yellowish white, nerves slightly darker. *Legs* pitchy brown: *thighs* at the apex pale brown: *tibiæ* pale brown: *tarsi* brownish yellow: *claws* black.

Abdomen above almost flat, last segment purplish. *Connexivum* pale brownish testaceous, almost vertical.

Female similar to the male in all respects, except in the length of the spines and the side lobes of the face.

Length $1\frac{3}{4}$–2 lines.

Genus Chauliops *.

Head short, wider across the eyes than the front of the pronotum: *crown* and *face* almost perpendicular, central lobe of the latter slightly widest at the apex; side lobes shorter than the central lobe; underneath each eye a stout spine. *Antennæ*, first joint stout, almost its entire length extending beyond the face; second and third thin, second stouter than the third and a little longer than the first; third two thirds the length of the second; fourth fusiform, about as long as the first. *Eyes* large, semiglobose, placed on a longish, thick peduncle. *Ocelli* minute, almost concealed beneath the anterior margin of the pronotum. *Rostrum* stout, reaching to the third pair of coxæ.

Thorax.—Pronotum large, trapezoidal, nearly twice as broad on the posterior margin as on the anterior; lateral margins slightly waved; hinder angles rounded and raised into a callus; posterior margin nearly straight across the scutellum, from thence to the hinder angles rounded; disk longitudinally and transversely convex, considerably deflected from in front of the calli to the anterior margin. *Scutellum* large, triangular, equilateral, with a central longitudinal channel; apex slightly raised. *Elytra*: *clavus* narrow, apparently without a middle nerve: *corium*, anterior margin constricted in the middle; posterior margin somewhat S-shaped. *Membrane* with five nerves; first and third exterior nerves almost joined at the base; second joined to the third a little below the base; fourth with a semicircular bend at the base, then concave interiorly next the apex; fifth slightly waved. *Sternum* deep, with a

* χαύλιος, projecting; ὄψ, eye.

rostral channel. *Legs*: *thighs* somewhat stout, narrowest at the base, with a tooth on the underside about one third their length from the apex; *tarsi* (third pair), first and third joints of about equal length; second shortest.

Abdomen deep, convex; ♀, upper margin of the last segment produced posteriorly and pointed.

Chauliops fallax.

Minute. Pale brownish or brownish luteous. *Pronotum* somewhat thickly and deeply punctured. *Scutellum* black, with a short white streak at the basal angles. *Corium* pale brownish, somewhat greyish at the base next the anterior margin; disk near the apex of the clavus with a small black spot; posterior margin broadly piceous.

Head: *crown* dark brown; *face* reddish brown. *Antennæ* yellow, first joint entirely and apex of the fourth brown. *Eyes* piceous or black, placed on a peduncle stretching forward obliquely in the shape of a wide-spread V. *Rostrum* brownish yellow, last joint black.

Thorax.—*Pronotum* pale brownish or brownish luteous, somewhat thickly and deeply punctured, in front with a black transverse band, interrupted by a pale central longitudinal line. *Scutellum* black, with a short white streak at the basal angles; disk with a narrow, deep, central channel not reaching to the base, its margins acute. *Elytra* pale brownish or brownish yellow: *clavus* with a single row of brown punctures: *corium* with a row of punctures next the claval suture; disk sparingly dark-brown punctured next the base, posteriorly with some seventeen to twenty punctures in short irregular oblique rows; near the apex of the clavus a small black spot; posterior margin broadly piceous, anterior margin from the base to the constriction somewhat greyish. *Membrane* transparent; disk with one or two more or less distinct brownish spots. *Sternum* piceous or pitchy brown, sides punctured. *Legs* yellow: *thighs* brown, basal half pale yellow or yellowish white: *tibiæ* yellow, with a broad brown band at the base, the lower half of which is piceous or black: *tarsi* yellow: *claws* brown.

Abdomen, above dark brown, beneath pitchy black or brown; posterior margin of the segments with a row of fine black punctures. *Connexivum* almost perpendicular, greyish yellow; posterior margins of the segments broadly pitchy brown, except the last (in the female), where the spot is in the middle.

Length $1\frac{1}{4}$ line.

A remarkable genus, which at first sight reminds one of a minute species of *Nysius* with the eyes of *Henestaris*, between which genera it apparently stands. Independently of size, the shape of the posterior margin of the corium and the toothed thighs will separate it at once from either of these.

Genus Tropistethus, Fieb.

Tropistethus antennatus.

Black, shining, clothed with fine yellow subdepressed hairs. *Antennæ* black, last joint canary-yellow. *Clavus* and *corium* pale brownish ochreous, the latter posteriorly brown, irregularly punctured. *Membrane* abbreviated, pale fuscous, with a darker triangular patch at the base, its lower margin bordered with white.

Head black, shining: *face*, central lobe red or red-brown. *Antennæ* black, terminal joint canary-yellow. *Eyes* purplish brown. *Rostrum* brownish ochreous, apex black.

Thorax.—Pronotum black, hinder angles and generally a portion of the posterior margin adjoining pale brownish ochreous. *Scutellum* black, dull; disk flat; apex very narrowly brownish. *Elytra*: *clavus* pale brownish ochreous, with three rows of brown punctures: *corium* brown, with a pale triangular patch extending from the base to the middle of the anterior margin, its inner angle reaching on to the disk beyond the first nerve, down the exterior margin of which is a row of fine brown punctures; next the inner margin a narrow pale streak extending almost from the base to in a line with the apex of the scutellum; disk somewhat thickly punctured posteriorly; posterior margin dark brown. *Membrane* abbreviated, pale fuscous, at the base a darker triangular patch extending from the apex of the anterior margin of the corium to beyond the middle of the posterior margin, having its lower side with a white border. *Sternum* black. *Legs* brown; *thighs*, apex pale; *tarsi* yellow or pale brownish yellow.

Abdomen beneath black, shining; last genital segment rufous.

Length $1\frac{1}{4}$ line.

The yellow terminal joint of the antennæ will separate this species from all others of the genus.

Genus Lasiosomus, Fieb.

Lasiosomus pallipes.

Head, *pronotum*, and *scutellum* black, shining. *Antennæ*: first three joints pale brownish yellow, base of the second narrowly brown, fourth brown, base narrowly pale. *Elytra* testaceous, brown-punctured: *corium* posteriorly with a large triangular brown patch. *Legs* yellow.

Head black, shining, convex. *Antennæ* pale brownish yellow, base of the first and second joints narrowly brown; fourth brown, base narrowly pale brownish yellow. *Eyes* purplish. *Rostrum* stout, brown, apex black.

Thorax.—*Pronotum* black, shining, very finely punctured posteriorly; hinder angles pale brownish testaceous or clear brown. *Scutellum* black, finely but distinctly punctured; apex sometimes castaneous. *Elytra*: *clavus* testaceous, with three rows of brown punctures; scutellar margin narrowly brown, posterior margin internally narrowly brown. *Corium* testaceous, nerves and disk posteriorly brown-punctured, and with a large triangular brown patch extending from about in a line with the apex of the scutellum to the posterior margin. *Membrane* abbreviated, pale fuscous yellow, base brownish yellow. *Sternum* black, shining, punctured. *Legs* testaceous: *thighs*, base of all the pairs piceous.

Abdomen underneath black, shining, last segment red-brown.

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

Differs from *L. enervis*, the only other species I know, in the puncturing, and by the large triangular brown patch on the elytra and piceous base of the thighs.

Genus Diplonotus.

Diplonotus rusticus.

Black; elytra grey, with piceous punctures.

Head black. *Antennæ* yellowish or pale brownish yellow; first joint piceous, base very narrowly and apex broadly yellow; fourth brown, paler at the base. *Eyes* black. *Rostrum* brownish yellow; first, third, and fourth joints brown.

Thorax.—*Pronotum* black, collar more or less distinctly brown; between the constriction and the posterior margin reddish brown, thickly punctured, with a black central line and a more or less defined black patch on either side; margins narrowly yellowish. *Scutellum* black, punctured, and with a reddish-brown Y-shaped mark; extreme apex yellowish white. *Elytra* grey, with piceous punctures. *Clavus* with the punctures more or less thickly disposed towards the outer margin in different individuals. *Corium*: anterior margin pale yellowish white, apex black, edge pitchy black, and a little way before the apex is a very short longitudinal line composed of about three confluent punctures; inner posterior angle with a somewhat triangular greyish white patch; the punctures in the space from the latter to the base more or less confluent in different individuals. *Membrane* white, the spaces between the nerves at the apex more or less broadly fuscous. *Sternum* black. *Prosternum* round the base of the legs brown. *Legs* black or dark piceous: *coxæ*, first pair black, shining, second and third pitchy brown: *fulcra*, first pair dark pitchy brown, second and third yellow: *thighs*, first pair black or dark piceous, apex yellow; second and third yellow, more or less broadly dark piceous before the apex, second always less broadly than the third: *tibiæ* yellow, apex of the first pair and base of the third fuscous or blackish: *tarsi* yellow, apex of the first joint and third joint entirely brown.

Abdomen, underside black.

Length 2–2¼ lines.

Somewhat allied to *D. luridus*; but it is much broader than that insect, and has besides differently coloured antennæ and legs.

Diplonotus hemipterus.

Black, not shining. *Elytra* grey, with piceous punctures. *Membrane* rudimentary.

Head black. *Antennæ* pale brownish yellow; first joint, basal half black; third at the apex broadly and fourth entirely black; sometimes the apex of the second joint is narrowly black. *Eyes* black. *Rostrum* piceous.

Thorax.—Pronotum black, anterior half of the collar generally brown, posterior angles and margin more or less broadly brown. *Scutellum* black, with a few punctures on the sides; apex narrowly greyish white. *Elytra* grey, with piceous punctures; anterior margin pale yellowish white, next the apex a black spot, apex narrowly pale yellowish white; a little before the apex is a small piceous spot formed by the confluence of a few of the punctures, not reaching the outer edge of the anterior margin; inner posterior angle with a somewhat triangular greyish white patch, in which there are generally one or two piceous punctures, and above the patch frequently several of the punctures are confluent and form a dark blotch. *Membrane* rudimentary, black; apical margin with two white or whitish spots. *Sternum* black; posterior margin of the *pro-* and *metanotum* narrowly brown. *Legs* black: *coxæ* black: *fulcra* of all the pairs yellow: *thighs*, first pair black, base narrowly and apex yellow; second and third pale brownish yellow, apical half more or less dark brown: *tibiæ* yellow: *tarsi* yellow, third joint brown.

Abdomen black: *connexivum* brown.

Length 2¼–2½ lines.

Readily distinguished from the other species by its elongate appearance, the different form of the pronotum, and the rudimentary membrane.

Diplonotus luridus.

Pale brownish yellow; elytra finely brown-punctured.

Head black. *Face*, apex of the central lobe more or less brown. *Antennæ* yellow; first joint somewhat brown at the base; third, apex reddish; fourth, apical two thirds black. *Eyes* piceous. *Rostrum* yellowish, apex piceous.

Thorax.—Pronotum black; collar brownish yellow, with a transverse row of punctures; between the constriction and the posterior margin brownish yellow, somewhat thickly brown-punctured, two longitudinal keels and the posterior angles paler. *Scutellum* black, with a central keel, extending from the middle to the apex, punctured exteriorly, the central keel and two side pieces forming a Y-shaped patch more or less distinctly brown. *Elytra* pale brownish yellow. *Clavus* with three rows of brown punctures. *Corium*: anterior margin pale yellowish white, with two short black streaks—one at the apex, the other almost in a line with the apex of the clavus; at the inner posterior angle an unpunctured triangular patch. *Membrane* fuscous, nerves white; on the anterior margin, a little way below the apex of the corium, is a small black spot, and exteriorly, at the base of the second nerve from the inner margin, is another; the spaces between the nerves next the apex more or less white, in which are a few minute fuscous spots. *Sternum* black or pitchy black, finely punctured. *Legs* yellow: *thighs*, first pair reddish brown, apex yellowish, second and third somewhat brownish yellow: *tarsi* yellow, apex of the third joint brown.

Abdomen underneath more or less clear chestnut-brown.

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

At first sight of this insect one is reminded of *Plociomerus luridus*; but its narrower and more elongate form, longer head, thicker anterior thighs, and different number of teeth on the latter easily separate them.

There are only two specimens of this species in the collection.

Diplonotus lateralis.

Black, not shining; anterior margin of the elytra yellowish white.

Head black, finely shagreened. *Antennæ* brown; first joint darker than the second; third black, base dark brown; fourth black, basal third yellowish, base with a narrow black ring. *Eyes* black. *Rostrum* yellow, first joint pitchy brown, apex piceous.

Thorax.—*Pronotum* black; collar with a punctured central channel; between the constriction and the posterior margin coarsely punctured; posterior angles more or less distinctly dark brown. *Scutellum* black, extreme apex yellow or brownish yellow, sides with a few coarse punctures. *Elytra* pitchy brown. *Clavus* pitchy brown, margins paler. *Corium* pitchy brown; anterior margin yellowish white from the base to a little before the apex, where it widens and extends for a little way upon the disk, forming an irregular-shaped blotch; nerve, from the base to about the middle, yellowish; between the inner edge of the anterior margin and the nerve towards the base, more or less mottled with yellowish; a little below the inner posterior angle a yellowish spot. *Membrane* abbreviated, fuscous brown; nerves white; a small patch at the apex, and a transverse streak extending from the apex of the corium to about midway across the disk, nearly in a line with the sutural margin, white. *Sternum* black-punctured. *Legs* yellow: *thighs*, first pair pitchy brown, shining, apex yellow; second and third yellow, the latter before the apex broadly brown: *tibiæ* and *tarsi* yellow, apex of the first and third joints somewhat brown.

Abdomen black.

Length 2–2¼ lines.

Genus Metochus *.

Elongate.

Head longer than broad. *Crown* convex transversely. *Face* convex. *Antennæ*: first joint stoutest, somewhat clavate, not half the length of the second; second joint longest; third and fourth subequal. *Rostrum* reaching to between the middle pair of coxæ.

Thorax.—*Pronotum* very much constricted beyond the middle; anterior margin with a narrow collar; sides with a narrow margin; posterior margin slightly concave; posterior angles raised. *Scutellum* triangular, elongate. *Elytra*: anterior margin somewhat concave near the base. *Membrane*: disk with five nerves, the first two approximating at the base and distinctly waved, third about midway between the second and fourth, curving round near the base towards the fourth and fifth, which are united near the apex of the corium. *Sternum*: *prosternum* with a faint central keel, depressed from the anterior margin to a little before the middle, from thence to the

* μέτοχος, a participator.

base of the first pair of legs gently rounded; posterior margin in the centre considerably recurved. *Legs*: *coxæ*, first pair in front armed with two teeth: *thighs*, first pair incrassated, fusiform, with two rows of teeth on the underside, each row consisting of seven or eight; three of the teeth on the inside row longer than any of the others, and the one next the apex longest: *tibiæ* straight; first pair dilated at the apex; inner margin with four or five spines: *tarsi*, first joint of the third pair more than twice the length of the second and third together, which are very short.

The shape of the head and pronotum, and form and arrangement of the nerves of the membrane, associate this genus with *Diplonotus* more than with any other I know; but the toothed coxæ, and different number and disposition of the teeth on the anterior thighs, and straight anterior tibiæ are sufficiently characteristic to separate the one from the other.

Metochus abbreviatus.

Dull black, somewhat thickly punctured.

Head black, with a few longish erect pale hairs; very finely punctured, except a small space round the ocelli. *Face*: central lobe produced considerably in front of the side lobes. *Antennæ* black; second joint as long as the third and fourth together; base and apex of the first and second joints and base of the third very narrowly brownish yellow; fourth, basal half yellow or yellowish white, except a narrow black ring at the base. *Eyes* black. *Ocelli* red. *Rostrum* yellowish or pale brownish yellow, fourth joint piceous.

Thorax.—*Pronotum* black; anterior portion very convex, finely and sparingly punctured; anterior margin with a narrow collar, joined to which is a very short, central, longitudinal keel; disk posteriorly coarsely punctured, more or less mottled with brown, and with a distinct central keel; sides at the constriction much depressed, the margin somewhat acute, and terminating in a fovea before reaching the posterior angle, so that when viewed from above, in certain positions, it appears to be notched; posterior angles raised into an unpunctured callus. *Scutellum* black, irregularly punctured; apex yellow. *Elytra* black. *Clavus*: inner margin and nerve interiorly with a row of black punctures, between which is a central row extending from about in a line with the apex of the scutellum to the lower edge of a yellow spot near the base; lower half of the scutellar margin yellowish; claval suture yellow, and with a row of punctures on either side. *Corium* yellowish at the base, black-punctured; anterior margin yellow for a little more than half its length, the edge piceous, exteriorly minutely multiindentate, thereby giving it a submoniliform appearance; the two inner nerves with a row of punctures exteriorly, and between them another row placed at wide intervals, and terminating before reaching the base; on the innermost nerve are two yellow streaks—one near the apex, the other about in a line with the middle of the scutellum; between the two inner nerves are two yellow spots—one at the apex, the other midway between the streaks above mentioned; inner edge of the anterior margin with a row of black punctures, between this and the nerve more or less clear yellowish or brownish yellow, as far as about the middle of the claval suture; next the apex a large irregular yellow patch, in which are a few black punctures; posterior margin black, the colouring widest and irregular interiorly next the anterior margin; apex of the latter very narrowly yellow. *Membrane* abbreviated, pitchy brown, with a small yellow spot at the apex of the anterior margin of the corium, and another on each of the three adjoining nerves; next the apex a somewhat semicircular yellow streak. *Sternum* black, thickly punctured. *Legs* black: *coxæ*, outer edge in front with two teeth, the anterior one largest: *fulcra* yellow, apex narrowly piceous: *thighs* black; first pair narrowly yellow at the base, and with two rows of teeth (seven to eight in each row) on the underside; second and third pairs broadly yellow at the base; before the apex of the latter, on the underside, are two long black spinose hairs: *tibiæ*, first and third pairs brown or pitchy brown, second yellowish; apex of all the pairs piceous: *tarsi* piceous; base of the first joint narrowly and second entirely yellow.

Abdomen black. *Connexivum* black; fourth and fifth segments with a yellow spot, that on the former segment largest.

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

There are three specimens in the collection.

Genus Prosomœus *.

Elongate, narrow.

Head long, somewhat pointed in front. *Face*: central lobe produced beyond the side lobes. *Antennæ*: first joint stout, reaching for half of its length beyond the end of the face; second twice and a half as long as the first, more slender, apex somewhat clavate; third clavate, about two thirds the length of the second; fourth spindle-shaped, as long as the third. *Eyes* small. *Rostrum* scarcely reaching to the second pair of coxæ; first joint not so long as the head.

* προσόμοιος, resembling.

Thorax.—Pronotum considerably deflected from the posterior to the anterior margin, the latter with a narrow collar; disk with a transverse channel; lateral margins constricted before the middle, to which point they are slightly rounded, from thence posteriorly straight and gradually widening; hinder angles raised into a callus; posterior margin somewhat deeply concave across the scutellum, from thence rounded to the hinder angles. *Scutellum* slightly elongate, with a short apical and two side keels, forming a Y-shaped character. *Elytra*: *clavus* deflected to the corium. *Corium*: anterior margin concave before the middle. *Membrane* with four nerves, the two inner nearer to each other than the two outer ones, free at the base, first curved inwardly and then outwardly; the two outer ones approximate at the base, then diverge, and curve inwardly. *Legs*: *thighs*, first pair incrassated, spindle-shaped, and with four teeth on the underside, the two middle ones long; second and third pairs thin at the base, clavate next the apex; third stouter than the second, and with two teeth on the underside: *tibiæ*, first pair widened inwardly at the apex: *tarsi*, third pair, first joint longest, about one third longer than the second and third together.

The genus *Paromius*, Fieber, is the nearest with which I can associate the above; but it has the following differences, viz. the elytra slightly contracted before the middle, the position and number of the teeth on the anterior thighs, and, in addition, the two teeth on the underside of the third pair.

Prosomœus brunneus.

Brown; pronotum somewhat thickly, and elytra sparingly dark-brown punctured.

Head dull black or pitchy brown, very finely wrinkled transversely, and sparingly clothed with fine, depressed, pale yellowish hairs. *Face*: central lobe reddish brown. *Antennæ* brownish yellow, clothed with short yellow hairs; second joint red at the apex; third, apical half red; fourth pitchy red, base broadly and the extreme apex red. *Eyes* reddish brown. *Ocelli* bright red. *Rostrum* pale brownish yellow, last joint (except the base) piceous.

Thorax.—Pronotum, collar fuscous brown, from thence to the transverse channel dull black, very finely and sparingly punctured: posterior portion brown, with coarsish piceous punctures. *Scutellum* fuscous, black-punctured, extreme apex white, apical and side keels dull reddish brown. *Elytra*: *clavus* brown, the space between the suture and the nerve white, except the apex; margins and nerve on both sides thickly and regularly dark-brown punctured, between the inner margin and the nerve an irregular row of punctures: *corium* white; sutural margin and the adjoining nerve exteriorly thickly and regularly dark-brown punctured; apex of the space enclosed between these with two or three remote punctures; disk with an irregular, transverse, thickly punctured brown band before the apex, broadest at the anterior margin, and terminating before reaching the inner posterior angle; anterior margin thickly and finely dark-brown punctured from the base to the lower margin of the band; posterior margin dark brown, apex next the anterior margin black. *Membrane* brown, with an irregular darker cloud extending from the apex of the corium, and widening until it reaches the inner margin. *Sternum* pitchy black or black: *prosternum* thickly and somewhat finely punctured: *mesosternum* more sparingly and coarsely punctured: *metasternum* thickly punctured, the punctures similar to those on the mesosternum. *Legs* pale brownish yellow: *coxæ*, first pair brown, second and third clear brown, apex yellow: *fulcra* of all the pairs yellow: *thighs* clear brown; base of the first pair narrowly, second and third broadly yellow: *tarsi* pale brownish yellow, third joint dusky brown.

Abdomen: underside brown.

Length $2\frac{1}{2}$–3 lines.

Genus GYNDES.

Gyndes albomarginatus.

Black, dull. *Head* and *pronotum* clothed with a fine somewhat golden pubescence, intermixed with long erect dark hairs; anterior margin of the elytra white from the base to beyond the middle.

Head black, somewhat shagreened. *Antennæ* black. *Eyes* dark pitchy brown. *Rostrum* pitchy black, shining; first joint black; apex of the first, second, and third joints narrowly pitchy red; second, third, and fourth joints with longish erect dark hairs.

Thorax.—Pronotum black; between the constriction and the posterior margin thickly, coarsely, and irregularly punctured. *Scutellum* black, with long, erect, dark hairs; from the middle to the apex is a central keel, on either side of which are a few deep punctures; anterior portion finely punctured. *Elytra* piceous, with a few erect dark hairs not so long as those on the head, pronotum, or scutellum: *clavus* piceous, base and a patch before the apex black: *corium* piceous to beyond the middle, beyond which is a broad transverse band extending from the anterior to the interior margin, bounded posteriorly by a white lunate patch; anterior margin white to beyond the middle, where the colour is widest; edge narrowly black; posterior margin black; apex and a round spot a little below the inner posterior angle white. *Membrane* black, apex with an oval white patch. *Sternum* black: *prosternum* finely wrinkled on the sides, and sparingly and delicately punctured, anteriorly as far as the channel somewhat deeply punctured. *Legs* black: *coxæ*, second and third pairs at the apex white: *thighs* black; first pair clothed with long erect dark hairs; second and third pairs broadly white at the base, all the pairs at the apex narrowly yellowish white or brownish: *tibiæ* black: *tarsi* piceous, second joint palest.

Abdomen black, beneath clothed with a somewhat golden pubescence: *connexivum* black; fifth and sixth segments with a yellowish-white patch exteriorly.

Length 3 lines.

Genus LETHÆUS, Dallas.

Lethæus Dallasi.

Piceous, shining, finely punctured.

Head dark piceous or black, very finely and thickly punctured above and beneath, except a narrow space next the basal margin. *Antennæ* pale pitchy brown; apical half of the second joint, apical three fourths of the third, and the fourth entirely (except a narrow white ring at the base) pitchy black; extreme apex of the second and third joints white. *Eyes* dark brown. *Ocelli* red. *Rostrum* brownish yellow, apex darker.

Thorax.—*Pronotum*, except the callosities, thickly and finely punctured, the punctures appear slightly elongated, as if made obliquely; anterior portion pitchy black; posterior pitchy brown; collar, lateral margins, and posterior angles brownish yellow. *Scutellum* pitchy black, depressed in the middle and very finely punctured; sides sparingly punctured. *Elytra* pale, almost white, finely brown-punctured: *clavus* with four rows of brown punctures; base with a dark brown patch; between the inner margin and the nerve two elongate pale spots separated by a brownish cloud: *corium* near the base, between the claval suture and nerve, a triangular brown patch; anterior margin beyond the middle with a broad irregular-shaped brown patch, darkest exteriorly, and widening as it approaches the nerve; apex brown; the area enclosed between the bifurcation of the nerve brown, with a pale patch extending somewhat obliquely in the direction of the inner posterior angle; nerve pale. *Membrane* pale fuscous brown, nerves darker; the space between the first and second exterior nerves and third and fourth interior whitish. *Sternum* pitchy brown, shining, finely punctured. *Legs* pitchy brown: *thighs*, apex pale brownish yellow or yellowish: *tibiæ* pale brownish yellow or yellowish, spines on the second and third pairs dark brown: *tarsi* yellowish, apex of the joints sometimes narrowly brownish.

Abdomen beneath pitchy brown or castaneous, shining, very finely punctured.

Length $3\frac{1}{4}$–$3\frac{1}{2}$ lines.

Genus Calyptonotus, Dougl. & Scott.

(Subgenus *Raglius*, Stål.)

Calyptonotus albomaculatus.

Grey, yellowish, or whitish, black-punctured. *Pronotum*, anterior half black. *Corium* with a black spot at the inner angle of the posterior margin. *Membrane* with numerous small white spots on the disk.

Head black. *Antennæ* black; first joint, apical half brown, with a few long nearly erect stout black hairs; fourth with a yellow ring before the base. *Eyes* black. *Rostrum* pitchy black.

Thorax.—Pronotum anterior half black, not extending on to the reflexed lateral margins, except at the anterior angles; lateral margins pale yellowish or whitish, extreme edge black; inner margin of the raised posterior angles black; posterior margin dark fuscous. *Scutellum* black, punctured on the sides; before the apex two short longitudinal brown streaks; apex yellowish white. *Elytra* grey-yellowish or whitish, black-punctured: *clavus* with a black spot at the base; apex very narrowly black: *corium* posteriorly with a somewhat rhomboidal black spot; inner angle of the posterior margin narrowly pale; anterior margin at the apex and the inside of the posterior margin narrowly black. *Membrane* dark fuscous, with a number of minute white spots scattered over the disk; sutural margin black; apex narrowly white. *Sternum* dull black: *prosternum*, anterior margin brown, posterior fuscous white; outer posterior angle yellowish or whitish: *metasternum*, posterior margin white. *Legs* black, base of all the pairs exteriorly white: *coxæ* black, apex of the second and third pairs white: *fulcra*, first pair black, base brownish; second and third yellowish white, apex narrowly black: *thighs*, first pair black, second and third broadly yellowish or yellowish white at the base: *tibiæ*, first and second pairs brown, outer margin paler; apex pitchy black or black; third pitchy black or black: *tarsi* piceous, base of the first joint narrowly brownish.

Abdomen beneath black.

Length 3 lines.

Very closely allied to *Pachymerus pineti*, H.-Sch.

Family **Pyrrhocoridæ**.

Genus Pyrrhocoris, Fall.

Pyrrhocoris coriaceus.

Male pale luteous, *female* reddish brown; both sexes thickly punctured with piceous.

Head black, thickly punctured, with a longitudinal luteous central line. *Crown* more or less brown on either side the base of the central lobe of the face, and with a short, shallow, black, central channel. *Antennæ* pitchy black. *Eyes* reddish brown or piceous. *Rostrum* piceous.

Thorax.—Pronotum luteous or reddish brown, coarsely punctured, except two somewhat shining, trapezoidal, black patches a little before the middle; these are separated by a luteous line, and have also a pale margin. *Scutellum* luteous or reddish brown, with piceous punctures and generally a black patch in the centre. *Elytra* luteous or reddish brown, with piceous punctures, the punctures much finer than those on the pronotum: *corium* with two minute piceous spots—one almost in a line with the middle of the scutellum, the other almost in a line with the apex of the clavus (in the female these are very indistinct). *Membrane* imperfectly developed, pale or dark luteous, with piceous nerves. *Sternum* black, shining, delicately punctured: *prosternum*, anterior and posterior margins yellowish white: *meso-* and *metasternum*, posterior margins whitish. *Legs* dark piceous, base exteriorly white: *coxæ* piceous, apex whitish: *fulcra* pale brownish yellow: *thighs* dark piceous, somewhat shining, apex narrowly whitish or yellowish: *tibiæ* whitish or yellowish: *tarsi* pale brownish.

Abdomen above more or less pale; beneath chestnut, shining; posterior margin of the last segment yellowish white.

Length 3–3½ lines.

Family **Tingididæ**.

Genus Tingis, Fab.

Tingis pyrioides.

Extremely like *T. pyri* in nearly every particular; and therefore it will only be necessary to point out the characters which will separate them.

Tingis pyri.	*Tingis pyrioides.*
Disk of the elytra from the apex of the rhomboidal cell with five transverse rows of irregular meshes.	Disk of the elytra from the apex of the rhomboidal cell with three transverse rows of irregular meshes. *Pronotum*, lateral margins more upright than in *T. pyri*. Length $1\frac{1}{2}$ line.

I have only seen a single example.

Genus Monanthia, Lep. et Serv.

Monanthia monstrosa.

Pale cinnamon-yellow. *Pronotum*, side margins overlapped and produced posteriorly into a large bladder-like process of a dark chocolate-brown colour. *Elytra* with a dark brown or blackish patch in the middle of the anterior margin, and another smaller one of the same colour near the apex; anterior margin at the base and beyond the central dark patch with two rows of meshes; on the patch itself the meshes are minute.

Head black. *Crown* in front pale brown, and armed with five spines of the same colour placed as follows, viz. a short central one, one on each side in front (approximating and appearing but as one between the antennæ), and another appressed one along the inner margin of each eye. *Antennæ* thin, pale clear brown, fourth joint wanting. *Eyes* black.

Thorax.—Pronotum pale cinnamon-yellow, narrow in front; sides almost straight; the overlapped side margins produced posteriorly into a large bladder-like process of a dark chocolate-brown colour, and covered with large, for the most part five-sided meshes; hood small, anterior margin in the middle angulated; side keels of the scutellar process in a line with the inner margin of the cysts, the middle one, between the latter, apparently clothed with fine brown hairs. *Elytra*, anterior margin gradually widening to the gently rounded middle, then sinuate to the broadly rounded apex; marginal field narrow, with two rows of transparent meshes from the base and beyond the dark brown or blackish middle patch, in which last the meshes are minute; reticulation of the outer row of meshes beyond the patch black and Y-shaped; disk within the cells flat, brownish; outer nerve cinnamon-yellow; meshes finer than those on the cysts, posterior to the cells with a dark brown or blackish cloud, and the meshes gradually becoming larger towards the apex. *Legs* clear brown: *tarsi*, third joint dark brown, towards the apex fuscous: *claws* fuscous.

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

This insect belongs to the section in which are *M. scapularis*, *quadrimaculata*, *dumetorum*, *lupuli*, &c. In colour it somewhat resembles *M. quadrimaculata*; but the bladder-like form into which the overlapped side margins are produced posteriorly will be found sufficient to separate it from every other known species.

There appears to be only one example in the collection.

Monanthia Fieberi.

Slightly dusky cinnamon-brown, darker across the elevated posterior portion of the overlapped sides of the pronotum, and also in that portion of the elytra posterior to the cells; anterior margin of the *elytra* with two rows of meshes throughout.

Head black. *Crown* with five pale brownish-yellow spines placed as follows, viz. a short one in the centre in front, another on either side of the last (approximating and appearing to form but one between the antennæ), and one along the inner margin of each eye, its apex curving round until it touches the base of the anterior pair. *Antennæ* pale brown; first, second, base of the third, and fourth joint entirely darker. *Eyes* black.

Thorax.—Pronotum, sides at the base for a very short distance straight, then slightly convex towards the hinder angles; hood very small, anterior margin almost straight; the overlapped side margins swelled up posteriorly, viewed from above united and enclosing the middle keel, from the side somewhat semiovate, flattened above; side keels of the scutellar process brown at the base, slightly diverging posteriorly. *Elytra*, sides gradually but gently rounded to beyond the middle, at which last they are widest, then sinuate to the broadly rounded apex; marginal field with two rows of transparent meshes, becoming larger beyond the middle, in which last some of the reticulation is dark brown and forms almost a patch; base of three or four of the reticulations in the sinuate portion next the anterior margin with a brown spot; round the apex dark brown. *Legs* brown: *tibiæ* pale brownish yellow: *tarsi* pale brownish yellow, third joint brown.

Length $1\frac{1}{4}$ line.

This insect also belongs to the same section as *M. monstrosa*, from which, however, it is easily separated by the difference in form of the overlapped side margins, which in *M. Fieberi* unite posteriorly and enclose the middle keel of the pronotum —a character which will also distinguish it from any other in the genus. In colour it most nearly resembles a dingy *M. dumetorum.*

Genus CANTACADER, Am. et Serv.

Cantacader Lethierryi.

Clear pale brownish yellow. *Crown* armed with four long spines. *Pronotum* with five keels; the three inner ones parallel, extending throughout its entire length; the two outer posterior, short, curving round interiorly. *Elytra* with an irregular fuscous shade throughout, darkest in the cells; sides in the middle and the apex with a blackish patch.

Head brownish yellow. *Crown* with four long spines, placed two in front, stout, reaching to about in a line with the base of the third joint of the antennæ, and two, more slender than the others, springing from near the middle of the inner margin of each eye; antenniferous processes produced into a stout spine exteriorly. *Antennæ* brownish yellow; first joint stoutest, somewhat obconic, and with a small petiole; second oval, about half the length of the first; third long, slender; fourth fusiform, black, and with a few longish erect dark hairs. *Eyes* dusky purplish. *Rostrum*: cheek-plates of the sheath somewhat luteous, with about four rows of fine meshes; apex blackish.

Thorax.—Pronotum pale brownish yellow, narrow in front; lateral margins straight, gradually but gently widened to the acutely rounded hinder angles; anterior margin concave, almost angular; posterior margin semiovate, straight between the first and second outer keels, concave between the inner ones; disk with five keels,—the three inner ones parallel, extending throughout the entire length of the pronotum, viewed from above slightly waved; the two outer ones spring from the posterior margin near to the hinder angles, and curve round interiorly about the middle of the disk, which is somewhat depressed. *Elytra* somewhat elliptic, pale brownish yellow, with an irregular fuscous shade throughout, darkest in the cells; cell-nerves pale; marginal field very narrow, with one row of meshes; disk within the cells almost straight, exteriorly (on the sides) sloping towards the anterior margin; reticulation throughout fine; anterior margin in the middle and apex with a blackish patch. *Legs* brownish yellow: *tarsi* dark brown.

Length $1\frac{7}{8}$ line.

Somewhat like *C. Staudingeri*, but larger and darker in colour, and having the third joint of the antennæ more slender, the three inner keels of the pronotum parallel, and the posterior margin of the same of a totally different form.

Family **Brachyrhynchidæ.**

Genus Mezira, Am. et Serv.

Mezira scabrosa.

Pitchy black or brown, covered with minute tubercles.

Head pitchy black, thickly tuberculate. *Antennæ* pitchy black, thickly punctured; fourth joint, apex dusky yellow. *Eyes* pitchy brown. *Rostrum* dark brown.

Thorax.—Pronotum dull pitchy brown, tubercles thickly and irregularly disposed, four anterior callosities generally brown in the centre. *Scutellum* black or pitchy black, thickly tuberculate, central keel and apex sometimes brownish. *Elytra* pale brownish yellow; between the anterior margin and the first nerve, towards the apex, more or less brown; posterior marginal nerve piceous; all the nerves tuberculate and the spaces between sparingly so; tubercles brown. *Membrane* brownish yellow, nerves brown; below the apex of the corium a yellowish patch. *Sternum* black-brown, round the base of the legs dark brown. *Legs* dark brown: *thighs* thickly and finely granulate.

Abdomen beneath dark brown; anterior margin of the first four segments in the middle finely granulate, fifth and sixth entirely granulated. *Connexivum* dark brown; posterior margin of the segments pale brown.

Length 3–4 lines.

Family **Reduviidæ.**

Genus Acanthaspis, Am. et Serv.

Acanthaspis humeralis.

Black, clothed with long, fine, yellow and black hairs.

Head black. *Face*, apex round the base of the rostrum brown. *Eyes* pitchy brown. *Antennæ* black, clothed with long, almost erect, black hairs; third and fourth joints, in addition, with short yellowish hairs. *Rostrum* black.

Thorax.—Pronotum dull cinnamon-brown, clothed with long, fine, yellow hairs; anterior portion to behind the callosities, and a transverse streak across the centre of the posterior portion, not reaching to the margin, black. *Scutellum* black, base narrowly and somewhat indistinctly fuscous yellow. *Elytra* black. *Corium*, base with a somewhat triangular yellowish-brown patch. *Membrane* black. *Sternum*, *legs*, and *abdomen* black.

Length $6\frac{1}{2}$–7 lines.

Family **Ectrichodidæ.**

Genus Mendis, Stål.

Mendis japonensis.

Deep red, shining. *Head* and *pronotum* anteriorly clothed with short, erect, very fine, black and pale hairs intermixed. *Corium*, anterior margin crimson, terminating in a triangular patch, in the centre of which is a short, fine, curved, black streak.

Head lurid. *Crown* between the ocelli reddish. *Antennæ* black, clothed with long black hairs; first joint more sparingly clothed than the others; apex of the second and fourth very narrowly, and the pedunculation reddish; neck above black. *Rostrum* brown.

Thorax.—Pronotum deep red, anterior portion as far as the transverse channel somewhat lurid testaceous; transverse channel interiorly with a black spot; posterior portion of the central longitudinal channel with about eight or nine punctures. *Scutellum* black, the H-shaped portion reddish, clothed with long, erect, pale hairs. *Elytra* black, base and the anterior margin as far as the first nerve crimson, apex narrowly black; in the centre of the triangular patch a short, fine, curved black streak, the convexity turned towards the apex of the scutellum. *Membrane* pitchy black, nerves black; base of the trifurcate nerve testaceous, exterior margin of the two outer nerves with a brown margin. *Prosternum* black, shining. *Legs* red: *coxæ* dark brown: *thighs* at the base narrowly piceous: *tibiæ* at the apex exteriorly piceous or black: *tarsi* piceous, first joint brown.

Abdomen above red; underneath red, sparingly clothed with longish, fine, pale hairs, and with a large, black, somewhat ovate patch on each segment just within the spiracles.

Length 6 lines.

There is only a single example (♂), wanting an elytron. It was submitted to Dr. Stål, who returned it as unknown to him, but with the remark, "*nigripenni*, Fab., affinis," a species I do not possess, and therefore cannot point out the differences.

Family **Nabidæ.**

Genus Nabis, Latr.

Nabis brevilineatus.

Male pale brownish yellow. *Corium*, anterior margin at the base and beyond the middle with a short black line.

Head brown, with a reddish tinge, sparingly clothed with fine depressed yellow hairs. *Antennæ* yellow or pale brownish yellow; first joint, apex narrowly fuscous; second, base narrowly fuscous, apex black. *Eyes* dark red or chestnut-red. *Rostrum* yellow, last joint orange-red.

Thorax.—Pronotum pale brownish yellow, sparingly clothed with depressed yellow hairs; anterior portion as far as the transverse channel darker than the posterior, and with a reddish tinge; posterior portion punctate crenate. *Scutellum* pale brownish yellow, with a slight reddish tinge. *Elytra* pale brownish yellow: *clavus*, inner marginal nerve from the base to beyond the apex of the scutellar margin red: *corium*, anterior margin beyond the middle with a short black line, first nerve at the base with a short black line, the space between the nerves more or less powdered with red towards the base; apex broadly brown. *Membrane* pale, almost white, spaces between the nerves at the base brown; from the apex to the coloration between the two exterior nerves is a pale brownish cloud, concave on its lateral margins. *Sternum* brownish yellow, with more or less of a reddish tinge, down the middle broadly black: *mesosternum* round the base of the legs yellow, below which is a black spot. *Legs* yellow: *coxæ* and *fulcra* of all the pairs yellow: *thighs*, first pair red, apex yellow; second and third pairs yellow; all the pairs with two dark brown or piceous rings: *tarsi* yellow, apex of the third joint blackish.

Abdomen above red or red-brown, basal segment entirely and the posterior margin of the last in the middle black, genital segments with a broad black dash down the middle; beneath red, four basal segments down the middle broadly black. *Connexivum* red, exterior margin narrowly yellow, posterior angle of the third, fourth, and fifth segments black.

Female yellowish, with a red tinge. *Head* and *pronotum* red. *Elytra*, *clavus*- and *corium*-nerves red. All the other characters as in the male.

Length, ♂ 4, ♀ $4\frac{3}{4}$ lines.

Family **Pelogonidæ**.

Genus Pelogonus, Latr.

Pelogonus flavomarginatus.

Dull black; lateral margin of the pronotum and anterior margin of the elytra yellow.

Head black, with a fine central keel terminating between the ocelli. *Face* bronzy black, finely wrinkled, and with a golden shimmer in certain lights; on each side of the central keel between the eyes is a depression; apex with a yellow margin. *Eyes* dark brown. *Antennæ* yellow, third and fourth joints dusky. *Rostrum* piceous, shining; apical half of the third joint and fourth entirely brown.

Thorax.—Pronotum black, finely punctured; lateral margin anteriorly brown, posteriorly yellow, next the base the colour is widened out into a triangular yellow patch; posterior margin yellow, the colour widest across the scutellum, and with a row of fine black punctures on its inner edge; disk on the sides with one or two almost obsolete milky white spots. *Scutellum* black, finely punctured. *Elytra* black: *clavus*, posterior margin and apex narrowly yellowish; base with one or two almost obsolete milky white spots: *corium*, anterior margin narrowly yellow, within which, at almost regular intervals, are five almost obsolete milky white spots; opposite to these the colour of the anterior margin is paler; disk with a few small, scattered, almost obsolete milky white spots. *Membrane* dark fuscous brown, with a few longitudinal whitish streaks round the apex. *Sternum* black, punctured: *prosternum*, posterior margin brownish yellow; *xyphus*, margin pale yellow: *metasternum*, posterior margin brownish yellow. *Legs* yellow: *coxæ*, first pair fuscous: *thighs*, apical two thirds of all the pairs on the upper half fuscous brown, inside with one or two rows of fuscous or black punctures: *tibiæ* yellow, inclining to brown exteriorly; apex narrowly blackish; base of the long, yellow, spinose hairs set in a black puncture: *tarsi*, first and second pairs yellow, third joint black; third pair brown, third joint black.

Abdomen beneath black, posterior margin of some of the last segments narrowly brownish.

Length 2½ lines.

I have only seen one specimen of this species.

Family **Gerridæ**.

Genus Limnobates, Burm.

Limnobates albolineatus.

More or less dark fulvous brown.

Head.—Crown with a depression between the eyes; from the base to the latter a more or less distinct, fine, white, central line; sides between the base and the eyes more or less broadly black. *Face*, apex red, shining. *Antennæ* pale brown; first joint, except the base, pitchy brown; second, apex narrowly pitchy brown or blackish; third and fourth blackish. *Eyes* dark pitchy brown. *Rostrum* brown, last joint black; beneath, from the base to the eyes, with a more or less broad pale central line, apex pale.

Thorax.—Pronotum between the base and the constriction brown, posteriorly yellowish, with a white central line throughout its entire length; central line and sides margined with brown, and with a few scattered white atoms; shoulder-calli somewhat piceous. *Elytra* fuscous: *clavus* with a short white line at the base: *corium*, nerves dark brown or piceous, the very narrow space enclosed between the bifurcation of the anterior marginal nerve white; central longitudinal nerve exteriorly from the clavus to the apex with a broad white streak. *Legs* brown: *thighs*, apex black: *tibiæ*, apex very narrowly black: *tarsi* black.

Abdomen beneath black, with a somewhat hoary covering; down the middle a somewhat indistinct, broad, brown line.

Length 5–5½ lines.

Family **Veliidæ**.

Genus Microvelia, Westwood.

Microvelia Douglasi.

Olivaceous brown, dull. *Crown* with a narrow silvery-white streak along the inner margin of each eye. *Face*, apex pale brownish yellow. *Pronotum* in front with a narrow brown collar (in certain lights whitish), divided by the fine, central, longitudinal keel; hinder angles acute, prominent, slightly tuberculate; side margins of the scutellar process convex. *Elytra* white, the entire margin and cell-nerves brown-black. *Connexivum* brown. *Legs* pale brownish yellow.

Head olivaceous brown, dull, very convex. *Crown* with a narrow silvery-white streak along the inner margin of each eye. *Face*, apex of the central and side lobes entirely pale brownish yellow. *Antennæ* pale brownish yellow, apex of the second and fourth and fifth joints with a dusky hue. *Eyes* deep pitchy black. *Rostrum* pale brownish yellow, base of the first joint in the middle exteriorly with a narrow longitudinal black line.

Thorax.—Pronotum olivaceous brown, dull; anterior margin straight, adjoining which is a narrow brown collar, having a silvery white appearance in certain lights; lateral margins straight, diverging widely to the acute, prominent, and somewhat tuberculate hinder angles; the latter, viewed from the side, narrowly brown; margin of the scutellar process spatulate-acuminate; disk very convex, with a fine, black, central longitudinal keel not reaching to the apex of the scutellar process. *Elytra* white; anterior margin broadly and interior margin narrowly brown-black; cell-nerves brown-black; central cell suboval, elongated towards the base, divided throughout its length by a slightly curved brown-black line; longitudinal half of the apical cell brown-black, with a tooth on its inner margin towards the base. *Sternum*, sides clothed with a thick, shining, silvery-white pile. *Legs* pale brownish yellow: *tarsi*, apex of the second joint brownish.

Abdomen black, beneath clothed with a thick, shining silvery pile. *Connexivum* pale brown.

Length $\frac{3}{4}$ line.

Very closely related to the *M. pygmæa*, L. Duf., but differs from that species in having the antennæ, legs, and connexivum pale. On the other hand, the characters on the elytra in both species seem very similar; and not having seen a macropterous specimen of *M. pygmæa*, I am unable to point out in what the differences consist.

This insect is not included in the list given at the commencement of this paper, as since its publication I have only received a specimen from Mr. Lewis.

Family **Naucoridæ.**

Genus Naucoris, Geoffr.

(*Ilyocoris*, Stål, Öfv. Vet. Ak. Förh. 1861, p. 201.)

Naucoris exclamationis.

Head and *pronotum* yellow; the former in front with a short, more or less distinct, brown or black clavate streak. *Elytra* fuscous brown.

Head yellow. *Crown* posteriorly somewhat ferruginous, and dotted with numerous dark brown atoms; in front, and nearer to the centre than the inner margin of the eyes, with a short, more or less distinct, brown or black clavate streak.

Thorax.—*Pronotum* on the sides broadly yellow; disk more or less ferruginous, and dotted with numerous dark brown atoms. *Scutellum* brownish yellow, disk sometimes brownish, margins brownish yellow. *Elytra* fuscous brown, very finely shagreened. *Wings* and nerves milk-white. *Sternum* yellowish or testaceous. *Legs* yellowish: *thighs*, first pair underneath black: *tibiæ*, second and third pairs with long brown spines: *tarsi* and *claws*, second and third pairs brownish yellow.

Abdomen above somewhat ochraceous, fuscous or brownish down the middle; posterior margin of the segments broadly brown, outer angle black; beneath testaceous or dusky testaceous, outer angle black, marginal hairs long, yellowish.

Length 5 lines.

Smaller than *N. cimicoides*, to which it is allied. It is, however, much clearer-coloured than that species, and has also the posterior margin of the abdominal segments broadly brown, which, with the clavate streak on the head, is sufficient to separate them.

Family **Belostomidæ**.

Genus Appasus, Am. et Serv.

Appasus Lewisi.

Luteous, testaceous, or brownish.

Head testaceous. *Crown* sometimes brownish. *Eyes* black.

Thorax.—*Pronotum* testaceous or luteous in front; posteriorly from the transverse channel frequently brown, and somewhat thickly and irregularly punctured; disk towards the front with a pale or dark brown triangular fovea on each side joined to a >-shaped black line. *Scutellum* testaceous grey or brownish, finely crenulate; near the basal angles a more or less distinct, somewhat triangular, pale spot; towards the apex generally a dark, somewhat heart-shaped patch; apex more or less clear brownish yellow. *Elytra* luteous or testaceous yellow, crenulate punctate: *clavus*, disk more or less fuscous; inner and posterior margin and claval suture testaceous yellow: *corium*, disk more or less fuscous, base and anterior margin broadly testaceous yellow; inner posterior angle with a triangular patch of short golden hairs: or the entire *clavus* and *corium* brown, anterior margin of the latter broadly paler. *Membrane* unicolorous. *Sternum* testaceous. *Legs* testaceous or brownish yellow: *thighs*, first pair sometimes brownish: *tibiæ*, second and third pairs sometimes brownish.

Abdomen beneath somewhat dusky testaceous.

Length 8 lines.

Family **Nepidæ**.

Genus Laccotrephes, Stål.

Laccotrephes japonensis.

Fuscous brown. *Prosternum* at the base and apex with a tubercle. *Abdomen* above orange-red, with a broad black streak down the back.

Head: central keel granulated.

Thorax.—Pronotum longer than broad, narrower in front than behind, sides concave, rounded in front; anterior margin behind each eye with a tubercle; on each side of the centre a longitudinal curved ridge, roughly granulated; sides in front and posteriorly from the transverse channel coarsely granulated. *Scutellum* with a granulated keel on each side next the base, and a central keel extending from the apex to the termination of the side keels. *Wings* milky white, principal nerves yellow. *Legs* fuscous brown.

Abdomen above orange-red, with a broad black streak down the centre; apex thickly clothed with greyish hairs; anal appendages yellowish towards the apex.

Length of body 13, appendages 15 lines.

Genus Ranatra, Fab.

Ranatra pallidenotata.

Male brownish yellow; posterior portion of the pronotum finely punctured. *Elytra* with several small, almost round, pale spots. Anterior *thighs* beyond the middle with a large triangular tooth, and before the apex with a small one. Anal appendages longer than the body.

Head.—Crown with a transverse channel a little in front of the posterior margin of the eyes. *Eyes* black, shining.

Thorax.—Pronotum brownish yellow; posterior portion finely punctured; callus of the hinder angles dark brown or piceous. *Elytra* more or less inclined to brown next the base: *clavus* pale brownish yellow; inner marginal nerve testaceous; central nerve brownish, with several oblong spots or short streaks; disk at the base, between the central nerve and claval suture, with a long, brown, somewhat triangular dash: *corium* brown, near the apex of the clavus pale brownish yellow; first exterior nerve testaceous or brownish yellow; disk with several pale yellowish-white spots of unequal size and irregularly disposed. *Membrane* pale yellowish white, nerves brown. *Sternum* brownish yellow. *Legs* brownish yellow: *tibiæ*, second and third pairs at the base and apex narrowly pitchy brown: *tarsi* brownish yellow; second and third pairs at the apex pitchy brown: *claws* brown.

Abdomen above black, dull, and with a mouldy appearance in certain lights; margins next the connexivum brownish; *connexivum* brownish yellow; beneath testaceous or brownish yellow; anal appendages reddish at the base, towards the apex testaceous.

Female similar to the male, but with darker elytra.

Length, ♂ (without appendages) 17, appendages 20 lines; ♀ 19, appendages 20 lines.

According to Dr. Stål, who has seen the insect, it is allied to his *R. valida*; but, unfortunately, I do not possess a specimen wherewith to compare it and point out the differences. In the shape of the metasternum it resembles *R. chinensis*, Mayr, 'Reise der öst. Freg. Novara,' p. 191, t. v. fig. 59 *b*.

Ranatra unicolor.

Luteous. *Crown* between the eyes with a small callus. *Pronotum*, anterior portion appearing as if thrust into the posterior; the latter finely dark-grey punctured, and its anterior margin above ⌣⌣-shaped. Anterior thighs with a triangular tooth beyond the middle. Anal appendages not two thirds the length of the body.

Head.—*Eyes* piceous or purplish brown, faintly shining.

Thorax.—*Pronotum*, anterior portion pale brownish yellow, stouter next the head than at its junction with the posterior portion, into which latter it has the appearance of being thrust; posterior portion luteous, thickly and finely dark-grey punctured; its anterior margin above ⌣⌣-shaped. *Scutellum* brownish, with a small fovea on each side of the centre below the middle. *Elytra* lurid, very thickly and very finely dark-grey punctured. *Membrane* darker than the elytra, nerves brown. *Sternum* lurid or somewhat testaceous. *Legs* luteous or somewhat testaceous: *thighs*, first pair with a triangular black tooth beyond the middle, second and third at the apex narrowly brown: *tibiæ* lurid or yellowish; second and third pairs, especially towards the apex, on the sides with short, spinose, black hairs; apex narrowly dark brown: *tarsi*, second and third pairs pale brownish yellow; apex dark brown: *claws*, second and third pairs at the base pale; apex brown.

Abdomen above pitchy brown, paler on the sides; *connexivum* luteous or pale brownish yellow: beneath lurid or somewhat testaceous: anal appendages luteous.

Length of body 13, appendages 7 lines.

This is a genus of which I have seen and possess but few species. All of those known to me are larger than the insect above described, and which, although belonging to the group with only one tooth in the middle of the anterior femora, has as a distinguishing character short anal appendages.

There are two male specimens in the collection.

LV.—*Descriptions of new Species of Fishes in the British Museum.* By Dr. ALBERT GÜNTHER, F.R.S. &c.

[Continued from p. 371.]

Corvina nigripinnis.

D. 9 | $\frac{1}{37}$. A. 2/7. L. lat. ca. 65.

The height of the body equals the length of the head, and is contained thrice and two thirds in the total length (without caudal). Snout obtuse, with the upper jaw overlapping the lower. Præoperculum with a fine spinous serrature. Dorsal spines slightly flexible at the top. The second anal spine strong, rather more than half as long as the longest ray. Silvery, with oblique dusky lines along the series of scales. All the fins black.

A single specimen, 9 inches long, from the coast of the Cameroon country, has been presented by Dr. J. A. Smith.

Gobius caffer.

D. 6 | 14. A. 12. L. lat. 70.

The head and neck are entirely naked; the scales very small on the front part of the trunk, but becoming gradually larger hindwards. There are about twenty-two longitudinal series of scales between the second dorsal and anal. Head broader than high, with a broad obtusely rounded snout. The height of the body is two ninths or two elevenths of the total length (without caudal), the length of the head two sevenths. Eye rather small, two thirds of the length of the snout. Height of dorsal fins less than that of the body; the ventral terminates at a great distance from the vent. The last dorsal rays extend to the root of the caudal, which is obtusely rounded. Canine teeth none. This fish is (in spirits) of a brownish-olive colour, with twelve purplish vertical bands, which are as broad as the interspaces. The bands are very regular in one specimen, and anastomosing in another. Dorsal fins with series of dark spots; caudal and anal immaculate.

Two specimens, 4½ inches long, from Port Elizabeth; purchased.

Gobius natalensis.

D. 6 | 11. A. 10. L. lat. 54.

Head and nape naked; scales rather irregularly arranged, small on the anterior part of the trunk, and becoming gradually larger hindwards. About eighteen longitudinal series of scales between the second dorsal and the anal. Head rather broader than high. The height of the body is contained five times and a half in the total length (without caudal), the length of the head three times and a half. Eyes rather close together, somewhat shorter than the snout, and nearly one fifth of the length of the head. Dorsal fins nearly as high as the body; caudal rounded; ventral extending to the vent. Canine teeth none. Light brownish, mottled with darker, the dark spots having a tendency to form vertical stripes on the sides of the body. An indistinct dark spot above the base of the pectoral. Dorsal and caudal fins with small dark spots arranged in series.

Two specimens, $3\frac{1}{2}$ inches long, from Port Natal. Collected by Mr. Ayres.

Gastromyzon (g. n. *Homalopterin.*).

Distinguished from *Homaloptera* by having a great number of rays in the ventral fins, which are united into a suctorial disk.

Gastromyzon borneensis.

D. 11. A. 7. P. 28. V. 21. L. lat. 74.

Snout short, with semicircular outline and trenchant margin; barbels very small. Eye small, entirely in the posterior half of the length of the head. Lower lip fringed. Scales smooth. Origin of the dorsal fin immediately in front of the first ventral ray. Caudal subtruncated. Blackish brown; dorsal and caudal rays annulated with black.

Several specimens from mountain-torrents of the interior of Borneo. The largest examples are $3\frac{1}{2}$ inches long.

The collector at Labuan has accompanied the specimens of this most singular fish with the following notes:—"The fish are only found in the rapid sources of rivers as they descend from the mountains of the interior; when disturbed they dart rapidly across the swiftest current from one stone to another, and stick like limpets to the stones, along which they crawl slowly like a molluscous animal. These specimens come from the sources of the Mingalong river."

Chalcinus paranensis.

D. 11. A. 30. V. 7. L. lat. 32. L. transv. $6/2\frac{1}{2}$.

The height of the body is contained twice and two thirds in the total length, the length of the head four times. Operculum twice as high as long, reaching to the vertical from the axil of the pectoral. The scales in the thoracic region are much larger than the others. The distance of the origin of the dorsal fin from the root of the caudal is two thirds of its distance from the extremity of the snout. The length of the head is only two thirds of that of the pectoral. Silvery, the middle caudal rays and the posterior half of the pectoral black.

One specimen, 4½ inches long, from the river Parana.

Engraulis olidus.

D. 16. A. 27. L. lat. 42.

The height of the body is two ninths of the total length (without caudal), the length of the head one fifth. The diameter of the eye is much more than the length of the snout and one fifth of that of the head. Snout not much projecting beyond the lower jaw. Teeth in both jaws; those in the upper very small, the lower being larger, about thirty on each side. Maxillary narrow behind, reaching somewhat beyond the mandibulary joint. Gill-rakers lanceolate, of moderate length, about twenty-four on the lower branch of the outer branchial arch. Origin of the dorsal fin rather nearer to the root of the caudal than to the end of the snout; anal fin commencing below the middle of the dorsal. Abdomen scarcely compressed. Pectoral fins not reaching to the ventrals. Silvery, without spots; posterior margin of the caudal fin blackish.

One specimen, 10 inches long, from the Parana.

Syngnathus Jonesii.

D. 18. Segment. 17+32.

Allied to *Syngnathus nitidus*, and perhaps to *Syngnathus crinitus*, but without filaments on the head. A ridge runs across the operculum, but without reaching to its end. Head and snout short, the latter somewhat bent upwards, shorter than the postorbital portion of the head, keeled above, but without spines in the median line. Interorbital space concave; crown and occiput with a median keel. Keels of the body sharp, but not spiny; the lateral keel of the trunk passes into the lower keel of the tail. Tail twice as long as the trunk without head. The base of the dorsal fin is not raised above the level of the back; it occupies six segments, of which the first is the anal segment. Caudal very short. Blackish brown; upper half of the trunk with three, upper half of the tail with seven equidistant whitish cross bands.

A single female has been sent by J. Matthew Jones, Esq., from the Bermudas; it is 4½ inches long.

LVI.—*Further Instances of the Sponge-Spicule in its Mother Cell.* By H. J. Carter, F.R.S. &c.

[Plate XXI. figs. 26 & 27.]

Since my description and figures of the mother cell of the sponge-spicule were published ('Annals,' 1874, vol. xiv. p. 100, pl. x.), I have met with two more examples where the cells respectively enclosed a single tricurvate (flesh-spicule) so nearly approaching in length and form (in one instance especially) to a skeleton-spicule, that I have given representations of them in Plate XXI. figs. 26 & 27, to show also how a long, linear spicule may be thus enclosed throughout in an equally long, bolster-shaped or tubular, nucleated sponge-cell.

Figure 26 comes from a variety of *Esperia ægagropila*, Carter; and although much thinner than the skeleton-spicule of this species, it is so slightly undulous and so much longer than the latter, that it might be easily mistaken for a second form of skeleton-spicule, which is contrary to one of the characters that I have assigned to the Esperiadæ, viz. that they only possess *one* form of skeleton-spicule. Finding it, however, in a cell (fig. 26, *b*), and seeing it more tricurvate in form in the ovum of the parent (fig. 25), there was no difficulty in concluding that it was the tricurvate of this variety of *Esperia ægagropila*. As it appears in the adult it is linear, very thin, smooth, slightly undulous (fig. 26, *a*), and longer than the skeleton-spicule both in the parent and in the ovum which has nearly arrived at the embryonal degree of development (fig. 25, *e*); so that we may fairly assume that this, which is the chief peculiarity of the variety, is constant. In measurement it is more than twice the length of the tricurvate in the typical species, which, on the other hand, gains in stoutness what it loses in length, the former being 90-6000ths inch long. Growing in small patches scantily on the rocks (at Budleigh-Salterton) towards low-water mark, it (with the exception of possessing a much smaller bihamate) agrees with the typical species, viz. *Esperia ægagropila*, in the form and size of its single inequianchorates as well as in their rosette-forms, together with all the other characteristics of the latter.

Figure 27, on the other hand, comes from a distinct species of Microciona, Bk., in which the small, abruptly subangular form of the tricurvate in the centre of the spicule contrasts strongly with its greatly extended and almost straight arms. Ending in *spined* extremities, however, causes it to differ from all the species described by Dr. Bowerbank, although that called "*M. armata*" (B. S. vol. ii. p. 129) seems to come so near to it that I cannot help thinking that, if it had been more accurately noticed in detail, there would be no difference between the two whatever. The tricurvate in the adult of this sponge is at once recognized by its form (fig. 27, *a*), while the nucleated cell (fig. 27, *b*) which encloses it, corresponding with its extreme length, presents the same bolster-like appearance or tubular form as that in the variety of *Esperia œgagropila* just mentioned.

As this sponge appears to me to be *Microciona armata* of Dr. Bowerbank, I shall describe it under this appellation.

Microciona armata, Bk. (?).

General form incrusting, thin, spreading indefinitely. Sessile, flat. Colour sponge-yellow or scarlet. Structure consisting of short, erect, scopuliform bundles of spicules in juxtaposition, imbedded in sarcode and based on a minutely reticulated horny membrane. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of three forms, viz.:—1st, the largest and longest, curved, acuate, smooth, except at the large end, which is round and spined; average largest size 45 by 1-1800th in its greatest diameters: 2nd, sub-pinlike, nearly straight, acuate, smooth throughout except at the inflated end, which may bear one or two minute spines; size variable, from 10 to 30 by $\frac{1}{4}$-1800th inch in its greatest diameters (? incipient forms of the foregoing spicule): 3rd, the smallest, short, acuate, straight, more or less spined throughout or to within a short distance of the point. All these spicules have their large ends fixed in the scopuliform bundle. Flesh-spicules of two forms, viz.:—1st, tricurvate (fig. 27, *a*), abruptly bent into a subtriangular form in the centre, with the arms extended in a more or less straight line on each side, ending in pointed extremities which are spined (fig. 27, *d*); average longest forms 30-1800ths inch in length: 2nd, equianchorate, minute, navicular or weaver's-shuttle-like in form, 1-1800th inch long; these are scattered throughout the sarcode in which the scopuliform bundles are imbedded. General size of species about a line in thickness and of indefinite extent.

Hab. Marine, on rocks of the New Red Sandstone conglomerate.

Loc. Budleigh-Salterton, south coast of Devon.

Obs. This seems to me, as before stated, to be Dr. Bowerbank's *Microciona armata*; and if so, his description is so imperfect that the above will be found absolutely necessary before it can be identified. The characters mentioned easily distinguish it from *Microciona atrosanguinea*, Bk., whose colour, although sometimes also sponge-yellow, is crimson or dark blood-red and not "scarlet" or bright red.

It occurs just now in an advanced oviparous state, from which the embryos are issuing. The latter are ciliated all round except over the root-cells at the posterior extremity, like the embryo of *Halichondria simulans*; but there is no ring of long cilia round the base. It is also much smaller, measuring 22 by 15-1800ths inch in its greatest diameters, which brings it near to the size of the embryo of *Halisarca lobularis* (Pl. XX. fig. 11); while it is remarkable for having the third form of skeleton-spicule, viz. the acuate spiniferous one, together with the two forms of flesh-spicules, *alone* developed, all of which, as in other embryos, are confined to the posterior end of the body, where the former (that is, the spined acuates) lie grouped parallel to each other, with their heads posteriorly and their points anteriorly directed, not mixed up heterogeneously in the cell-mass throughout the body (see the position in *Halichondria simulans*, Pl. XXII. fig. 28, *e*).

This sponge should come into my fourth division, or ARMATÆ—that is, where the spicular skeleton-structure is armed with spined acuates (the echinating spicule), as in *Dictyocylindrus* and the like, since the third form of skeleton-spicule above mentioned appears to be the latter.

I must be pardoned for not believing in the existence of the "bidentate" anchorate mentioned and figured by Dr. Bowerbank here and elsewhere, which I believe to be an optical illusion, since I have sought often and never been able to find one. In no instance does an anchorate appear to me to exist without the elements of the *three* arms or teeth at each extremity, whether it be of the equi- or inequianchorate form.

LVII.—*Note on the* Planula- *or* Gastrula-*phase of Development in Mollusca.* By E. RAY LANKESTER, M.A.

PROF. SALENSKY, of Kasan, in a recent paper in Leuckart and Troschel's 'Archiv für Naturgeschichte,' expresses doubts as to the occurrence of a *Planula*- or *Gastrula*-phase of development in certain Mollusks in which I have asserted its occurrence *. I am anxious to make some reply to Prof. Salensky; and, first of all, I must ask him and others who, rightly enough, are not prepared to accept "bare assertion" to wait until my drawings are published in the 'Philosophical Transactions' for 1875 before speculating as to whether I am right or not. Let me repeat emphatically what is the condition I have observed in the embryos of *Pisidium*, *Tergipes*, *Polycera*, *Limax*, *Lymnæus*, and, I may now add, *Paludina*. The first cleavage of the

* [A translation of Prof. Salensky's paper has been prepared, and will appear in the next number of the 'Annals.'—ED.]

egg-cell leads to the formation of a mulberry mass (*Morula* of Häckel); at one point the cells forming this mass become invaginated; the cavity of invagination is the primitive alimentary canal, the invaginated cells constitute its walls. The orifice of invagination closes up, and the pedicle formed by that portion of the primitive alimentary cavity which is continuous with the cells of the outer or body-wall, the pedicle of invagination as I term it, becomes the rectum. In the cases above cited, with the exception of *Paludina*, the rectum is thus for a long time blind. In *Paludina*, however, the orifice of invagination does not close up until a very late stage, if at all, and is ciliated. The mouth and œsophagus eat their way into the primitive alimentary sac *subsequently* in all these cases. In a recent paper on *Lymnæus* I have shown that the cells which are invaginated to form the primitive gastric sac of the *Planula* or *Gastrula* undergo very remarkable modifications before the ultimate form of the alimentary canal is developed (see 'Quarterly Journal of Microscopical Science for October 1874).

I do not hold that the formation of a double-walled sac by *invagination* of a primitively single-walled sac is the essential feature which constitutes a *Gastrula* or *Planula*. The endoderm of this developmental stage may take its origin by *delamination*—that is, by direct cell-division from the primitive single series of cells constituting the wall of a hollow *Morula*. We have accordingly to distinguish these two very different modes of origin of the Diploblastic *Planula* or *Gastrula*. Facts must be accumulated to enable us to decide which is the *original mode* of formation of this developmental form, and to understand the steps by which the one process was substituted for the other. The origin of structures by *invagination*, when looked at broadly in a large series of animal forms and in the case of many organs, points to the conclusion that invagination is an *economy of material*—a mode of rapidly filling in the outline of an organ in the embryo, whilst leaving the organ in a hollow condition for subsequent completion. This is seen in the contrasted modes of development (by delamination on the one hand and by invagination on the other) of the nerve-chord in annelids, in osseous fishes, and in higher Vertebrata, also in the cases of the otocysts of Gasteropods and of Cephalopods. At the same time I do not know that at present we have any strong reason for supposing that the delaminate mode of origin of the *Gastrula*-endoderm preceded the invaginate. That the difference between these two modes of origin is not a fundamental one appears from the fact that in closely allied genera we find either the one or the other occurring indifferently. As I have suggested, the presence of "nutritive-yelk" particles is very probably a disturbing factor in the early stages of recapitulative development; and I hope by the application of this hypothesis that some further results of a definite kind may be attained.

Meanwhile I beg to assure Prof. Salensky and other doubters that the primitive endoderm does arise by invagination in the Mollusks cited by me, as there will, I hope, shortly be evidence to show in the form of careful drawings.

The drawings of Lovén of embryos of *Crenella* and *Cardium*, which *clearly* indicate a diploblastic phase brought about by invagination as I have followed it out in other Mollusks, are not in the least degree elucidated or touched by Prof. Salensky's figures of young *Ostrea* in the paper in the 'Archiv für Naturgeschichte.' There is no question whatever about the mouth: these stages are long antecedent to the formation of mouth or velum. The figures of Lovén to which I refer are those in which the "Richtungsbläschen" is seen escaping from the mass of cells, and in which an orifice is marked as the orifice at which the "Richtungsbläschen" escape. This orifice is, I am persuaded (by analogy with fully worked-out examples in other Mollusks), the orifice of invagination of the *Gastrula*-endoderm, and *not* connected with the "Richtungsbläschen" as Lovén supposed.

Let me, in conclusion, point out that the publication of figures to illustrate such observations as those which now have to be made, on embryological matters, is in this country a terribly lengthy and tedious affair, and that naturalists must have some patience and consideration for one another under the infliction.

BIBLIOGRAPHICAL NOTICE.

Evenings at the Microscope; or Researches among the Minute Organs and Forms of Animal Life. By PHILIP HENRY GOSSE, F.R.S. A new edition. 8vo. London: Society for promoting Christian Knowledge, 1874.

THIS little book of Mr. Gosse's (a writer whom one is always pleased to meet in the field of natural history) is intended as a guide to those who, possessing a microscope, are desirous of using that instrument as a means of obtaining something more than mere passing amusement. It is founded for the most part upon his own observations, or at least upon observations practically verified by himself, a circumstance which gives it a very different character from that of most of the compilations which aim at popularizing natural history.

The author's plan is a very admirable one. Instead of going out of his way to describe and figure objects whose great interest is their rarity, he sticks almost throughout to those common forms which are within the reach of almost every one, and while confining himself pretty strictly to the description of strictly microscopic objects, contrives at the same time to furnish a tolerable general sketch of the animal kingdom.

Of the vertebrates, of course, Mr. Gosse cannot speak as microscopic objects, but he describes the structure of hairs, feathers, and scales, and the characters presented by the blood of these animals. Had he gone a little further and noticed the structure and mode of formation of bones and teeth, and of some of the more important soft parts, he might have made this section of his work far more instructive. In the treatment of the invertebrate animals, Mr. Gosse arranges his subject in accordance with the generally received classification, devoting a chapter or more to each of the great groups or classes (which he notices separately), and describing in a clear and pleasant style all those parts in the investigation of which the use of the microscope is necessary. Not unnaturally the Rotifera, the Sea-Anemones, and some other groups, upon which Mr. Gosse has worked with results well known to all zoologists, come in for a favourite's share of his attention: but on the whole he has behaved with a commendable impartiality; and the student who works through the course of study here laid down by Mr. Gosse, will rise from his labour with no contemptible amount of zoological knowledge. We may add that the book is adorned with a considerable number of good wood-engravings, and, although published by the Society for promoting Christian Knowledge for the express purpose of indicating the wonders of the Divine handiwork in the animal world, is not disfigured by any undue obtrusion of the natural-theological element, such as we are but too much accustomed to in many books with a similar purpose.

MISCELLANEOUS.

Note on Ablepharus pusillus. By W. T. Blanford.

In the description of the above-named species in the 'Annals' for July last, p. 33 of the present volume, a serious error occurs, the number of transverse rows of ventral scales between the axils being stated to be 26 instead of 36. The latter number is correct; and as the only important difference between *A. pusillus* and *A. Brandti*, Strauch, consists in the number of scales between the axils, which are fifty in the last named form, whilst *Blepharosteres agilis* of Stoliczka (Proc. As. Soc. Bengal, 1872, p. 126) has forty to forty-five, and appears from the description to agree in every other character of importance with the other two species, there is every probability that these three races must be considered varieties of one species, which will bear Strauch's name *A. Brandti*. The type of the latter is from Turkestan; Dr. Stoliczka's species is from the Punjab; and *A. pusillus* was procured by me close to Basrah, commonly called Bussorah, the port of Mesopotamia on the estuary of the united Tigris and Euphrates; so this scinque has a wide range in Asia.

The Winged Fruits of the Carboniferous Genus Cardiocarpus.

The genus *Cardiocarpus* was probably related to the modern Conifers of the *Welwitschia* type, as shown by the similarity of the fruit and also by the close relation of the leaves, if those called *Cordaites* belong, as both Geinitz and Newberry have independently remarked, to *Cardiocarpus*. The *Welwitschia* is an embryonic form of Conifer, it producing no leaves except the cotyledonous; but, while probably unlike *Cordaites* in its embryonic features, it shows what leaves and fruit are consistent with the type of Conifers.—*Dana's Manual of Geology*, New Edition, pp. 328, 330.

Remarks on the Fishes of the Algerian Sahara. By M. P. Gervais.

In the communications which have recently been made to the Academy on the subject of the possibility of establishing a sea in the Algerian Sahara, there have been urged, successively for or against that project, facts derived from geology, botany, and even zoology. In fact M. Cosson, calling in the aid of this last branch of natural history, has cited the *Coptodon Zillii*, described by me, as proving the continuity of the sheet of water under this region*.

This *Coptodon*, which M. Valenciennes has proposed to unite with *Glyphisodon*, a genus of marine fishes, although it differs therefrom in several characters, and especially in the non-ctenoid character of its scales, has received several other denominations. It is the *Perca Guyonii* of Heckel; and Dr. Günther has made it the type of a new genus under the name of *Haligenes Tristrami*; but it had been previously indicated under the name of *Bolti* from examples collected in other parts of Africa, principally in the Nile; and it is also the *Tilapia* of Andrew Smith, who had the opportunity of observing it in South Africa. It is known also in the Senegal and Mozambique, and everywhere lives in fresh water. We cannot say, therefore, like Dr. Tristram, that in Algeria it may be regarded as a last living vestige of the fauna which peopled the Saharian sea during the Tertiary epoch "before the elevation of the ground in Northern Africa poured into the Mediterranean the waters of that vanished ocean."

In my memoir on the fishes of Algeria † I brought forward the objection which the essentially fluviatile character of the Bolti enables us to oppose to this opinion, and indicated that this was also the case with the *Cyprinodon*, which is likewise ejected by the artesian waters of the Sahara under the same conditions; and I added that I did not think we ought any longer to accept the expression that has been sometimes employed with regard to this genus of fishes (namely, that they are derived from a sea stretching beneath the region in question), seeing that, wherever we know the Cyprinodons, they are, like the Bolti, exclusively proper to fluviatile or lacustrine waters, and, like it, are strangers to the sea. This is what we ascertain, whether we observe these fishes in Algeria or capture them in Portugal, Spain, Syria, Egypt, and even in America. Moreover the fossil Cyprinodonts which Agassiz names *Lebias* are like-

* See 'Comptes Rendus,' tome lxxix. p. 934.

† Zool. et Pal. gén. p. 200.

wise foreign to deposits of marine origin; and all those which we know, have been found buried in lacustrine formations, at whatever epoch of the Tertiary period they may have lived. It is under these conditions that we meet with them at Aix in Provence, at the Puy en Velay, in the Limagne d'Auvergne, and in the gypseous deposits of the neighbourhood of Paris.—*Comptes Rendus*, August 31, 1874, tome lxxix. p. 557.

On Fossil Evidences of a Sirenian Mammal (Eotherium ægyptiacum, *Ow.*) *from the Nummulitic Eocene of the Mokattam Cliffs, near Cairo.* By Prof. Owen, F.R.S., F.G.S., &c.

The specimens described in this paper were obtained by Dr. Grant, of Cairo, in a block of the white limestone of the Cerithian Nummulitic zone, quarried extensively for building-purposes in the Mokattam Cliffs. They consisted of a few fragments of the base of the cranium and a cast of the entire brain with the commencement of the myelon. The author discussed the characters presented by these remains, which he regarded as having belonged to an extinct sirenian, probably allied to *Halitherium*, which he proposed to name *Eotherium ægyptiacum*. The characters of the brain, as deducible from the cast, were detailed, and shown to be sirenian. By comparison with the brains of other Sirenia, the author was led to trace a progress in the cerebral characters of the animals of this type, from its first known appearance in the Nummulitic formation of Egypt to the present day. He also inferred, from its presence in the Nummulitic limestone, that this rock had been deposited not far from a shore.—*Proc. Geol. Soc.* Nov. 18, 1874.

Coal of the Carboniferous Era not made of Bark.

The suggestion has been made, in view of the many *Sigillaria*-stumps hollowed out by decay, and flattened stems of other trees, found in the coal-measures, filled with shale or sandstone, that the vegetable débris from which the coal has proceeded was largely bark, or material of that general nature. But the occurrence of such stumps and stems outside of the coal-beds, while proof that the interior wood of the plants was loose in texture and very easily decayed, is no evidence that these trees contributed only cortical portions to the beds of vegetable débris. Moreover the cortical part of Lepidodendrids (under which group the Sigillarids are included by the best authorities), and of Ferns also, is made of the bases of the fallen leaves, and is not like ordinary bark in constitution; and *Equiseta* have nothing that even looks like bark. This cortical part was the firmest part of the wood; and for this reason it could continue to stand, after the interior had decayed away,—an event hardly possible in the case of a bark-covered Conifer, however decomposable the wood might be. Further, trunks of Conifers are often found in the later geological formations, changed, *throughout* the interior, completely to brown coal or lignite.—*Dana's Manual of Geology*, New Edition, p. 362.

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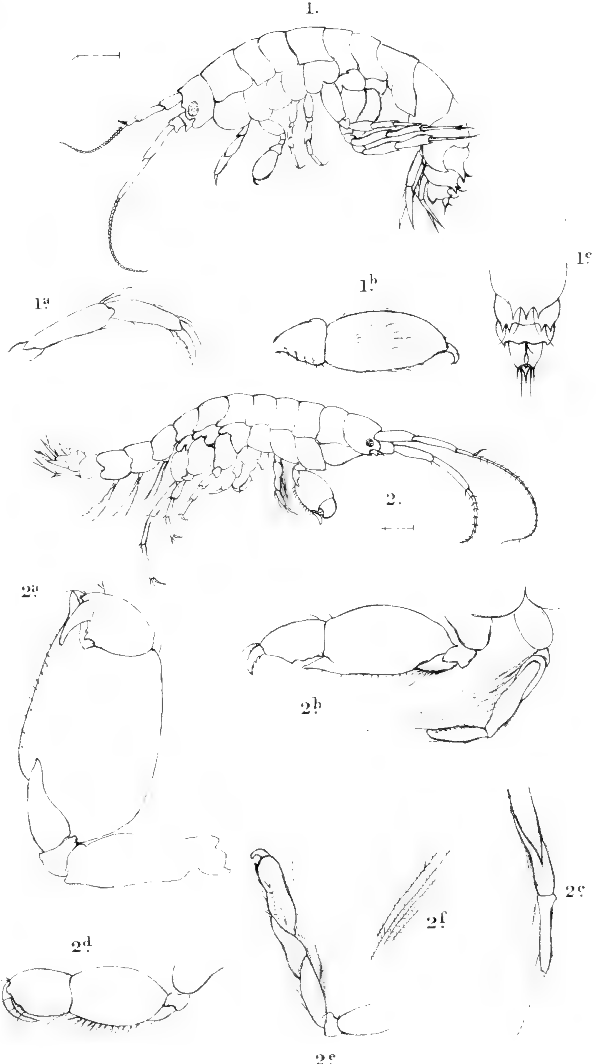

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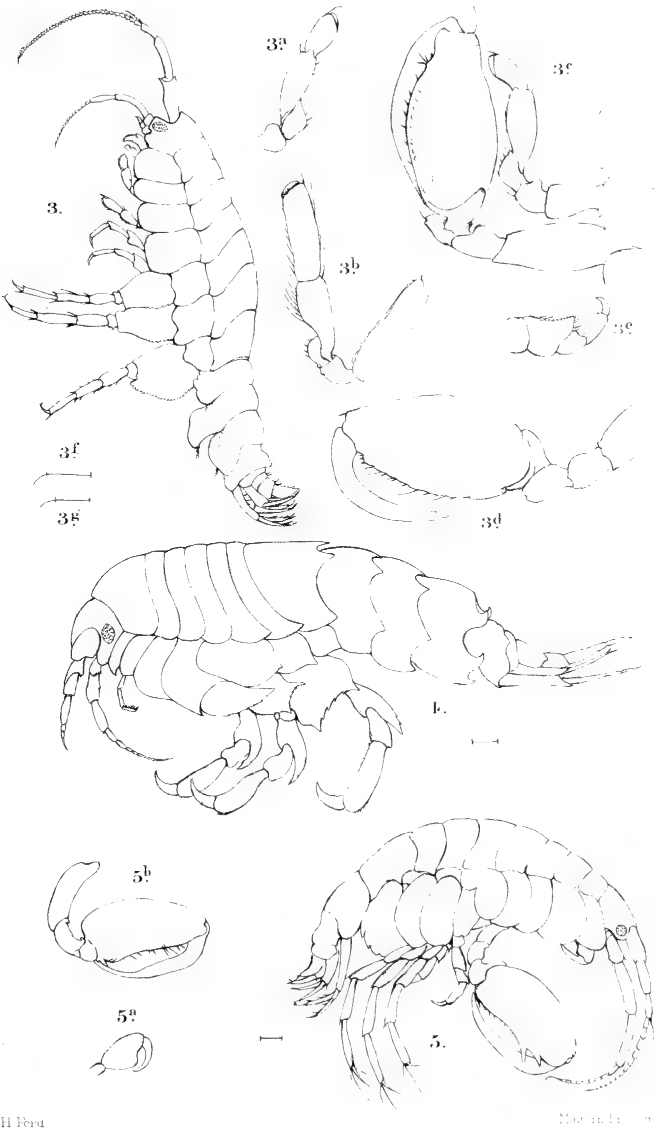

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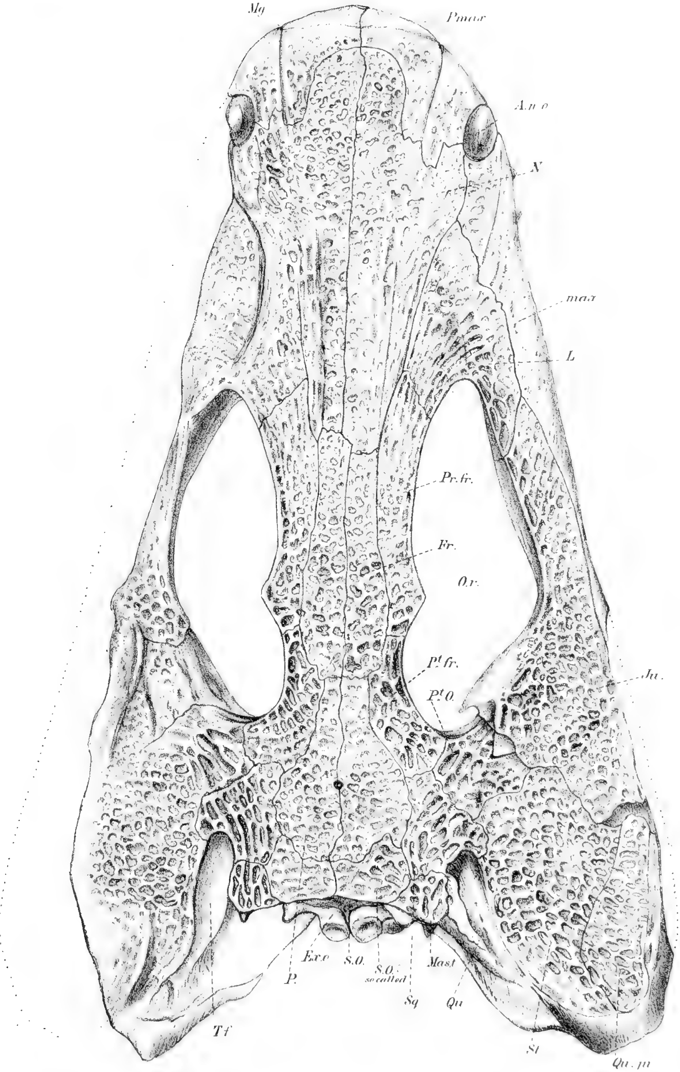

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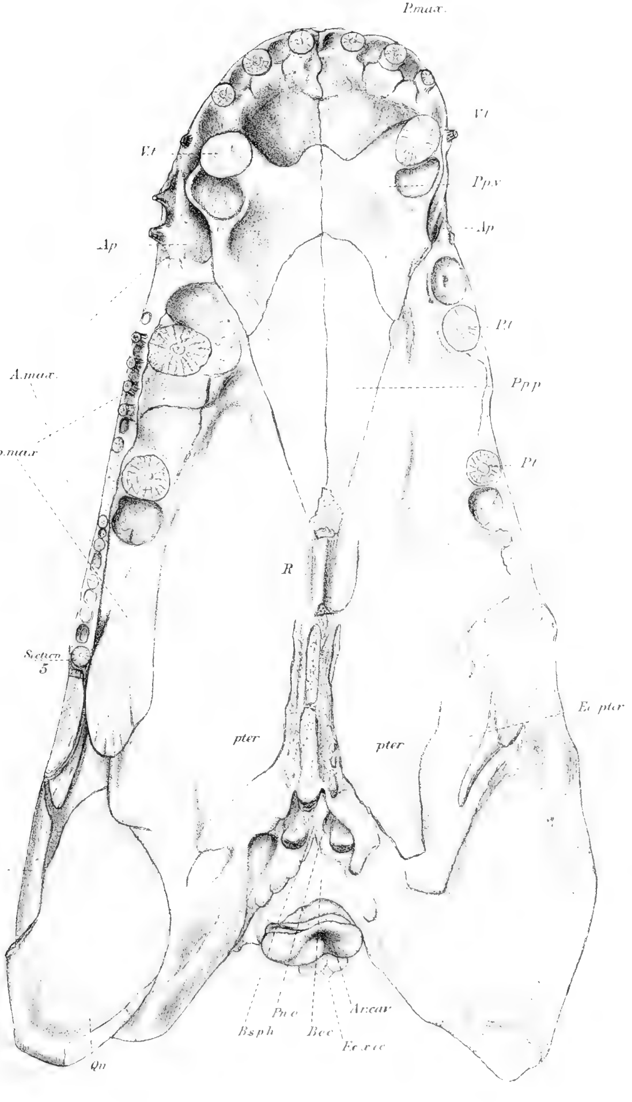

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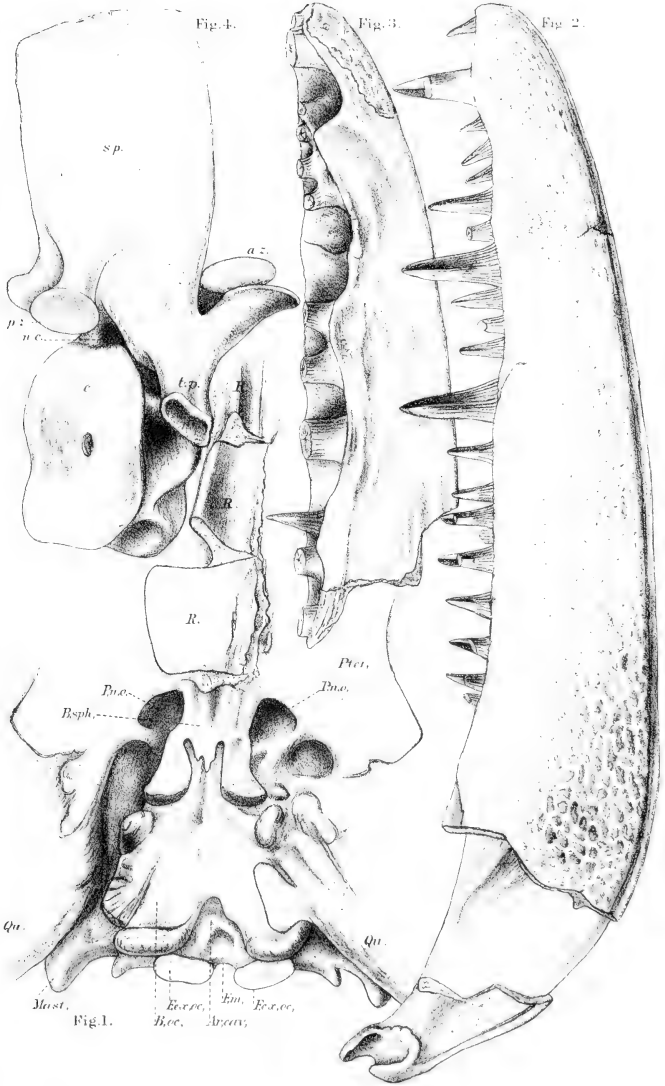

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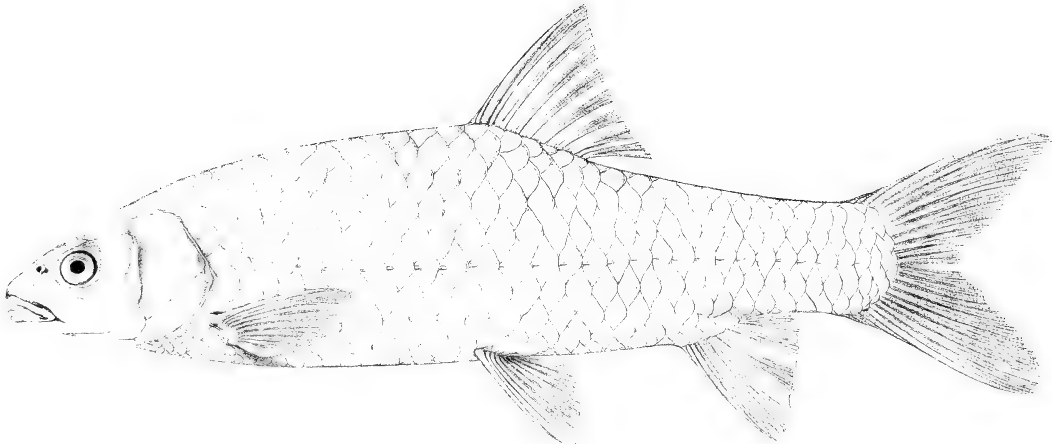
MACRONES COLVILLII



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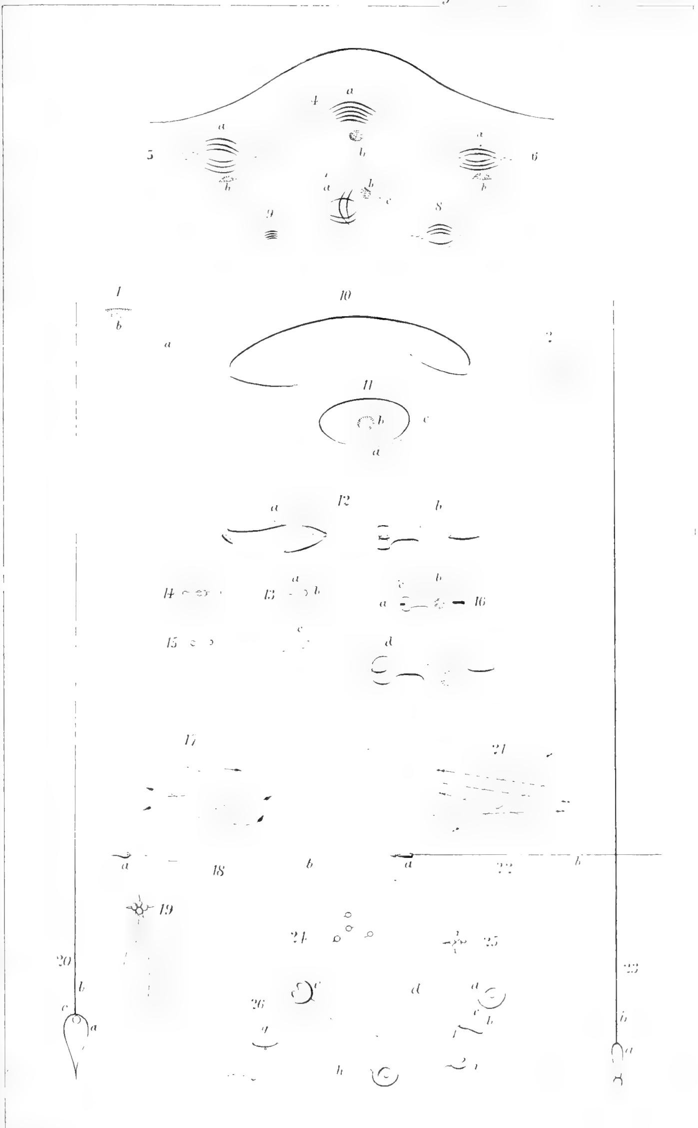

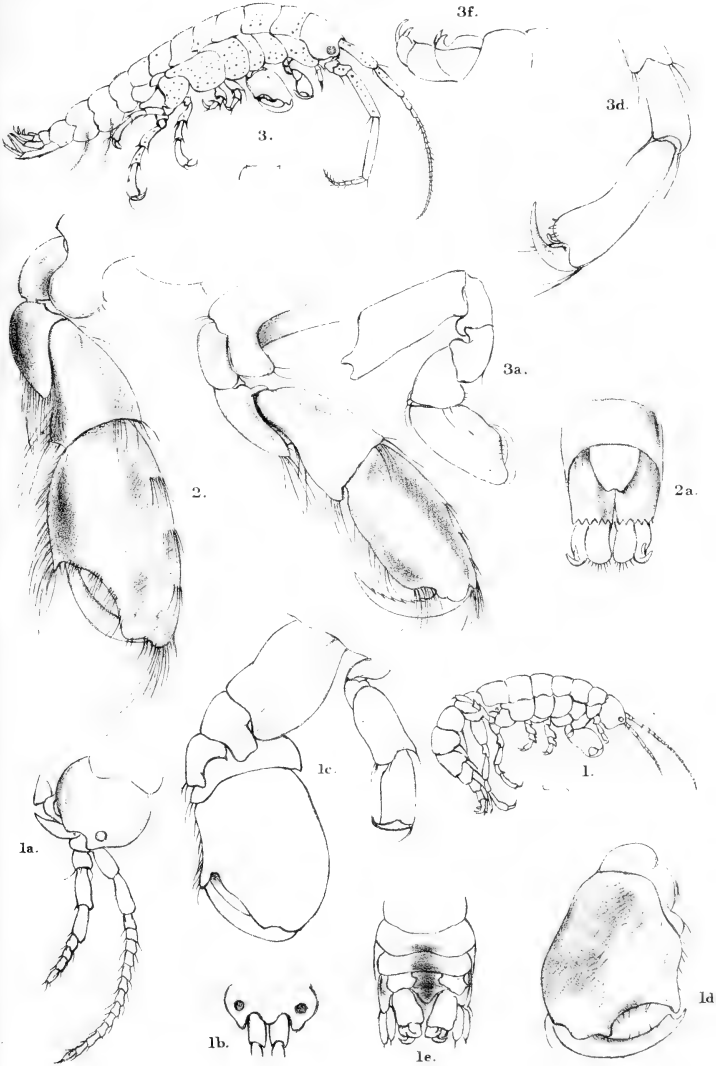

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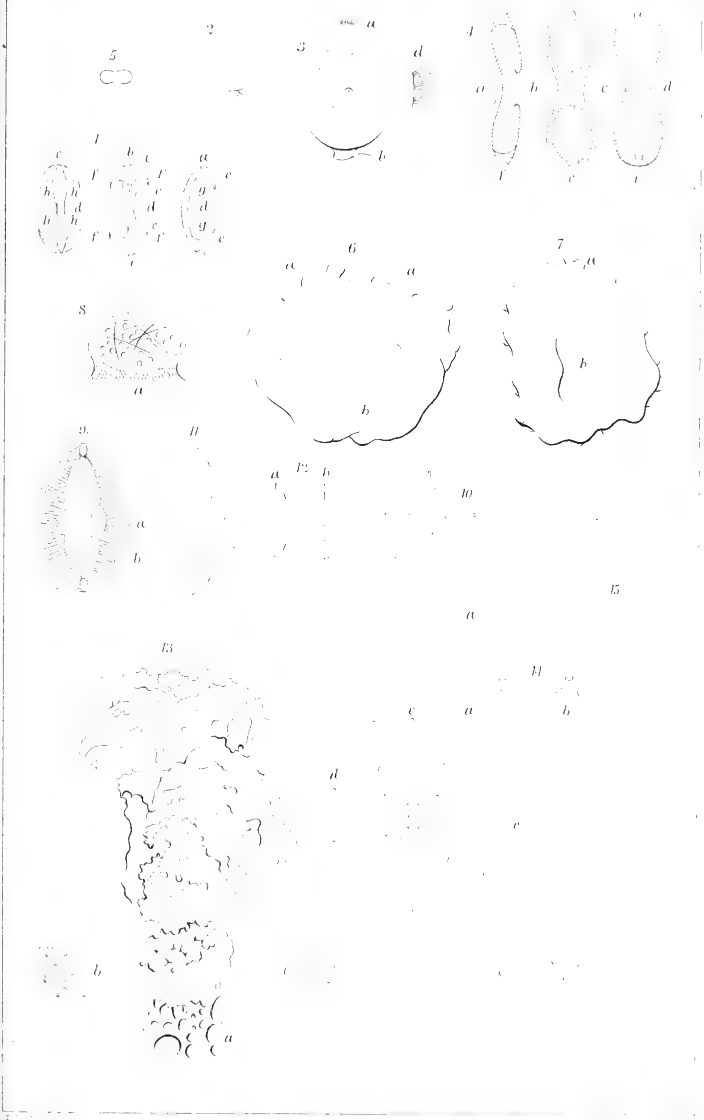

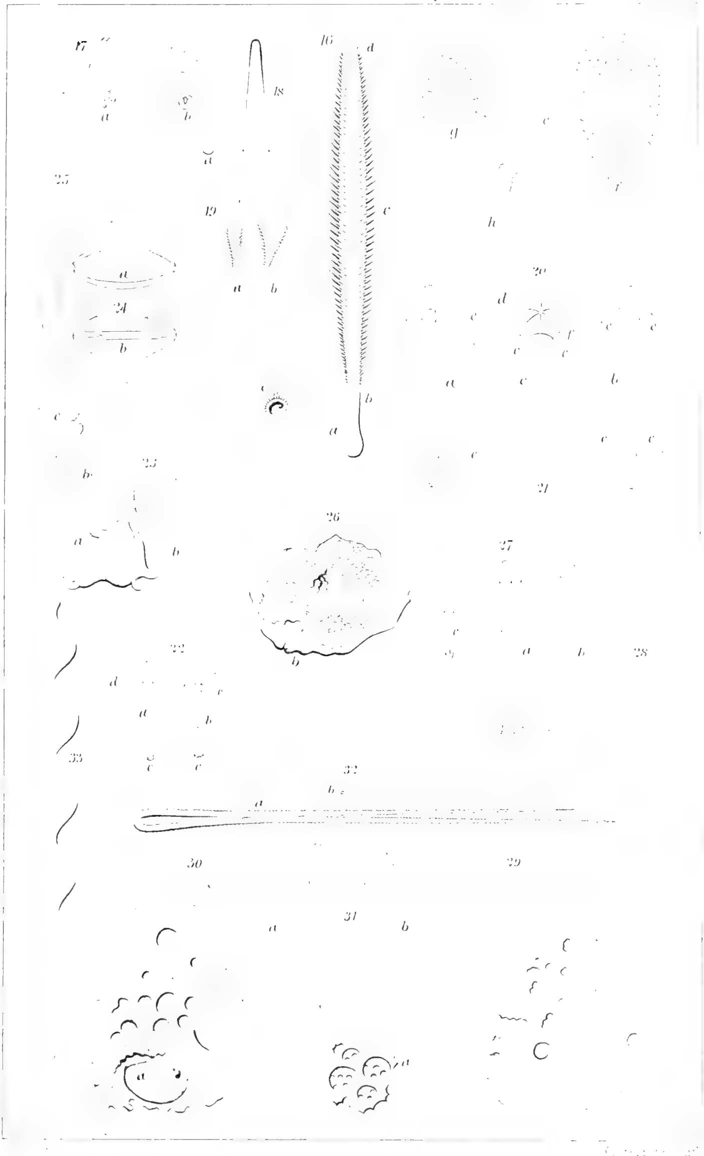

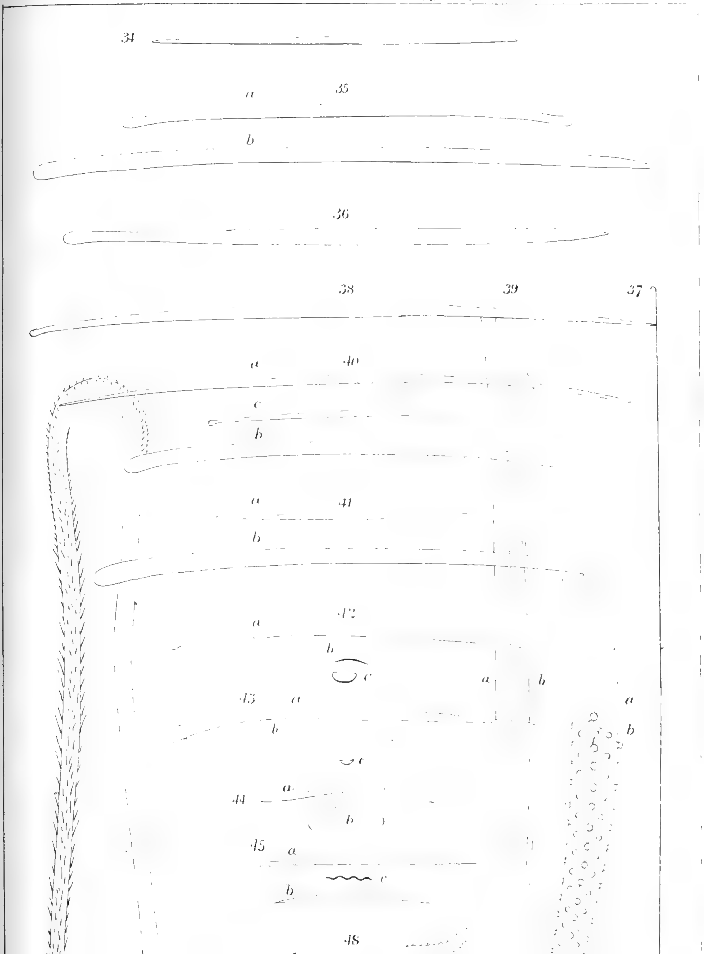
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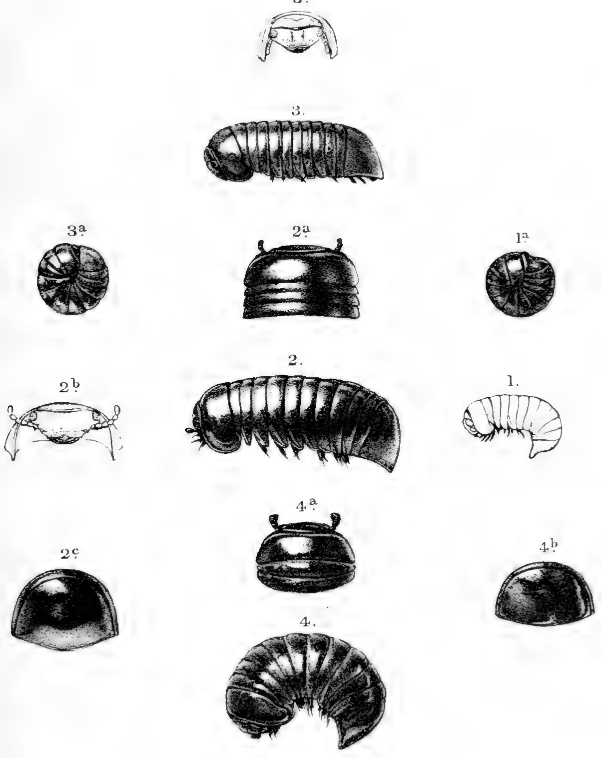

A. G. Butler del et lith. July 1874.

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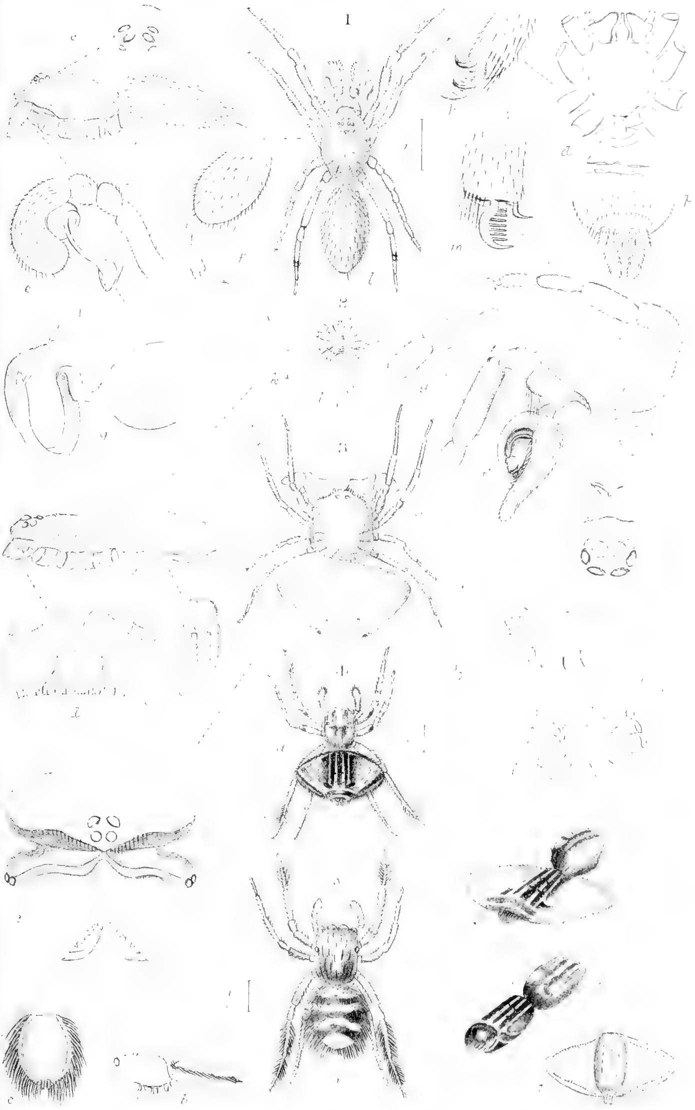
1. 1a. ZEPHRONIA EXCAVATA
2. 2a. 2b. 2c. SPHÆROTHERIUM POLITUM.
3. 3a. 3b. SPHÆROTHERIUM MACULATUM.
4. 4a. 4b. ZEPHRONIA LÆVISSIMA.



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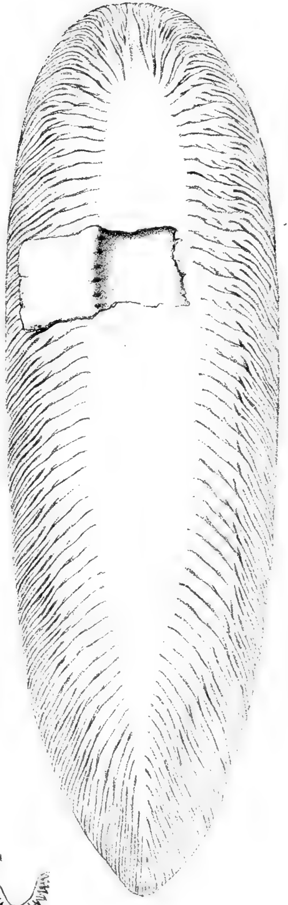

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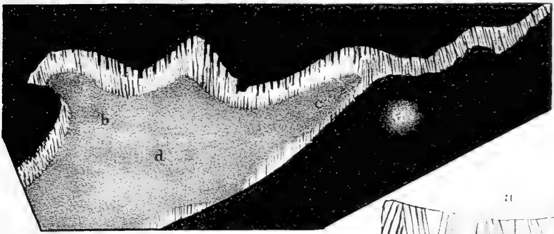

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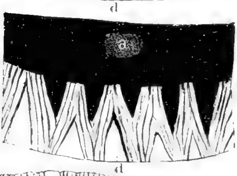

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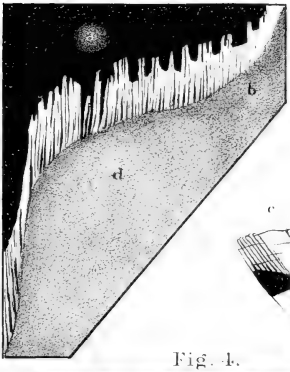

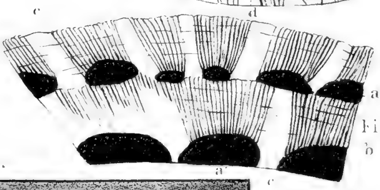

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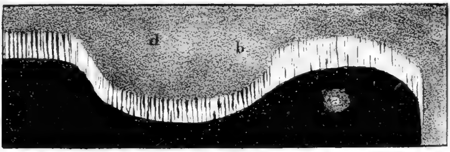

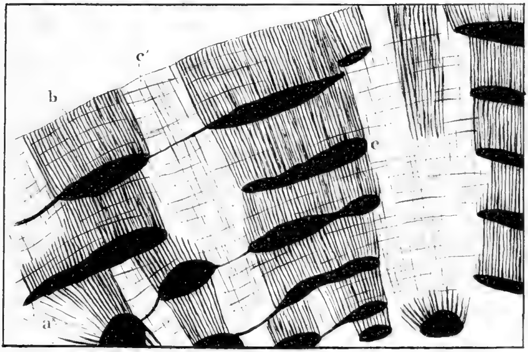

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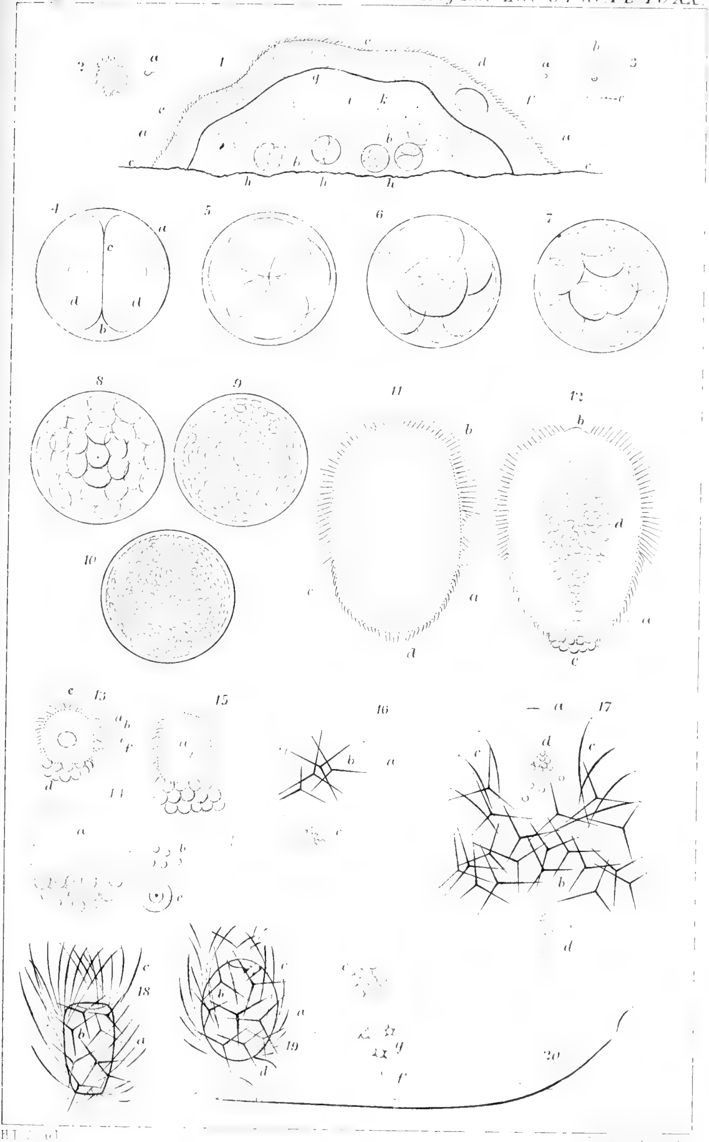

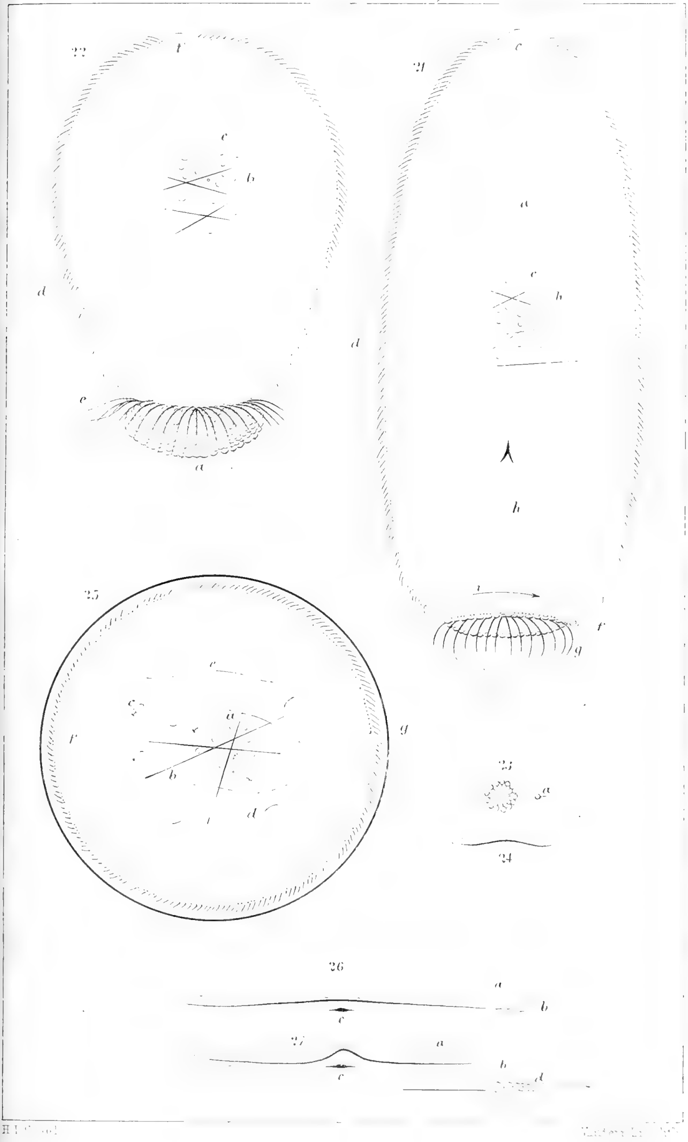

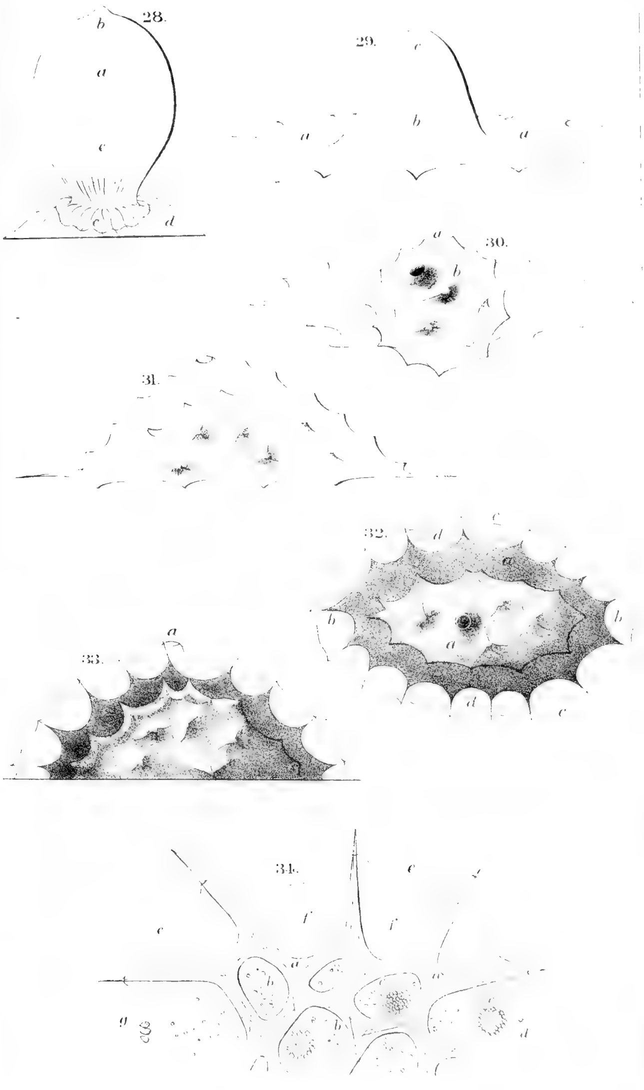

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