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INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

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

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

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

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

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

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

No. 55. JULY 1862.

I.—*Description of some new Species of Entomostracous Crustacea.* By W. Baird, M.D., F.L.S.

[Plate I.]

In one or two late Numbers of the 'Annals and Magazine of Natural History' (Oct. 1859 and Sept. 1861), I have described several new species of exotic Entomostraca bred in this country from mud brought in a dry state from the neighbourhood of Jerusalem, which was placed in pure water and left to stand a certain time during the warm weather of spring and summer. The number of species amounted to six; and it was interesting to observe the great number of individuals of two or three of the species amongst these, that successively made their appearance as the warmth of the weather increased. Since then I have had another opportunity afforded me of observing the extraordinary power the ova of these animals possess in resisting the action of long-continued drought. Sulzer and several other authors assert that the adults themselves possess this power also, and maintain the opinion that, after being completely dried up for a length of time, they revive when placed in water. I am not prepared to deny this *in toto*, especially when they are in their native haunts, deeply immersed in the soft mud; but the experiments of Straus and Jurine upon individuals exposed to artificial exsiccation go to prove the contrary of Sulzer's statement. That the ova of many Entomostraca, however, possess this faculty in a great degree there can be no doubt. In the beginning of the spring of this year I had a small quantity of dry mud from South Africa supplied to me by Mr. Henry Woodward of the British Museum. This mud had been given to him by Mr. W. S. M. d'Urban, who received it from Dr. Rubidge as taken by him from the bed of a dried-up "vley" (or large pond) near Port Elizabeth, Cape Colony, in August 1861.

In the month of January 1862 it was placed in some pure spring-water, care having been taken to see that it contained no animal or vegetable matter. In April, as the weather became somewhat warm, a number of small Entomostracous Crustacea made their appearance. These were all young animals, evidently bred from the ova contained in the mud. Numerous specimens of the carapaces of two or three species were found lodged in the mud; but no adults revived from their exsiccated state. One of these dried carapaces was that of a Phyllopodous Crustacean, a species of *Estheria*, which I have described in a paper read before the Zoological Society this year, and which I have named *Estheria Rubidgei*. No young of this species have as yet made their appearance; and only one species of the Branchiopoda has showed itself. This is a species of *Daphnia*, closely resembling in almost every particular the *Daphnia longispina* of Müller (=*D. pulex*, var. *a* of the 'British Entomostraca'). This *Daphnia* would appear to be, along with the *D. Atkinsoni* from Jerusalem (Ann. & Mag. Nat. Hist. ser. 3. vol. iv. p. 281, pl. 5. fig. 2) and *D. Newportii* from India (Proc. Zool. Soc. 1860, p. 446), the representative in those countries of our common European *Daphnia pulex*. Two species of Lophyropodous Crustaceans have shown themselves also. One of these, not quite satisfactorily made out, is a species of *Cypris* somewhat resembling the English species *C. tristriata*. The other, which has arrived at a state of maturity, is a very distinct species; and of this I subjoin a figure and description.

Legion *LOPHYROPODA*.

Order OSTRACODA. Family Cyprididæ.

Genus Candona.

Candona d'Urbani, Baird. Pl. I. figs. 1, 1*a*, *b*.

Carapace elongately oval, flattened at both extremities, narrower posteriorly than anteriorly. The central portion of the carapace is much swollen, and has a slight indentation at about one-third from the anterior extremity, indicated by a slightly raised knob or protuberance on the side near the dorsal margin. Externally the surface of the carapace is hispid with short strong setæ, and variously marked with dark-green streaks, and, when examined by the lens, appears entirely covered with punctations. The ventral margin is slightly concave or sinuated in the centre, while the dorsal margin is nearly straight for half its length, then slopes down at each extremity, the anterior of which is rounded, and the posterior somewhat acuminate. The valves of the carapace unite closely in the centre of the ventral margin, but are slightly gaping at both extremities. Internally the centre of the valve is of a dull colour, while the two extremities are shining and smooth, and there is a slight duplicature of the shell at the edge. The spot marked externally by the slight protuberance near the anterior margin is internally represented by a depression. The lucid spots on the carapace are small and indistinct.

Length 3 lines; breadth $1\frac{1}{2}$ line.

Hab. Freshwater ponds, Cape Colony.

This is about the largest species belonging to the family Cyprididæ that I have yet seen. A number of dead valves were found in the mud, but only two or three living specimens made their appearance. One, which must have been bred from a dried ovum, made its appearance at the end of April. At first small, it gradually grew to what I suppose, from the size of the dead specimens in the mud, to be its full growth, about the middle of May. It is the specimen figured. Its habits were rather peculiar. It generally kept close to the bottom of the vessel in which it was preserved, either walking upon the mud or, when the weather was cold, digging under the surface or creeping under the little lumps of earth that remained unincorporated. When it rose to the surface of the water, it was by walking up along the side of the vessel, descending afterwards, as it were, by its own gravitation.

A few other species of Ostracodous Entomostraca from other habitats have occurred to me, figures and descriptions of which I here subjoin.

1. *Cypris unispinosa*, Baird. Plate I. figs. 2, 2 *a*, *b*.

Carapace elongately oval, a little narrower anteriorly than posteriorly. The carapace is moderately tumid, the most prominent portion being near the anterior extremity. Ventral margin nearly straight, slightly sinuated or concave; the dorsal margin is nearly straight for about half its length, then slopes down to each extremity. Externally the carapace appears to be smooth, until examined by a tolerably high power, when it is seen to be minutely punctate, and it is marked by several dark-green streaks and lines. The right valve is peculiarly marked by being at its posterior extremity prolonged into a short sharp spine, while the left valve is rounded and free from any such prolongation. The valves are nearly equal in breadth, and do not overlap each other at their ventral margin, but appear to fit into a slight groove, which, when viewed from the interior, may be seen to run all round the ventral margin and the edges of both extremities. The setæ on the pediform antennæ are five in number, long, and finely plumose.

Length 2 lines; breadth 1 line.

Hab. Sandwich Islands; W. Newcomb, Esq. Jamaica; E. Chitty, Esq.

2. *Cypris Texasiensis,* Baird. Pl. I. figs. 3, 3*a*.

Carapace of an ovoid shape, narrowed and somewhat flattened anteriorly, considerably swollen and tumid posteriorly, and of a dull uniform white colour, with the exception of the margin of the anterior extremity, which is of a dark hue. Ventral margin nearly straight, or only slightly sinuated, but distinctly marked with a notch near the anterior extremity, somewhat resembling that of a Cypridina. Dorsal margin rounded, as well as both extremities. The two valves fit closely to each other. The surface of the carapace is quite smooth and shining or only slightly punctate, the punctations being only visible when under a high power. Lucid spots placed near the middle of the valve.

Length $1\frac{1}{2}$ line; breadth at broadest part 1 line.

Hab. Texas; Mr. Cuming.

As only the empty carapace remains, I was unable to distinguish whether this species belongs truly to the genus *Cypris* or *Candona*.

3. *Cypris Chittyensis,* Baird. Pl. I. figs. 4, 4 *a, b*.

Carapace elongately elliptical, narrow, and of a uniform green colour, marked here and there with streaks of a darker green hue. The ventral margin is sinuated in the centre; the dorsal margin and the two extremities, which are both of equal size, are rounded. External surface of carapace quite smooth and shining. The edges of the valves, especially internally, are strongly sulcated, and at either extremity there is, on the inside of the shell, a kind of shelf which is also strongly striated. The posterior shelf appears the larger of the two. Pediform antennæ each furnished with a bundle of about four or five setæ, which are of exactly the same length as the antenna, but are not plumose. The caudal filaments are of a peculiar form; they are of moderate length, flattened, and differing from each other in some respects. One of them is strongly serrated or toothed on its outer edge, while the other (which is somewhat narrower) is simple, or is without the strong teeth or serrations which characterize the first described. Each of them give out, as usual, two short appendages or fingers at its extremity, both of which are strongly serrated.

Length 1 line; breadth $\frac{1}{3}$ line.

Hab. Yallah's Hill, Jamaica; E. Chitty, Esq.

4. *Cypris Verreauxii*, Baird. Plate I. figs. 5, 5 *a*.

Carapace oval, elliptic, of a green colour, with darker patches and streaks of the same hue. Ventral margin slightly sinuated about the middle of its length; dorsal margin rounded. Extremities nearly equal in size, and rounded. Surface of valves smooth and shining. Internally the valves are furnished with a shelf at each extremity, which, as well as the edges of the valves themselves, are simply striated. The setæ of the pediform antennæ are short, and not plumose. Caudal filaments alike, both finely serrated on the edges, and sending off two short appendages, which are rounded and sharp-pointed, and very finely serrated. This species is considerably like the preceding, but is broader and shorter; the edges of the shelf internally are merely striated, while those of *Chittyensis* are strongly sulcate. The setæ of the pediform antennæ and the caudal filaments differ also considerably.

Length $\frac{3}{4}$ line; breadth nearly $\frac{1}{2}$ line.

Hab. Chili; M. Verreaux.

5. *Cypris Yallahensis*, Baird. Pl. I. figs. 6–6 *a*.

Carapace rotundately ovoid, much swollen, narrower anteriorly, of a green colour. Ventral margin slightly sinuate at about the middle of its length. Dorsal margin rounded; greatest height at about its middle. Extremities rounded. Externally the surface of the carapace is hispid and strongly punctate.

Length about $\frac{1}{6}$ line; breadth about the same.

Hab. Yallah's Hill, Jamaica; E. Chitty, Esq.

EXPLANATION OF PLATE I.

Fig. 1. *Candona d'Urbani*, on its side, magnified 8 diameters: 1 *a*, the same, seen from underneath, magnified 8 diameters, with natural size annexed; 1 *b*, internal view, magnified 8 diameters.

Fig. 2. *Cypris unispinosa*, on its side, magnified 8 diameters; 2 *a*, the same, seen from underneath, magnified 8 diameters, with natural size annexed; 2 *b*, internal view, magnified 8 diameters.

Fig. 3. *Cypris Texasiensis*, on its side, magnified 8 diameters, with natural size annexed; 3 *a*, the same, seen from underneath, magnified 8 diameters.

Fig. 4. *Cypris Chittyensis*, on its side, magnified 20 diameters; 4 *a*, the same, seen from underneath, magnified 20 diameters, with natural size annexed; 4 *b*, internal view, magnified 20 diameters.

Fig. 5. *Cypris Verreauxii*, on its side, magnified 20 diameters; 5 *a*, the same, seen from underneath, magnified 20 diameters.
Fig. 6. *Cypris Yallahensis*, on its side, magnified 40 diameters; 6 *a*, the same, seen from underneath, magnified 40 diameters, with natural size annexed.

II.—*On the Systematic Position of the* Charybdeidæ. By Fritz Müller*.

Eschscholtz's section of the *Discophoræ phanerocarpæ* formed a well-defined group of closely allied animals, united by a great number of common characters:—the disk a shallow and smooth segment of a sphere, but capable of being more strongly arched during natation, with a notched margin, in the notches of which, always to the number of eight, are the marginal corpuscles with crystals insoluble in acids; round the mouth four arms, and alternating with these, in peculiar pits, the sexual organs, forming bowed bands folded like frills; the stomachal filaments in the same place, and so forth. The mouth, indeed, was sometimes freely open (*Medusidæ*) and sometimes closed, and, instead of it, numerous orifices on the arms (*Rhizostomidæ*); but this peculiarity of the *Rhizostomidæ*, important as it certainly is for their mode of obtaining nourishment, did not disturb the morphological unity of the group, as it is derived without difficulty from the ordinary form of mouth †. Some subsequently discovered somewhat anomalous forms of *Medusidæ* likewise did not prejudice the unity of the general picture, which they only served to complete ‡.

* Translated from Wiegmann's 'Archiv,' 1861, by W. S. Dallas, F.L.S.

† Gegenbaur (Zeitschr. für wiss. Zool. viii. p. 210, note) declares the polystomism of the *Rhizostomidæ* to be a paradox not reconcilable with the general plan of the *Medusæ*, and even doubts the fact. The fact is easily ascertained, and has lately been repeatedly proved, even by myself. Its explanation also seems to me to be pretty easy. A temporary polystomism, if it may be so called, may be easily seen in Hydroid Medusæ, where the margins of a much-folded four-lobed oral fringe lie upon each other here and there. Thus also the polystomism of the *Rhizostomidæ* will result from the growing together of the membranous laminæ which surround the arms of the *Phanerocarpæ*. When the orifices of the arms have the form of long slits, often continued into strap-like tentacles, as in a *Cephea* of the South-Brazilian coast, scarcely any doubt can remain as to this mode of production. It seems more difficult to explain the perforation of the peduncle of the arms, or its "origin with four roots," as occurs in the same *Cephea*, and, according to Forskal, in *C. octostyla*.

‡ Such as *Nausithoë*, Köll., with its eight extremely simple sexual glands, and *Trichoplea*, n. g., with marginal corpuscles in deep niches on the under surface, two inches from the undivided margin of the disk, which measures two spans in diameter. Amongst the older, less accurately-known species, *Medusa persea*, Forsk. (*Rhizostoma*, Eschsch.), is certainly to be placed with the "*Acraspeda*," notwithstanding its undivided margin and large velum.

It is otherwise, however, with the family of the *Charybdeidæ*, which Gegenbaur arranged with his Acraspeda, the Phanerocarpæ of Eschscholtz. *Charybdea marsupialis*, Péron, and still more *Tamoya haplonema* and *T. quadrumana*, described by me, are opposed most decidedly in almost all the essential features of their structure to the above general picture: a bell with deeply furrowed sides and a broad velum, scarcely capable of any alteration of form; the marginal corpuscles four in number, distant from the margin, in deep niches of the outer surface of the bell; a long oral funnel, after the fashion of *Thaumantias*; sexual organs in the form of broad membranous laminæ in the wide lateral pouches of the stomach, and therefore remote from the stomachal filaments; tentacles upon peculiar clavate or hand-like processes; a distinctly marked nervous system, &c.

In its external form (and this only is known) the *Charybdea periphylla*, Péron, is almost still more strikingly in contrast to the ordinary *Medusæ*; it is, as it were, a *Tamoya quadrumana* with hand-like appendages increased to sixteen in number, and deprived of their tentacles.

It appears, therefore, scarcely possible to imagine transition-forms between the *Charybdeidæ*, on the one side, and the *Medusidæ* and *Rhizostomidæ*, on the other, or even to derive the two groups from a common fundamental form containing essentially anything more than the general features of all *Hydromedusæ*. The intuitively clear picture of Eschscholtz's *Phanerocarpæ* would fade into a shadow by the reception of the *Charybdeidæ*, and at any rate their union would be perfectly unnatural.

And yet, if we will retain the usual bipartition of the Discophorous Acalephs, in which the systems of Forbes, Lütken, and Gegenbaur have altered nothing but the names*, and which even recurs (in respect of the Medusoid forms) when the *Discophoræ*, and rightly, are no longer recognized as a systematic unity, as in the *Acalephæ* and *Hydroida* of R. Leuckart, the *Charybdeidæ* can only find a place among the higher *Medusæ*, with which they have in common at least the stomachal filaments and the insoluble contents of the marginal corpuscles. It cannot be disputed that they are still further removed from the Medusoid brood of the *Hydroida*.

On a former occasion, in describing the *Tamoyæ*, I already thought of a preferable tripartition of the *Discophoræ*, and anti-

* Not the foundation, or principle of division, as Gegenbaur will have it. Eschscholtz by no means regards the "germ-cushions" as either the sole or most important character of the Phanerocarpæ: he placed, like Gegenbaur, the emargination of the margin in the first rank, and was very well acquainted with "the soft, membranous, annular lobe on the margin of the disk," as the common character of his Cryptocarpæ.

cipated that this would derive support from the developmental history. Still earlier, although information of the fact did not penetrate to the place of my exile until subsequently, R. Leuckart, following the same idea, had formed the section of *Ceratostera*, but soon gave it up again; for his supposition has, as is well known, proved to be quite destitute of foundation. Krohn saw *Pelagia noctiluca* reproduce without change of brood, whilst Busch traced the brood of *Chrysaora*, which is scarcely separable generically from *Pelagia*, up to the polype-form. Among the *Hydroida*, it has been shown by Gegenbaur that *Trachynema ciliatum*, and by myself that *Geryonia* (*Liriope*) *catharinensis*, are probably developed directly from the egg; whilst, on the contrary, the supposition of the direct evolution of the *Æginidæ*, founded solely upon the ciliary coat of the young of *Æginopsis*, has lost its support by the discovery of ciliated brood in the stomach of *Cunina Köllikeri*.

Nevertheless, my formerly imagined grouping of the *Discophoræ* has become more and more plausible with every new investigation. It appears to me that in this case, as in so many others, the unfettered intuition of the older observers has hit the right course in uniting with *Charybdea marsupialis* and *periphylla* the *Charybdea bitentaculata*, which is now usually placed, under the name of *Æginopsis mediterranea*, J. Müll., or *Æ. bitentaculata*, Köll.*, in the family *Æginidæ*, at the end of the *Cryptocarpæ*. Not that I would support the union of *Charybdea* and *Æginopsis* in the same genus, or even, after the example of Lütken, in the same family; but I am of opinion that *the families* Charybdeidæ *and* Æginidæ, *Ggbr., are to be united to form a group of the* Hydromedusæ *equivalent to the* Siphonophora, Hydroida, *and* Acalephæ (in Leuckart's sense). To group together the most highly organized of all known Hydromedusæ, and perhaps of all Cœlenterata, the *Tamoya quadrumana*, and the *Æginidæ*, which apparently represent the lowest step in the series of Hydromedusæ, and some of which, such as *Eurystoma*, Köll., only digest by the cavity of the lower surface, which is partially closed by the velum†, certainly long appeared to me to be rather a doubtful course. Since I have been able to examine carefully a species extremely similar to this *Eurystoma* both in form

* The difference of colouring can hardly be accepted as a specific distinction in a group of animals in which, as in the Acalephæ (*Rhizostoma*, *Chrysaora*, &c.) and Hydroida (*Corymorpha*), the greatest variability of coloration within the species may almost be regarded as the rule.

† I did not think I might doubt this representation of Kölliker's (which is probably erroneous) upon Gegenbaur's authority alone, as in other *Medusæ* I had not always found his statements perfectly well founded,—still less on account of any *à-priori* notions respecting "a general plan of the Medusæ."

and in the development of the brood budding in the stomach, and since I have again obtained Eschscholtz's admirable 'System der Akalephen,' this hesitation has disappeared; and I now regard my view as sufficiently well founded to venture to submit it to the judgment of zoologists.

The incompatibility of the *Charybdeidæ* with the Acalephæ of Leuckart has already been spoken of. *Cunina, Æginopsis,* and their allies stand in a precisely similar position towards the other Cryptocarpæ or Hydroid Medusæ. The disk of the latter, although very variable in form, is still always entire at the margin, and either smooth, as in the other Acalephs, or furnished with slightly projecting ridges running from the middle of the back; they have always radiating vessels and an annular canal, and the former, except when very numerous, in a fixed number; the marginal vesicles, when present, are always roundish and sessile; the marginal filaments, although very variable in structure, always occupy the immediate vicinity of the annular vessel. Lastly, in the structure of the sexual organs, the Hydroid Medusæ approach the Acalephæ (Leuckt.) or Phanerocarpæ; for, although their forms are exceedingly numerous, the extremes are united by a tolerably close series of intermediate forms (from the astomatous sexual clubs of the Medusæ of *Corymorpha* to the densely appressed ramifications along the radiating vessels of *Olindias**), they still always occupy the external wall of the gastrovascular system, and empty their products externally. On the other hand, the disk of *Cunina* and its allies is frequently, if not always, notched at the margin†, and, as in the *Charybdeidæ,*

* *Olindias*, nov. gen. Habitus of *Thaumantias mediterranea*, Ggb.; four radiating vessels, and numerous (more than 100) retrograde vessels; at the margin extremely extensible filaments and slightly moveable tentacles, both hollow and of indefinite number; at the base of the tentacles are the marginal vesicles in pairs; the sexual organs are arborescently ramified along the radiating vessels. It is probable that the filaments (*Fangfäden*) on the radiating vessels of *Melicertum* are nothing but sexual organs, and this the rather, as even in the structure of the marginal filaments *Olindias* approaches most closely to *Melicertum.* As a transitional structure from the stomachal to the peripheral sexual organs, I may cite, not to refer to undescribed forms, *Lizzia Köllikeri*, in which, according to Gegenbaur's observation, confirmed by me on a nearly allied species, the sexual gland lying on the stomach is traversed by a branch of the radiating vessel.

† Gegenbaur is of opinion that the possession of a velum presupposes an entire margin of the body, and for this reason, apparently, he denies, in opposition to Eschscholtz and Kölliker and in contradiction to himself, the notching of the margin in the *Æginidæ*; for in *Ægineta flavescens* he shows the gelatinous substance continuing itself in considerable thickness upon the stomachal sacs; in the intervals, therefore, there are gaps or notches of the gelatinous substance, *i. e.* "the body," over which only membrane is stretched; as in the *Æginidæ*, which are destitute of an annular vessel, only the cessation of the gelatinous substance can indicate

traversed by deeper or shallower furrows, extending a greater or less distance upon the dorsal surface; the stomach has broad lateral sacs, often in variable number, no radiating vessel or annular canal; the marginal vesicles are usually pedunculate; the tentacles, never exceeding the number of the stomachal sacs, are always situated on the back, often springing very far from the margin; they are, moreover, characterized sometimes by a peculiar rigidity, and sometimes by "a mobility not observed in other Medusæ" (Eschscholtz*). The sexual materials of *Cunina* are formed in the interior of the lateral sacs, and, indeed, in their lateral angles, from which their place of formation extends in the form of a horse-shoe from one sac to another.

From all this, the alliance of *Cunina*, *Æginopsis*, &c. with the Hydroida is equally loose and forced, and as little effected by any transitions as that of the *Charybdeidæ* with the Acalephæ. If, therefore, the separation of these two families from their present alliances is not subject to any serious doubt, neither does any such appear to present itself against their union. It is true that a wide gap exists between *Cunina* and *Tamoya*, but not wider than between the Medusoid of *Corymorpha*, without tentacles, eyes, or mouth, and *Olindias*, or between *Nausithoë* and *Cephea*—a gap like that between the young brood and the mature animal, over which fancy readily finds a gradual passage by intermediate steps, and not a wall of separation set up by incompatible characters. From the shallow furrows in the flat, slightly notched disks, often (according to Gegenbaur) of a cartilaginous hardness, of many *Cuninæ*, the intermediate form of *Ægina citrea* leads to *Charybdea marsupialis*, and to the complex bells of the *Tamoyæ*, whilst, even in both the extreme genera, the combination of a velum with a disk not entire at the margins, observed neither in Hydroida nor in Acalephæ, occurs as a common character. From the flatly stretched stomachal membrane

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the boundary between body and velum. As in the *Æginidæ* the muscular membrane of the lower surface is continued over a notched margin, the marginal membrane may, in like manner, be wanting in disks with entire margins, even in Hydroid Medusæ; at least, I am unable to detect any trace of it in a small *Campanularia*-bud, *Tintinnabulum resupinatum*, n. s., which *always* swims with the disk reversed.

* This is the case in *Ægina sulfurea*, as it is called in Eschsch. System p. 9, or *Æg. citrea*, at p. 113. The second Eschscholtzian species, *Ægina rosea*, is probably to be separated from this, and referred to *Cunina*, as, according to Eschscholtz's figure (tab. x. fig. 3 *a*), it appears more natural to ascribe to the stomach six lateral sacs excavated opposite to the origin of the tentacles, than twelve such organs. If, with Gegenbaur, we characterize the *Æginidæ* by "rigid tentacles," the choice of the name after that of a species distinguished from all other Medusæ by the exact opposite cannot be described as particularly happy.

of *Cunina*, with its simple proteiform mouth, closely repeated in *Ægineta*, *Polyxenia*, and *Æginopsis bitentaculata*, the four arms on the mouth of *Æginopsis Laurentii*, Brdt., lead to the structure of the stomach in *Charybdea* and *Tamoya*. In the same way the form of the sexual organs of *Tamoya* may be deduced without constraint from those of *Cunina*; but neither the one nor the other can be referred to the fundamental form developed in Hydroida and Acalephæ. If *Tamoya quadrumana* has an entire series of perfectly new parts not even indicated in *Cunina*, such as a well-developed nervous system, there is nothing remarkable in this; some of them, such as the eight finger-like processes in the base of the bell and the dendritic glands, are totally wanting even in *T. haplonema*.

The formation of the marginal corpuscles is certainly essentially different; but we still know nothing about their development in *Charybdea* and *Tamoya*, or of their structure in the intermediate forms *Ægina citrea* and *Æginopsis Laurentii*; and, again, their difference is not more considerable than between the eye-spots and marginal vesicles of the Hydroida.

The formation of the tentacles also is perfectly anomalous, but nevertheless by their dorsal origin they contrast equally with the marginal filaments of the Hydroida and Acalephæ. The tentacles of *Cunina* are rigid, those of *Tamoya* contractile; but those of the young brood of *Cunina* are also contractile. The tentacles of *Cunina* are solid, those of *Tamoya* hollow; but hollow and solid tentacles are exhibited by otherwise very nearly allied genera, such as the various *Campanularia*-buds*; nay, both forms occur simultaneously or successively in the same animal (*Liriope*). In this, therefore, no ground for the union of our two families can be sought; but that which especially speaks in favour of it is that at present it is not possible to draw a marked boundary-line between the two, and to refer the median forms

* For the *Campanularia*-buds with solid and but slightly moveable tentacles, exactly like those of *Campanularia* itself, I propose to retain Dalyell's name *Tintinnabulum*; it appears that they are always born with a greater number of tentacles. Here belongs also *Eucope polystyla*, Ggb. What Gegenbaur describes and figures in this species as roundish inflations of the annular vessel, directed into the substance of the disk, may be the thickened roots of the tentacles, judging from the nearly allied *Tintinnabulum resupinatum*, n. sp. The *Campanularia*-buds with hollow filaments dilated at the base and very contractile, of which, when set free, they have only four and the first traces of four more (*Eucope*, Ggb., excl. *E. polystyla*), have, in my opinion, a title to the name of *Thaumantias*; for it appears to me scarcely doubtful that it is to these, and not to *T. mediterranea*, Ggb., that the two Eschscholtzian species of *Thaumantias* belong; and for them, therefore, in a division of the genus, the old name should be retained.

to one or the other. Amongst these are *Ægina citrea,* which approaches the higher forms in the four arms and the great mobility of the tentacles, and *Æginopsis Laurentii,* which allies itself to them by the four arms at the mouth. So also *Charybdea periphylla,* Péron, which resembles *Tamoya quadrumana* in the form of the marginal appendages, but departs from the other *Charybdeidæ* in the multiplicity of its tentacles.

I would consequently arrange the *Charybdeidæ* in the following manner in the system of the Hydromedusæ:—

HYDROMEDUSÆ.

1. Siphonophora, including the free sexual animals (*Chrysomitra*).
2. Hydroida.
   - a. *Tubularinæ,* together with the Hydroid Medusæ without organs of sense or with eye-spots.
   - b. *Sertularinæ,* with the Hydroid Medusæ with marginal vesicles*.

     In respect of the development, there are in this group—
     - α. Polypes without free sexual animals.
     - β. Polypes with free sexual animals.
     - γ. Free sexual animals without polypes (*Trachynema, Liriope*).
3. Acalephæ, R. Leuckt. (*Discophoræ phanerocarpæ,* Esch.).
   - a. *Monostomatous* (*Medusidæ,* Esch.).
   - b. *Polystomatous* (*Rhizostomidæ,* Esch.).
4. Æginoidæ (*Æginæ,* Lütk.).
   - a. *Lower*: *Cunina* (with *Ægina rosea,* Esch.), *Ægineta, Polyxenia, Æginopsis bitentaculata.*
   - b. *Higher*: *Charybdeidæ. Æginopsis Laurentii*?, *Ægina* (*citrea*), *Charybdea* (*marsupialis*), *Tamoya, Periphylla* (*C. periphylla,* Pér.).

* Gegenbaur was the first, as far as I know, who pointed out the importance of the ocelli and marginal vesicles in the Hydroid Medusæ, and laid some stress upon the difference of the marginal filaments; and, indeed, the families of "Craspedota" established by him, from being more natural and depending less upon the exclusive application of one character, contrast very advantageously with those of Forbes, and even of Lütken, and may serve as a more convenient starting-point for further systematic attempts. To future workers I would especially recommend a careful consideration of the marginal filaments, by which, apparently, amongst other things, the *Geryonidæ* and *Thaumantiadæ* of Gegenbaur might be more sharply defined.

III.—*On the Occurrence of a Species of* Regalecus *among the Rocks at St. Andrews; with a few Notes on its Anatomy.* By Robert Walker, Assistant-Curator of the St. Andrews Museum.

In the month of April last, my attention was called by Mr. J. Howie to a fish cast ashore among the west rocks at St. Andrews. This fish proved, after examination, to be a species of *Regalecus*, very likely *Banksii*; but, as it was rather too imperfect for exact specific identification, I propose giving the following description, which may assist zoologists in arriving at that determination:—

The fish was perfectly fresh, but much mutilated. The head was entirely destroyed, and a considerable portion of the posterior end of the body was wanting: as it was, it measured from what appeared to be the coracoid (*i. e.* immediately behind the gills) to the broken end 7 feet 2 inches; 9 inches deep at the coracoid; 12 inches a little before the anus; and $8\frac{1}{4}$ at the broken end. The body was very much compressed, and was of a sword-blade-like shape, the greatest thickness being somewhat below the middle of the depth, where it was $2\frac{1}{2}$ inches thick. From this it gradually tapered away to the dorsal and ventral margins, the dorsal edge being considerably the thinnest of the two, scarcely amounting to $\frac{1}{4}$ inch. There was a dorsal fin extending the whole length, and consisting of 167 rays, which were much broken, as was also their connecting membrane. The longest of these rays measured $2\frac{3}{4}$ inches in length. There was no anal fin. On the right side the pectoral and ventral fins were lost. On the left side the pectoral consisted of eleven broken rays, the longest about 1 inch in length; and the ventral, of a spine about $\frac{3}{8}$ inch in length, and $\frac{1}{4}$ inch in thickness. The skin was completely covered by what appeared to be bony tubercles, the largest of which were arranged in four pretty distinct longitudinal belts, which, from their size, gave to the surface of the body a somewhat ridged-like appearance. These belts or ridges varied from $1\frac{1}{8}$ to $\frac{3}{4}$ inch in breadth, and the spaces between them were occupied by smaller tubercles. None of these tubercles were regularly arranged, but seemed to be placed without any regard to individual connexion or relation to each other. Between some parts of the tubercles there was a beautiful silvery-looking lustre, which was very easily taken off, adhering to the fingers or to any object that came in contact with it. There were a few faint dark streaks on the anterior part of the body, proceeding from the dorsal margin and extending obliquely downwards and backwards, but not appearing to cross the lateral line. The lateral line at the coracoid was about one-third from the dorsal edge; thence it descended obliquely till about halfway between it and the anus. It then proceeded pretty straight, but still converging towards the ventral edge as it extended outwards to the posterior end; at the anus it was $2\frac{1}{2}$ inches from the margin. The anus was 4 feet 6 inches from the coracoid. The viscera were not particularly examined; this is the less to be regretted, as the viscera of *Regalecus* have been already clearly described by Messrs. Hancock and Embleton*. But, on cutting open the fish, the cæcal prolongation of the stomach was observed to pass behind the anus for the whole length of the portion preserved, and had evidently extended a considerable way beyond.

This specimen of *Regalecus*, like the others that have been found on the British shores, was very tender, and could have been easily broken to pieces; so much so that, on attempting to draw it out of the pool of water in which it lay, with a common crab-hook, which is quite thick and blunt at the point, the hook went right through it. In fact, the use of the hook had to be dispensed with, in order to preserve entire as much as possible of the fish.

The internal structure was not further examined at this time. The following description was drawn up from a piece of the fish commencing about 6 inches behind the vent, and extending to 20 inches in front of it, and after it had lain eight months in spirits.

The vertebral column was enclosed by a strong fibrous sheath or membrane, two branches of which proceeded from the upper side of the column to form the neural canal; they were at first about $\frac{4}{12}$ inch apart, approximating as they ascended, till they finally coalesced about $\frac{1}{4}$ inch above the vertebral column. From this point a single membrane passed vertically up the middle of the body, and enveloped the lower ends of the interneural spines. From this central membrane there were three septa or bands sent outwards on each side, till they became confluent with the corium or inner skin. From the middle of each side of the vertebral column there was another of these aponeurotic septa sent outwards till they joined the skin, and formed a strong connecting-band between it and the vertebral column.

The hæmal canal was formed by two membranes proceeding from the lower side of the vertebral column, and passing downwards about $\frac{3}{8}$ inch, when they coalesced. There was a slight swelling of the membrane at the coalescence, from which a band or septum was sent out on each side to join the skin, and another passed vertically downwards for a short distance, when it enlarged considerably immediately above the abdominal cavity. From this enlargement two bands were sent outwards, one on

* Ann. Nat. Hist. ser. 2. vol. iv. p. 7 et seq.

each side, to join the skin; other two proceeded downwards, and formed the lining of the abdominal cavity, at the lower edge of which they again coalesced, enlarged, and extended down to the ventral margin. The septa or bands connecting the lining membrane of the abdominal cavity and the corium were very numerous, from a little below its commencement down to the ventral edge of the fish.

The vertebral column appeared to be only a stage in advance of the primitive notochord, and presented no appearance externally of being segmented, but looked like a continuous flexible column, without any prominence or depression to indicate where the segments were. The only inequality visible was a slight depression on the sides between the neural and hæmal arches. The column had a somewhat hexagonal appearance externally, which was partly caused by its enveloping-membrane thickening along the middle of each side, where it proceeded outwards. When the column was bent from side to side, the joints were apparent; and when cut open, there was a slight depression observed at the joints, which was caused by the cartilage of each segment or vertebra not quite meeting that of the next.

The centra of the vertebræ were composed of what to the unaided eye appeared to be simple cartilage, and were entirely devoid of ossification; they measured on an average about $1\frac{3}{4}$ inch in length, and had the appearance of gradually shortening, the centra of the posterior end being slightly shorter than those of the anterior. Each centrum was hollowed out internally at both ends into a conical or hourglass-shaped cavity. The apices of the cavities were separated from each other in the middle of the centra by a layer of cartilage about $\frac{1}{12}$ inch in thickness, through which there was a small perforation, virtually connecting them together. The vertebral centra were $\frac{1}{2}$ inch in diameter, their contiguous cup-margins being very thin, scarcely amounting to $\frac{1}{12}$ inch. The cavities of the centra of the vertebral column were round internally, and were filled with a gelatinous-looking substance of sufficient consistency to retain its conical shape at both ends after being removed. This substance had been the base of the primitive embryonic chorda dorsalis, around which the cartilage had afterwards been developed. In its latter condition it consisted of alternate swellings and contractions corresponding to the internal shape of the column; in this form it had extended, in all probability, the whole length of the body. The neurapophyses consisted of narrow pieces of cartilaginous-looking laminæ developed in the walls of the membrane which formed the neural canal. At their lower ends they were firmly anchylosed to the middle of the centrum of each of the vertebræ; at their upper ends they coalesced at the same point as the membrane, and in this way they formed a series of rudimentary neural arches. The neural spines were about $3\frac{1}{2}$ inches long, and consisted, as well as the arches, of what appeared to be the hardest cartilage in the fish; they were confluent and perhaps connate with the neurapophyses, from which they extended up to a little beyond the commencement of the interneural spines. These neural spines were slender, flexible, and not easily recognized in the central membranous partition already referred to, in the walls of which they were developed, and remained imbedded. The interneural spines commenced about $4\frac{1}{2}$ inches below the dorsal margin. They were at first small, thread-like, and quite hid in the enveloping membrane, but gradually enlarged as they approached the dorsal margin, where they were about $\frac{1}{8}$ inch across. These spines began to expand on both sides, before and behind, about half an inch from their upper extremities. This expansion went on increasing till each spine was half an inch in breadth, when the enlarged or projecting portion joined that of the spine next to it, before and behind, and thus formed a continuous cartilaginous and strengthening ridge extending along the dorsal margin. The lateral projections of the interneural spines did not extend quite to the upper edge, but sloped away a little from the middle of the upper ends of the spines downwards on both sides, which formed a series of notches extending along the upper edge; each notch corresponded to, and was placed immediately above, the junction of each pair of spines. In these notches or cavities oval-shaped pieces of cartilage were placed, and held by ligaments, which allowed them a free motion principally from side to side; to these cartilages the bifurcated fin-rays were attached. There was a small disk-like addition on each side of the lower ends of these double rays, which was in contact with, and firmly held by ligaments to, the lateral surfaces of the oviform cartilages. The dorsal fin-rays were bifurcated for a considerable part of their length; it is very likely that they were confluent at the points, but of this I am not certain, as none of them were entire. For upwards of two inches of their length, however, they appeared to have had only a membranous connexion.

The parapophyses existed as cartilaginous laminæ developed in the membranous walls of the hæmal canal, anchylosed at their upper ends to the middle of the lower sides of the vertebral centra, and coalescing at the lower ends about three-eighths of an inch below the vertebral column; in this way they formed a series of contracted hæmal arches, which contained the aorta and the vena cava. There were thread-like hæmal spines confluent with and proceeding downwards from the parapophyses, till they were finally lost in the walls of the membrane a little above the abdominal cavity. From what was observed, it appears that these spines grew longer as the cæcal cavity grew less, towards the distal end of the fish.

The *Regalecus* appears to be rather a rare fish everywhere, its first recorded occurrence in Britain being in the 'Annual Register' of 1759. Since that time some eleven or twelve specimens have been observed, all on the north-east coast. Its first recorded occurrence in Scotland was of a specimen stranded at the village of Crovie, in Banffshire, in 1844. Another was stranded in the Bay of Cromarty in 1852. The St. Andrews fish, in 1861, makes the third time it has been noticed on the Scottish coast.

IV.—*Descriptions of new Species of Phytophagous Beetles.* By Joseph S. Baly.

Genus Lema, Fab.

Lema frontalis.

L. anguste oblonga, subcylindrica, nitida, testacea, pectore antice abdomineque piceis; capite (fronte excepto) nigro; antennis subfiliformibus, articulo ultimo basi fulvo-albo; thorace transverso, subcylindrico, lateribus medio modice constrictis, dorso ante basin transversim sulcato, hic illic fortiter punctato, medio utrinque unifoveolato; elytris viridi-cyaneis, basi vix elevatis, infra basin transversim depressis, sat profunde striato-punctatis, interspatiis lævibus, remote punctatis, ad apicem subelevatis; tibiis extrorsum tarsisque fuscis.

Long. 2–2½ lin.

Hab. Lizard Islands, Northern Australia.

Narrowly oblong, subcylindrical, nitidous, testaceous; anterior part of breast and the abdomen piceous; elytra cyaneous; apical half of tibia, together with the tarsi, nigro-piceous. Head black, with the exception of a large oblong rufous patch on the forehead; face triangular, its lower portion slightly produced; epistome separated from the face by a deep groove, from the apex of which an oblique sulcation runs upwards on either side along the edge of the orbits; upper portion of face coarsely punctured, bilobed; antennæ moderately robust, subfiliform, basal half of apical joint obscure white. Thorax transverse, sides moderately constricted in the middle, the upper surface deeply impressed in front of the base with a transverse sulcation, which extends at either end into the lateral constriction, its middle impressed with a single deep fovea; surface of disk coarsely punctured on the sides in front and down the middle, the latter part impressed on either side by a large deep fovea. Scutellum longitudinally grooved, its apex obtuse. Elytra much broader than the thorax, oblong, parallel in front, their apex rounded; upper surface transversely depressed below the basilar space, the latter not elevated; each elytron furnished with nine rows of deep coarse punctures, which become, however, finer and less deeply impressed towards the apex; interspaces nearly plane in front, indistinctly wrinkled transversely below the basilar space, thickened and subcostate towards the apex of the elytron. Legs pale testaceous; tarsi, apical half of four anterior tibiæ, together with the extreme apex of the hinder pair, nigro-fuscous; hinder thighs slightly thickened.

Lema Bowringii.

L. elongata, subcylindrica, nitida, subtus nigro-cyanea, argenteo pubescens; capite thoraceque rufo-testaceis, illo pone oculos valde constricto; oculis antennisque subfusiformibus nigris, harum articulis ultimis duobus sordide albis, hoc cylindrico lateribus vix pone medium valde constrictis, ante basin tranversim sulcato, sub lente remote punctato; scutello nigro; elytris læte cæruleis, parallelis, basi obsolete elevatis, punctato-striatis, interspatiis antice planis, disco exteriore indistincte transversim corrugatis, ad apicem subcostatis.

Var. A. capite thoraceque læte cæruleis, vertice obscure rufo.

Long. $2\frac{3}{4}$–3 lin.

Hab. Pulo-Penang.

Elongate, subcylindrical, nitidous, bluish black beneath, and sparingly clothed with adpressed silvery pubescence; head and thorax rufo-testaceous; elytra deep metallic blue. Head constricted behind the eyes; face triangular, epistome separated from the face by a deep, acutely-angled groove; from its apex two others run obliquely upwards, one on either side, along the edge of the orbit; inner portion of the latter stained with black; labrum piceous; general surface of head minutely and distantly punctured, front impressed with a single distinct fovea: antennæ subfusiform, moderately robust, black, their two terminal joints dusky white, basal joints incrassate, ovate; second short, submoniliform; third and fourth each longer than the first, equal, obconic; four basal joints nitidous, the rest opake. Thorax subcylindrical, slightly longer than broad; sides broadly and deeply constricted immediately behind their middle, narrowed at the extreme apex, thickened before their apex; upper surface impressed in front of the base by a deep sulcation, which is extended at either end into the lateral constriction; on the centre of the disk are five or six longitudinal rows of fine subremote punctures, visible only with a lens. Scutellum semiovate, obtuse. Elytra much broader than the thorax, parallel, their basilar portion indistinctly elevated; each elytron impressed with ten rows of deep distinct punctures, the outer row sulcate; interspaces plane in front, subcostate towards the apex, each impressed with a row of fine punctures; outer half of external disk obsoletely wrinkled transversely; hinder thighs ampullate, much shorter than the abdomen, moderately incrassate.

Var. A. In this variety the head and thorax (with the exception of an obscure patch on the vertex of the former) are concolorous with the elytra.

Genus Colasposoma, Laporte.

Colasposoma Downesii.

C. anguste oblongum, convexum, metallico-viride; labro, antennis (his extrorsum nigris) pedibusque rufo-fulvis, genibus viridi-æneis, tarsis fuscis; capite thoraceque fortiter subcrebre punctatis; elytris oblongis, subcrebre punctatis, lateribus transversim elevato-reticulatis, intra marginem exteriorem longitudinaliter excavatis, læte cupreis, utroque viridi-æneo limbato.

Long. 3 lin.

Hab. India.

Narrowly oblong, convex. Head and thorax deeply, but not coarsely, punctured; antennæ slender, filiform, two-thirds the length of the body, their basal third rufo-fulvous, the rest black. Thorax more than twice as broad as long, sides rounded, rotundate-angustate in front. Elytra oblong, their sides parallel, more coarsely punctured than the thorax, scarcely broader than the latter; disk transversely impressed below the basilar space.

Genus Euryope, Dalm.

Euryope monstrosa.

E. late subquadrato-oblonga, valde convexa, subgibbosa, subnitida, picea; antennis pedibusque pallidioribus; thorace transverso, crebre punctato, dorso subrugoso, utrinque excavato; elytris thorace latioribus, subquadratis, apice obtuse rotundatis, tuberculis magnis elevatis hic illic inter se confluentibus nitide rufo-piceis instructis, interspatiis subremote punctatis.

Long. 4–5 lin.

Hab. Port Natal.

Broadly subquadrate-oblong, convex. Head broad, somewhat closely punctured; epistome transverse, excavated on either side, not distinctly separated from the face, the latter impressed on its upper portion by a broad transverse groove. Thorax twice as broad as long, its surface irregular, deeply excavated on either side; lateral border rounded, narrowly margined, narrowed behind the middle, all the angles produced. Elytra gibbous behind the middle, thence obliquely deflexed to their apex.

Genus Chrysomela, Linn.

Chrysomela eximia.

C. elongata, convexa, nitida, cæruleo-ænea, abdominis segmentorum marginibus pedibusque læte æneis, supra viridi-ænea; antennis extrorsum, plaga frontali, thoracis basi utrinque ampliata vittaque centrali, scutello elytrorumque sutura vittaque discoïdali læte purpureis; thorace irregulariter punctato, lateribus incrassatis, intra marginem longitudinaliter excavatis, profunde varioloso-punctatis; elytris sat fortiter subcrebre punctatis, punctis in striis confusis dispositis, interspatiis aciculatis, irregulariter elevatis, ad apicem subverrucosis.

Var. A. supra cupro-ænea, signaturis viridi-æneis.

Long. 5–6 lin.

Hab. Mantchuria; collected by Mr. Bowring.

Elongate, convex, nitidous; body beneath metallic blue, with a greenish tinge; apical border of the abdominal segments, together with the legs, brassy; body above brassy-green. Head nearly perpendicular; face broad, distinctly punctured; epistome slightly depressed, separated from the face by an angular groove, from the apex of which an ill-defined longitudinal grooved line extends upwards on the face; the surface of the latter on either side this groove is irregularly excavated; vertex with a large purple patch; antennæ scarcely half the length of the body, their outer half purple, and covered with a short adpressed fuscous pubescence. Thorax twice as broad as long; sides moderately ampliate-rotundate, nearly straight and obsoletely sinuate at their base; apical margin broadly excavated; upper surface moderately convex, irregularly punctured; sides thickened, longitudinally excavated within, surface of excavated portion covered with large irregularly confluent variolose punctures; a longitudinal vitta down the middle of the disk, and a broad basal fascia, dilated at either end, but abbreviated just before reaching the lateral border, bright purple. Scutellum semiovate, obtuse, bright purple, its surface covered with irregular depressions. Elytra narrowly oblong, slightly broader than the thorax, nearly five times its length; sides subparallel; apex rounded; surface somewhat closely covered with coarse, irregular, deeply impressed punctures, arranged for the most part in irregular longitudinal striæ; general surface of the elytra irregularly thickened, aciculate, subverrucose towards the apex; a sutural line and a broad vitta on the disk, abbreviated at the base, bright purple.

This splendid species is very closely allied to our *Ch. fulgida*, Stephens; it is, however, nearly twice the size, and proportionately longer than that insect: it also differs in the form of the *ædeagus.*

Chrysomela Wallacei.

C. mas oblonga, parallela, *fœm.* ovata, postice ampliata, convexa, cuprea, nitida, subtus obscurior, purpureo tincta; antennis dimidio corporis longioribus, nigris, articulis basalibus subtus piceis; thorace modice convexo, disco tenuiter punctato, lateribus rotundatis incrassatis, intra marginem longitudinaliter excavatis et ibi profunde varioloso-punctatis; elytris *maris* parallelis, *fœm.* postice ampliatis, valde convexis, subcrebre tenuiter punctatis, punctis in striis confusis irregulariter dispositis.

Long. $3\frac{1}{2}$–5 lin.

Hab. Mantchuria.

Oblong and parallel in the *male,* ovate and enlarged towards the posterior extremity in the *female,* convex, shining cupreous, more obscure beneath, with a purple tinge. Head punctured; epistome depressed, bounded above by an acutely-angled grooved line, either end of which is suddenly rounded, and from its apex a faint longitudinal groove runs upwards to the vertex; antennæ rather slender, nearly filiform, rather longer in the *male* than half the body. Thorax twice as broad as long; apex broadly excavated; sides straight and nearly parallel, rounded and narrowed before the middle; upper surface moderately convex; disk subremotely but distinctly punctured; sides thickened, longitudinally excavated immediately within the thickened portion, the excavation itself being broad and deep on its hinder half, shallower and less distinct in front, its surface covered with subremote punctures, larger and deeper than those of the disk. Elytra much more closely and coarsely punctured than the thorax, the punctures arranged in numerous irregular ill-defined rows. The sides of the thorax vary somewhat in form in different individuals; rarely (in the *male*) they are rotundate-ampliate from the base; in the *female* they are always less straight behind the middle than in the other sex.

Chrysomela Krishnu.

C. anguste oblongo-ovata, convexa, cuprea, nitida; thorace modice convexo, disco fere impunctato, lateribus rotundatis, a medio ad basin angustatis, valde incrassatis, intus foveolatis, hic illic punctis magnis sparse impressis; elytris ovatis, postice subattenuatis, profunde gemellato-striatis, punctis purpureo-cupreis magnis inæquidistanter et remote positis in striis, striis nonnullis pone medium omnino deletis.

Long. 4 lin.

Hab. India.

Narrowly oblong-ovate, convex, bright cupreous. Head nearly impunctate; clypeus depressed, separated from the face by an angular grooved line, from the apex of which a longitudinal groove runs upwards to the vertex; antennæ rather longer than the head and thorax, moderately robust. Thorax twice as broad as long; sides moderately rounded, narrowed from the middle to the base; disk moderately convex, nearly impunctate, a few minute punctures being visible only under a lens; sides thickened, bounded within by an irregular longitudinal fovea, on which, and also for a short space on the outer surface of the disk, are to be seen a few deep punctures congregated in irregular rows and patches. Scutellum semiovate, obtuse. Elytra scarcely broader at the base than the thorax, oval, somewhat narrowed towards their apex, the latter subacutely rounded; surface of each elytron with about five double rows of large coppery-purple, deep, circular impressions, placed remotely and at unequal distances in each row, but rather more crowded at the base, more distant on the hinder half of the disk, the fourth double row from the suture being there entirely obsolete; interspaces smooth, impunctate.

Chrysomela Grutii.

C. oblongo-ovata, convexa, nitido-cuprea; antennis nigris, ore tarsisque obscure viride-æneis; thorace sparse hic illic fortiter punctato, lateribus paulo incrassatis, intra marginem leniter longitudinaliter excavatis et ibi profunde varioloso-punctatis, punctis confluentibus; elytris profunde et subremote punctatis, punctis sat magnis, ad latera et pone medium in striis gemellatis dispositis.
Long. $3\frac{1}{2}$ lin.

Hab. Rangoon.

Oblong-ovate, convex, shining cupreous; antennæ black; mouth beneath and tarsi obscure metallic green. Head remotely punctured; epistome and lower portion of face depressed, the former separated from the latter by an angular groove, from the upper edge of which three grooved lines run upwards on the face—viz. one from the apex, extending to the vertex, and one on either side, short, and running obliquely outwards towards the eye. Thorax twice as broad as long; apex concavely excavated; sides slightly rounded and narrowed, more quickly rounded before the middle, above moderately convex; disk somewhat sparingly impressed with coarse, deep, irregularly congregated punctures, sides slightly thickened on the outer margin, longitudinally excavated within, the excavated portion covered with large, deeply impressed, confluent, variolose punctures. Elytra ovate, impressed with numerous subremote, large, deeply impressed punctures, confused on the anterior two-thirds of the disk, arranged on the posterior third of each elytron in about four double longitudinal rows, the outer one extending the whole length of the elytron, just within its lateral border; interspaces smooth.

Chrysomela Bonvouloirii.

C. anguste oblonga, modice convexa, nitida, cuprea, pedibus obscure æneis; antennis nigris; thoracis disco remote punctato, lateribus paulo incrassatis profunde subvarioloso-punctatis; elytris fortiter striato-punctatis, striis nonnullis pone medium obsoletis.

Var. A. obscure ænea.

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

Hab. India; collected by Mr. Bretingham.

Narrowly oblong, moderately convex, bright cupreous, nitidous; legs obscure æneous. Head punctured; epistome depressed, separated from the face by an angular line; antennæ half the length of the body, black. Thorax two and a half times as broad as long; sides rotundate-angustate from base to apex, rather more quickly narrowed in front; anterior margin broadly concave; upper surface smooth, distinctly but sparingly punctured on the disk, the punctures being irregularly crowded; sides thickened on the lateral border, a narrow band along this latter being entirely free from punctures, a longitudinal space immediately within, however, is covered with numerous large deeply impressed subvariolose punctures, which extend also a short distance along the base of the thorax. Scutellum semiovate, smooth and impunctate. Elytra slightly broader than the thorax, their sides subparallel, the apex rounded; surface of each elytron covered with rows of deeply impressed punctures; on the posterior half of the surface, many of the rows are obsolete, causing the remaining rows to appear gemellate; interspaces remotely punctate; outer half of anterior disk indistinctly wrinkled transversely.

This species varies somewhat in the amount and also in the depth of the punctation of its surface.

Chrysomela Stevensii.

C. anguste oblonga, modice convexa, nitida, læte cuprea; capite, scutello pedibusque obscure æneis; antennis nigris; thoracis disco hic illic fortiter punctato, lateribus extus incrassatis, intus obsolete longitudinaliter depressis, rude varioloso-punctatis, fere rugosis; elytris rude punctato-striatis, striis irregulariter dispositis.

Long. $4\frac{2}{3}$ lin.

Hab. Rangoon.

Narrowly oblong, moderately convex, bright cupreous, nitidous; head, scutellum, and legs obscure æneous. Head irregularly but not closely punctured; clypeus nearly occupied by a narrowly ovate transverse depression; face with a longitudinal groove running down the middle; antennæ half the length of the body, black. Thorax more than twice as broad as long; sides nearly straight and parallel, subsinuate behind their middle, rounded and narrowed in front, anterior angles subacute, posterior acute; surface slightly convex, impressed here and there with deep punctures, congregated in irregular rows; sides thickened at their outer edge, broadly but obsoletely excavated within, their surface covered with large, irregular, deeply-impressed, confluent punctures. Scutellum semiovate, subacute. Elytra broader than the thorax, subovate; surface covered with numerous irregular rows of deeply-impressed punctures; interspaces somewhat irregular, indistinctly wrinkled transversely on the anterior half of the outer disk.

This species is more coarsely and closely punctured than *C. Bonvouloirii*; the rows of punctures on the elytra are more numerous, and the general surface of the latter is irregular.

Genus Australica, Chevr.

Australica erudita.

A. oblongo-ovata, convexa, flavo-fulva, nitida; vertice, antennis extrorsum, thoracis vittis duabus brevibus, infra apicem positis, fasciaque basali, utrinque abbreviata, medio sinuata, scutello pedibusque (femoribus anticis quatuor basi subtus exceptis) nigris; elytris punctato-striatis, nigro signatis; pectore nigro-piceo.
Long. 3 lin.

Hab. Dawson's River, Australia.

Oblong-ovate, convex, shining flavo-fulvous; the outer two-thirds of the antennæ, the vertex, two short subapical vittæ and a narrow basal fascia on the thorax, the scutellum and legs (the basal half of the under surface of the four anterior thighs excepted) black. Head broad and flat, minutely punctured; epistome scarcely distinct from the face; antennæ slender. Thorax three times as broad as long; sides rounded and narrowed from their base to their apex; upper surface convex, finely punctured, sides obsoletely excavated; lateral margin rather more coarsely punctured. Elytra broadly oblong, scarcely broader than the base of the thorax, each elytron impressed with ten rows of punctures, the first short; interspaces very minutely punctured; the suture, a curved line which, commencing at the base on the humeral callus, runs obliquely downwards and inwards to the lower edge of the basilar space, where it abruptly terminates at a short distance from the suture, a narrow wedge-shaped patch on the outer disk below the shoulder, placed parallel to the curved line, and three longitudinal vittæ on the hinder disk, the first commencing at the outer edge of the oblique line just before its apex, running parallel to the suture, and terminating long before reaching the apex of the elytron, the other two commencing about the middle of the outer disk, connected at their base by an obliquely transverse line, the inner one extending nearly to the sutural angle, the outer one short, black. Breast nigro-piceous.

Australica (*Stethomela*) *gibbosa.*

A. subquadrata, apice subangulata, dorso valde convexa, gibbosa, nitido-cuprea; thorace hic illic punctis magnis rotundatis viridi-metallicis profunde impresso; elytris postice declivibus, utrinque apicem versus ad latus longitudinaliter excavatis, punctis magnis rotundatis remotis viridi-metallicis in seriebus decem inæquidistanter positis profunde impressis; antennis pallide flavis, articulis intermediis fuscis.

Long. $4\frac{1}{2}$–$5\frac{1}{2}$ lin.

Hab. Dawson's River, Richmond River.

Subquadrate, subangulate at the apex of the elytra, very convex, gibbous, shining cupreous. Head broad, flat; face divided down the middle by a longitudinal groove, which extends nearly to the anterior margin of the epistome; the latter transverse, short, separated from the face by a nearly horizontal grooved line; antennæ rather more than half the length of the body, slender, filiform, pale yellow; intermediate joints fuscous. Thorax more than twice as broad as long; apex concavely excavated; sides nearly straight and parallel behind, rounded and narrowed in front; upper surface smooth, impressed here and there with irregularly congregated, large, round, deep, obscure metallic-green punctures. Elytra scarcely broader than the thorax at their base, slightly narrowed behind, conjointly angled at their apex, very convex, somewhat abruptly deflexed behind the middle; each elytron on its outer side covered with a broad but shallow depression, which extends from just before the commencement of the posterior third of the elytron, and reaches to immediately within the sutural border, leaving the apical portion of the suture itself elevated, and forming with its fellow a distinct ridge; on the surface of each elytron are ten rows of remote impressions similar to those on the thorax; they are rather larger and more deeply impressed, and are placed at unequal distances on each row; on the extreme outer border is a single row of smaller and more crowded punctures, concolorous with the disk; interspaces subremotely covered with faintly-impressed reticulations.

Genus Plagiodera, Redt.

Plagiodera Trimeni.

P. ovato-rotundata, modice convexa, nitida, læte cupreo-æenea; antennis fulvis, extrorsum nigris; thorace medio longitudinaliter canaliculato; elytris irregulariter subseriatim punctatis, viridi-æneis, cupreo vix micantibus, marginibus basali et suturali limboque submarginali læte cupreis; abdominis limbo fulvo maculato.

Var. A. obscure cærulea aut nigro-cærulea; elytris viridibus, marginibus concoloribus.

Long. 3–4 lin.

Hab. Cape of Good Hope; collected by Mr. Trimen.

Ovate-rotundate, moderately convex, nitidous, bright cupreo-æneous; antennæ moderately subincrassate, fulvous, their outer half black. Thorax narrowed from base to apex; sides nearly straight, suddenly narrowed and rounded at the apex; surface of disk slightly irregular, sides indistinctly thickened, impressed here and there with a few deep scattered punctures; central portion of disk impressed with a short longitudinal groove. Elytra with their outer margin moderately dilated, its surface irregular, somewhat thickened; bright metallic green, with a slight cupreous reflexion, an ill-defined line on the sutural and basal margins, and a submarginal stripe on the outer border, bright cupreous. Sides of abdomen marked with a row of fulvous spots.

Var. A. Body obscure metallic blue or bluish black; elytra metallic green, the cupreous markings obsolete.

Plagiodera viridivittata.

P. subrotundata, modice convexa, nitida, obscure viridi-ænea; antennis nigris; thorace hic illic leviter excavato, irregulariter punctato, punctis ad latera profundius impressis; elytris irregulariter punctatis, punctis prope suturam subseriatim dispositis, cupreis, utriusque margine laterali, linea suturali vittisque duabus, plus minusve distinctis, metallico-viridibus.

Long. 4–4½ lin.

Hab. Port Natal.

Very closely allied to the last species, rather larger, more rotundate; sides of elytra obsoletely angled; thorax more deeply pitted, and more coarsely punctured; longitudinal groove on disk obsolete, sides less straight, rather more distinctly rounded; antennæ entirely black; abdomen without the marginal spots.

Plagiodera cinctipennis.

P. rotundata, convexa, fulva aut pallide rufo-fulva, nitida; elytris punctatis, punctis subseriatim dispositis, obscure æneo-cupreis, fulvo marginatis; antennis extrorsum nigris.

Long. 2½ lin.

Hab. India; collected by Mr. Bretingham.

Rotundate, moderately convex, nitidous; antennæ short, subincrassate, their outer half black. Thorax rounded on the sides, narrowed in front. Elytra distinctly punctured, the puncturing varying in depth in different individuals, indistinctly arranged in irregular rows.

Genus Gonioctena, Redt.

Gonioctena scutellaris.

G. oblonga, modice convexa, fulva, nitida, pectore pedibusque (femoribus quatuor anticis basi exceptis) nigro-piceis; antennis extrorsum scutelloque nigris; elytris regulariter punctato-striatis.
Long. 3 lin.

Hab. Northern China.

Oblong, convex. Head coarsely punctured; epistome depressed, separated from the face by an angular groove, from the apex of which a short, ill-defined, longitudinal depression runs upwards on the face; antennæ scarcely longer than the head and thorax, their outer two-thirds black. Thorax more than twice as broad as long; sides angustate-rotundate from base to apex; disk distinctly but finely punctured, sides coarsely punctate. Scutellum nearly semirotundate, shining black. Elytra scarcely broader than the base of the thorax, sides below the shoulders slightly excavated; each elytron impressed with eleven regular rows of punctures, the first short; interspaces plane, minutely but not closely punctured. Body beneath deeply punctured; abdomen obscure fulvous, its puncturing subremote.

Gonioctena thoracica.

G. oblonga, convexa, nigra, nitida, thorace facieque inferiore obscure rufis; antennarum basi fulva; elytris regulariter punctato-striatis.
Long. $2\frac{1}{2}$ lin.

Hab. Northern China.

Very similar to the preceding, but (with the exception of the entire thorax above, together with its sides beneath, the lower portion of the face, and the base of the antennæ) entirely black. Head less coarsely punctured; the longitudinal depression on the face is wanting, but replaced by two indistinct grooves, which run one on either side obliquely upwards from the apex of the epistome; antennæ thicker towards their apex than in *G. scutellaris.*

Gonioctena æneipennis.

G. oblonga, convexa, testacea, nitida; elytris viridi-metallicis, punctato-striatis, punctis in striis ad latera minus regulariter dispositis; antennis flavis; scutello nigro.
Long. $2\frac{3}{4}$ lin.

Hab. Northern China.

Oblong, convex, shining testaceous; elytra bright metallic green, punctate-striate, the punctures less regularly placed on the striæ on the outer disk than in the foregoing species; face somewhat broader, slightly swollen, irregularly punctured; epistome separated from the face by a nearly semicircular groove, the middle of which is slightly produced upwards and angular.

Gonioctena rubripennis.

G. oblonga, convexa, nigra, nitida; elytris punctato-striatis, sordide rufo-fulvis; antennis basi fulvis.

Long. $2\frac{1}{2}$–3 lin.

Hab. Japan.

Oblong, convex, shining black; elytra obscure rufo-fulvous. Thorax at the base more than twice as broad as long; sides narrowly margined, rotundate-angustate, all the angles acute; above convex, sparingly covered with fine punctures on the disk; sides coarsely and more closely punctured, their outer edge, just within the lateral border, slightly thickened. Scutellum semiovate. Elytra scarcely broader than the base of the thorax; sides subparallel; apex regularly rounded; above convex, transversely depressed on the disk below the humeral callus; each elytron impressed with eleven regular rows of distinct punctures, the first abbreviated, interspace between the tenth and eleventh rows slightly thickened, the others flat, subremotely covered with fine but distinct punctures; under surface of body coarsely punctured.

Gonioctena nigro-plagata.

G. oblonga, convexa, fulva, nitida; elytris punctato-striatis; scutello elytrorumque puncto apicali plagisque octo, 4 vix infra basin, 4 pone medium, transversim positis, nigris.

Var. A. elytrorum maculis inter se confluentibus, facie inferiore piceo tincta.

Long. 3–$3\frac{1}{2}$ lin.

Hab. Japan.

Oblong, convex. Thorax more than twice as broad as long, sides rotundate-angustate, very narrowly margined, posterior angles acute, the anterior subacute; above convex; sides coarsely punctured, a narrow space just within the outer border thickened, impunctate; disk remotely punctured; medial line near the base impressed with a short longitudinal groove. Elytra similar in form and sculpture to the preceding species, the punctures being, however, rather coarser and somewhat less regularly placed on the striæ; each elytron marked with a small spot at the sutural angle and four large patches on the disk, shining black; these latter, which vary in shape, are placed in two transverse rows, viz. one immediately below the base and extending nearly to the middle, the other just below the middle; the two outer spots are generally elongate, and sometimes form a submarginal vitta, interrupted in its middle.

V.—*Revision of the Natural Order* Bignoniaceæ. By Berthold Seemann, Ph.D., F.L.S.

Before proceeding to publish the results of my examination of Bignoniaceæ, I shall give a list of all the genera I hold to be true members of the order. They will have to be grouped very differently when the whole of them shall have been subjected to closer investigation, and a number of new ones added. The two tribes Eubignonieæ and Catalpeæ, founded upon important carpological characters, must stand, and a third one (Jacarandeæ) be added to them.

I. *Eubignonieæ*, having a marginicidal fruit, and a septum placed parallel with the direction of the valves of the capsule.

II. *Catalpeæ*, having a loculicidal fruit, and a septum placed contrary to the direction of the valves of the capsule.

III. *Jacarandeæ*, having a marginicidal fruit, and a septum placed contrary to the direction of the valves of the capsule.

From the subjoined it will be seen that all *cirrhose* Bignoniaceæ are confined to America, and that, with only one exception (*Dolichandra*), they are Eubignonieæ; again, that, with the exception of two Asiatic genera (*Millingtonia* and *Calosanthes*) all the *erect* Bignoniaceæ belong to Catalpeæ and Jacarandeæ.

Synopsis generum Bignoniacearum.

Tribus I. Eubignonieæ.

Capsula marginicida, septum valvis parallelum.—Frutices scandentes cirrhosi Americani, rarissime arbores Asiaticæ.

Divisio I. *Monostictides.*

Semina ad quodque septi latus uniserialia.

* Frutices scandentes cirrhosi Americani.

Bignonia, Tournef. Amer. trop.
Pachyptera, Mart. Amer. trop.
Fridericia, Mart. Amer. trop.
Cydista, Miers (*Barteria*, Seem., non Hook. fil.). Amer. trop. et subtrop.
Cuspidaria, DeCand. Amer. trop.
Macfadyena, DeCand. (*Spathodea*, sp. auct.). Amer. trop.
Lundia, DeCand. Amer. trop.
Mansoa, DeCand. Amer. trop.

Arrabidæa, DeCand. Amer. trop.
Adenocalymna, Mart. Amer. trop.
Haplolophium, Endl. (*Aplolophium,* Cham.). Amer. trop.
Pyrostegia, Presl. Amer. trop.

** Arbores Asiaticæ.

Millingtonia, Linn. Ind. or.
Calosanthes, Linn. Ind. or.

Divisio II. *Pleostictides.*

Semina ad quodque septi latus serie duplici, triplici, vel quadruplici disposita.—Frutices scandentes Americani.

Distictis, DeCand. Amer. trop.
Amphilophium, Kth. Amer. trop.
Pithecoctenium, Mart. Amer. trop.
Anemopægma, Mart. Amer. trop.
Callichlamys, Miq. Amer. trop.

Tribus II. CATALPEÆ.

Capsula loculicida, septum valvis oppositum.—Frutices stantes vel arbores Gerontogææ vel Americæ, rarius frutices scandentes cirrhosi, radicantes vel volubiles, rarissime herbæ.

Divisio I. *Monostictides.*

Semina ad quodque septi latus uniserialia.

* Frutices stantes.

Craterotecoma, Mart. Amer. trop.
Stenolobium, D. Don. Amer. trop.
Tecomella, Seem. Ind. orient. (*Tecoma undulata,* Don).
Tecomaria, Fenzl. Amer. trop.
Chilopsis, D. Don. Amer. trop.
Rhigozum, Burch (*Catophractes,* D. Don). Afric. trop.

** Arbores.

Rademachera, Zoll. Ind. orient.
Spathodea, Beauv. Afric. trop.
Stereospermum, Cham. (*Dipterosperma,* Hassk.). Afric. et Asia trop.
Tecoma, Juss. (*Tabebuia,* Gomez). Amer. trop.
Catalpa, Scop. Asia et Amer. trop. et subtrop.

Divisio II. *Pleostictides.*

Semina ad quodque septi latus serie duplici, triplici, vel quadruplici disposita.

* Frutices cirrhosi, radicantes v. volubiles.

Dolichandra, Cham. Amer. trop.

Campsidium, Seem. et Reisseck. Chile.
Campsis, Lour. Asia trop. et subtrop., necnon Amer. subtrop.
Pandorea, Endl., Seem. Australasia et Asia trop.

** Arbores.

Delostoma, D. Don (*Codazzia,* Karsnt. et Trian.). Amer. trop.
Cybistax, Mart. (*Yangua,* Spruce). Amer. trop.
Zeyhera, Mart. Amer. trop.
Sparattosperma, Mart. Amer. trop.
Pajanelia, DeCand. Amer. trop.

*** Herbæ.

Argylia, D. Don (*Oxymitus,* Presl). Amer. subtrop.

Tribus III. Jacarandeæ.

Capsula marginicida, septum valvis oppositum.—Arbores Gerontogææ vel Americanæ.

Jacaranda, Juss. (*Pteropodium,* Meisn.). Amer. trop.
Dolichandrone, Fenzl, Seem. Ind. or. et Austral. (*Spathodeæ* sp. auct.).
Astianthus, D. Don. Amer. trop. (Genera 43.)
Heterophragma, DeCand. Ind. or.

Genera incertæ sedis.

Monttea, Clos. Chile.
Reyesia, Clos. Chile.
Oxycladus, Miers. Chile.

I shall not follow any particular order in communicating my investigation, but publish the results as the complete materials come to hand.

1. Astianthus, D. Don.

Char. gen. emend.—*Calyx* tubulosus, ecostatus, limbo 5-dentato æquali. *Corolla* infundibuliformis, basi tubulosa, limbo bilabiato, labio inf. 3-, sup. 2-lobo. *Stamina* 4, didynama, cum rudimento quinti. *Antheræ* parallelæ, nudæ. *Stigma* bilobum. *Capsula* siliquosa, echinulata, 2-locularis, marginicida, septo crasso spongioso valvis contrario. *Semina* in quavis septi fascie pluriseriata, minuta, compressa, alata, ala completa subovali, corpore cordato.—Arbor 30-ped. Mexicana et Guatemalensis, habitu Salicis; ramis glabris; foliis teris vel superioribus sparsis, elongato-linearibus, integerrimis, coriaceis (8–14 poll. long., 2–3 lin. lat.); racemis terminalibus sæpe dichotome paniculatis, floribus flavis.—D. Don in Edinb. Phil. Journ. vol. ix. p. 262 (1823); G. Don, Gen. Syst. iv. p. 228; De Cand. Prodr. ix. p. 177. Species unica:

Astianthus longifolius, D. Don in Edinb. Phil. Journ. vol. ix. p. 262

(1823); G. Don, Gen. Syst. p. 228; DeCand. Prodr. ix. p. 177; Bonplandia, t. 13.

Bignonia viminalis, Kunth in Humb. et Bonpl. Nov. Gen. Amer. vol. iii. p. 132; DeCand. Prodr. ix. p. 144.

Tecoma saligna, Lindl. Herb.

Nomen vernaculum Mexicanum, "Aguejote," teste Gregg.

Geogr. Distribution.—On the slopes of the mountains of Western Mexico, between Mescala and Estola (Humboldt and Bonpland! in Herb. Berol.); between Vera Cruz and Oaxaca (Galeotti! n. 1017), near Jalapa (Galeotti! n. 20); at Aguacatlan, near Tepic (Gregg! n. 946); in Guatemala (Skinner! in Herb. Lindl. et Hook.); always growing on the banks of rivers, and replacing our willows in those regions.

In Dr. Lindley's Herbarium there are specimens of *Astianthus* collected by Skinner in Guatemala, the value of which consists in their having both flowers and ripe fruit. The position of the genus, so long doubtful, is by means of these easily cleared up. Instead of belonging to the Eubignonieæ, *Astianthus* must be placed near *Dolichandrone*, amongst Jacarandeæ. It has nothing to do with *Catalpa*, as was supposed, neither agreeing with it in fruit nor flower, and four of the stamens being fertile. The seeds are not, as D. Don had described them, "villis numerosis papposa." Don must probably have described the seeds of another Bignoniacea as belonging to *Astianthus*, perhaps those of *Chilopsis*, a Mexican genus very much resembling *Astianthus* in habit, and growing also on the banks of rivers, but having purple instead of yellow flowers. Don and DeCandolle describe the corolla of *Astianthus* as "rubro-purpurea;" but all those who have seen the plant wild, as yellow.

I have identified *Bignonia viminalis* of Kunth with *Astianthus longifolius*: the authentic specimens of Humboldt and Bonpland leave no doubt on that point. The genus consists only of one species, and differs from its allies in its spiny fruit, regular calyx, and parallel anthers. Its seeds are the smallest of any Bignoniacea known to me.

2. Campsidium, Reiss. et Seem. (gen. nov.).

Char. gen.—*Calyx* campanulatus, ecostatus; limbo 5-dentato, æquali. *Corolla* tubulosa, leviter curvata; limbo 5-lobo, lobis subæqualibus. *Stamina* 4, didynama, cum rudimento quinti. *Antheræ* parallelæ, nudæ. *Stigma* bilobum. *Capsula* teretiuscula, lævis, loculicida. *Septum* valvis contrarium. *Semina* . . . . Frutex ecirrhosus scandens, Chilensis et Chiloënsis, glaberrimus; ramis angulatis; foliis oppositis 4–7-jugis cum impari, petiolo alato, foliolis ovato-oblongis vel ellipticis, utrinque obtusis vel acutis, sæpe mucronatis, margine dentatis vel subintegerrimis, supra læte viridibus, subtus pallidioribus; racemis terminalibus simplicibus, 4-9-floris, pedicellis elongatis bibracteolatis, bracteolis linearibus acutis, petiolis pedunculis calycibusque purpurascentibus, corollis aurantiacis, intus versus basin filamentisque villosis, ovario glabro. Species unica :

Campsidium Chilense, Reiss. et Seem. MSS. in Herb. Vindob.; Seem. in Bonplandia, vol. x. p. 147, t. 11.

Tecoma Guarume, Hook. in Bot. Mag. t. 4896, in adnot. (non DeCand.).

Nomen vernaculum Chiloënse "Pilpil Boqui," teste Bridges.

Geographical Distribution.—Chiloë (Bridges! W. Lobb! n. 474, King!); Island of Huafo, lat. 44° S. (Eights! in Herb. Hook.); Arique, near Valdivia (Lechler! Plant. Chil. n. 671).

This beautiful plant seems to be rather common between latitudes 40° and 44° S., and climbs over trees with a height of 40–50 feet. Nevertheless it is not mentioned in Gay's 'Flora of Chile,' and was thought identical with *Tecoma*? *Guarume* (*Bignonia alata*, Pav.) by Sir William Hooker. The authentic specimens of *Bignonia alata* in the Berlin Herbarium prove, however, to be identical with *Tecomaria fulva*, Seem. (*Tecoma fulva*, DeCand.); and the plant to which Sir W. J. Hooker alludes is the type of an entirely new genus, allied in habit to *Campsis*, Lour., but differing from that genus in the shape of the corolla and parallel, not divaricate, anthers. *Campsidium* has, however, no rooting branches, climber though it be, nor is it winding like *Pandorea*, nor furnished with tendrils like most climbing species peculiar to America.

VI.—*On the Functions of the Nitrogenous Matter of Plants.* By M. L. Garreau *.

The numerous researches prosecuted of late years respecting the organic elements of plants, whilst on the one hand adding to our acquaintance with the structure, composition, and relations of their tissues, have, on the other, suggested to several botanists various theories regarding their evolution and their functions. But the physiology of plants being, like that of animals, inseparably dependent upon the knowledge of their organs, and this knowledge being far from thoroughly understood, the consequence is that every fresh discovery in their organization is followed by a new interpretation of some question or other in their physiological mechanism.

The cell, regarded by most botanists as the primitive element of vegetable organization, is represented as a nearly independent

* Translated by Dr. Arlidge, from the 'Annales des Sciences Naturelles,' tome xiii. 1860, p. 189.

organism, formed by a closed membrane, capable of self-increase, of self-multiplication, and of absorbing and transmitting by endosmosis fluid materials destined to nourish it. This definition, though true in all its details when an examination is conducted by the aid of too feeble or of too strong magnifying powers, or when experiments are conducted on dead tissue, cannot be entirely sustained when the investigation is pursued by appropriate amplifying powers, and when the still living organization is submitted to observation; for, under such circumstances, it becomes possible to demonstrate that the vegetable cell is not so simple in its structure as has been presumed, nor so independent as supposed when it enters into the composition of a tissue. But notwithstanding that the cell is everywhere, whether isolated or aggregated with others, essentially the same in its organization, it is necessary, in order to its minute examination, to employ those portions of plants in which an active process of vegetation is proceeding,—where intra-cellular secretions are absent, and the cellulose and encrusting matters have not as yet so thickened the tissues as to impede the thorough examination of the cell-cavity.

If a slice of vegetable tissue be taken, so thin as to consist of not more than two superposed rows of cells (conditions readily realized in hairs, in the tissue of spongioles, in the lamina of fleshy leaves, in young epidermis, in the pith, in the parenchyma of young petioles, in various fruits, &c.), and if this be examined in a moist state, at a temperature of from 20° to 25° Centigrade, the microscope quickly reveals a small conglomerate mass in each cell, often granular in aspect, and attached to some part of its inner wall. Such is the little body designated by Robert Brown as the *nucleus*, and which he regarded, as did also Schleiden and Hugo Mohl, as a structure existing prior to the formation of the cell-wall. It was moreover looked upon by these naturalists, together with Schultz, Slack, and Meyen, as constituted by the more or less intimate aggregation of nitrogenous granules.

However, this little organ is not entirely formed by the reunion of agglomerated granules, and one might be easily led into error in making researches for its elucidation if it was assumed that it was always to be met with under the aspect above mentioned; for in the majority of the simple hairs of herbaceous plants, in epidermis, and in nearly all young tissues, it occurs under the form of an opaline globule, variable in dimensions, and refracting light much in the same way as fatty matters. Further, under an irregular form, it frequently presents itself in the sub-epidermic cells of leaves, infiltrated with chlorophyl, and with some granules in its middle. Again, in young cells, and in pollen in course of growth, it appears formed of flakes loosely coalesced into irregular spheres; whilst in the cells of young specimens of *Chara*, of *Hydrocharis morsus-ranæ*, of *Stratiotes aloïdes, Caulinia fragilis*, and *Sagittaria sagittifolia*, in the hairs of young shoots of *Borago officinalis*, in the epidermis of the petioles of young specimens of *Arum*, &c., it is represented only by some viscous flakes having no determinate figure. The nucleus, therefore, being essentially a variable organ, has not failed to give birth to the most divergent opinions relative to its nature, origin, and functions; and we should not materially err in asserting that there are not two botanists who entirely concur in respect to its composition or to the part it is intended to play in the economy of the cell. Yet, though this body is susceptible of assuming different aspects, the one under which it usually presents itself is that of a spheroid, in the form of a globule of mucus, having at its centre a collection of semi-transparent granules endowed with sufficient softness to make them adhere feebly together. Now, the presence of this granular matter in the centre is suggestive of the existence of a membranous pellicle about the periphery or surface; and some researches which I have made on this point prove to my mind that this supposition is well founded. Thus, to demonstrate the fact in the epidermis of *Tradescantia virginica*, it is only necessary to treat the slice of tissue under observation with a drop of liquid ammonia, which causes the disappearance of the internal collection of granules, and renders visible a membranous disk, which is no other than the collapsed sac within which the granules were contained. However, this soft pellicle is so very transparent, and of such tenuity, that it is oftentimes very difficult to distinguish its outline with clearness, particularly if, as very often happens, it lies in contact with the wall of the cell.

If, in place of employing the epidermis (which, by the way, need always be very transparent), choice be made of parts richer in water, such as the young root-fibres, the spongioles, the stem of young fleshy plants, the petals, &c., the study of this organ is facilitated; for, under these circumstances, the granular heap is less abundant, and the little membraniform hyaline sac which envelopes it is more perceptible, whilst at the same time the presence of liquid within the sac, apparently of rather stronger refracting-power than the fluid in the cell-cavity, may be detected on submitting the preparation to the action of a dilute acid or of alcohol of 86°; the little sac may be seen to contract and shrivel, to force out a portion of the liquid it contains, and to become reduced to one-third or one-fourth of its original dimensions. If the preparation be now moistened with a little liquid ammonia of 12°, the small sac regains its primitive form, though at the same time it acquires a somewhat larger volume than before, and is less transparent. This change is the consequence either of the action of the reagents upon it, or of the nature of the contained liquid being modified by them. If the flowers of the *Tradescantia virginica* be selected for observation at the moment when they begin to wither, and when the colouring-matter is diffused within the cavities of the cells, the nucleus may be still more precisely studied in respect to its form and its chemical characteristics. The constituent matter of the nucleus being readily penetrated by the colouring-material, and still more strongly impregnated by it than the surrounding cellulose wall of the cell, it happens that, on moistening the preparation with very dilute hydrochloric acid, the nuclear matter acquires an intense red colour, and is thrown into folds, but presently reappears under the eye of the observer with a green tint and of a larger size when the acid reagent is saturated by ammonia or by some other soluble base employed in slight excess. Lastly, on following the appearances along the borders of the film of tissue, and on using slight pressure by the glass covering it, some of these small bodies may be detached and forced out through the ruptured cells, when it becomes evident that they scarcely differ in form or in their nature from mucous globules. It may be added that, if the small body be carefully examined whilst still under the influence of the acid, its centre will be found to be composed of granules strongly condensed into a little mass of a deeper red colour than the softer wall enclosing it, and to which it is fixed by only a single point. From these facts it is at once evident that the nucleus is not a simple collection of particles adhering together, as Brown, Slack, Schultz, and others supposed it to be, but that it possesses a cavity limited by an albuminoid, soft and membranous material, containing granules and a fluid, and that its membrane and granules may be condensed in different degrees by the addition of an acid.

When similar observations are followed out respecting this particular state of the nucleus in tissues whose cells are of sufficient diameter, and their walls transparent enough to permit a just idea of the structure in question to be obtained, then without the help of reagents the above-named facts may be established in the case of most plants, and in all their transparent and actually living parts. But it is a simpler plan, where it is wished only to display the presence of the nucleus, to use a weak solution of iodine in iodide of potassium, which soon tints it of a pale yellow and afterwards of a brown colour. Nevertheless, it is worth noting that this reagent does not act in all plants, or indeed in all parts of a plant, with the same intensity, and that the colour it produces has to be waited for a longer or shorter time, and seems to be influenced by the degree of elaboration of the cellular liquid and by the abundance of nitrogenous granules contained within the membraniform envelope.

Hitherto the nucleus has been referred to as a nearly spherical globule; however, this form is not always that which it presents, although it is the most widely met with when the liquid it contains completely fills it, which happens in those portions of plants which are gorged with a large quantity of water; but when its cavity is less full, or when it is in motion, it has sometimes a wrinkled appearance (as in *Erodium moschatum*), and at others a wrinkled and tuberculated appearance at once (*Salvia Sclarea*), and is very irregular in its outline.

With regard to the dimensions the nucleus may attain, there is great variety; but in general it bears a pretty direct relation to the size of the cells when these have attained their complete growth, or a little before that period. Thus it is that the nucleus is found highly developed in the Liliaceæ, Commelineæ, the Orchidaceæ, Cactaceæ, Crassulaceæ, Aroïdeæ, in most Chenopodieæ and Solaneæ, and in the fleshy parts of all plants, such as the fruit of Rosaceæ, Rhamneæ, Ampelidæ, Grossulariaceæ, &c., which generally exhibit cells of large volume. On the other hand, it is small in most Gramineæ, Apocyneæ, Amentaceæ, and Jasmineæ, whose cells are commonly small in size.

The volume of the nucleus, compared with that of the cell, when young, is proportionally very great, as may be seen in the epidermis of the unexpanded flower of *Helleborus niger*, or in the young merithalli, spongioles, leaves, flowers, and pollen in course of growth; for in such examples the dimensions of the nucleus are so considerable that it sometimes occupies one-fourth of the whole of the cell-cavity. But when the cell has attained its full development, it is adherent to it, and occupies a far smaller proportional space within it than heretofore, being then reduced to one-tenth, one-fifteenth part, or even less of its cavity. However, though the nucleus itself does not keep pace with the growth of the cell, we shall find that, in the subsequent modifications it soon undergoes, it will, by means of appendages given off from it, acquire an equal increase with the cell, and a degree of development proportionate to the extent of its walls.

When examined relative to its consistence, the nucleus is found to be soft and extensible; sometimes, when distended by its contained liquid, it is ruptured in the attempt to detach by a sudden pull the small lamina of tissue to be submitted to examination. Its surface may be smooth, tuberculated, or wrinkled—varieties of appearance of which we shall presently recognize the cause. Lastly, it is not unusual to see it bordered by little vesicles; but these by degrees decrease in size under the eye of the observer, and ultimately merge into it.

The positions it occupies in the cavity of the cell are equally variable; but its most common place is in the centre of the cell, or adherent to some part of its wall. In the latter case, when the cell is elongated, it is seen to be almost always placed equidistant from the two extremities; however, it happens in cells which enter into the structure of hairs, that the nucleus is often seen attached to the septa between them, as in *Tradescantia virginica* and *Chelidonium majus*.

The constancy of this organ in cells in progress of growth led Schleiden to see in it the explanation of an important fact in the physiology of plants; and it was in making an attempt to substantiate this conviction that I was prompted to investigate its different forms, some of its properties, and its relations with the walls of the cell. After having submitted anew to the most attentive and minute observation the majority of the tissues that I had already examined, and which had presented me with cells at once sufficiently developed and transparent, I have been able to satisfy myself that the membranous sac of the nucleus whose characters have been detailed above frequently gives off filaments of the greatest softness, and often anastomosing one with another. Many of their slender extremities likewise proceed to coalesce with the layer of nitrogenous material that lines the interior of the cell-wall. In this structural condition I perceived that I had to deal with an important modification of the nucleus, which, instead of being applied directly to the cell-wall, occupied the centre of its cavity, suspended there by the medium of the viscous processes extended from its periphery as just described. Slack and Meyen long since suspected the relations of these filaments (or, as they called them, currents) with the nucleus. Schultz and Hugo Mohl still more distinctly appreciated this relation; but none of these naturalists would seem to have studied the subject under the most favourable conditions, otherwise they could not have failed to recognize the fact I shall proceed to establish, viz., that these processes are capable in many cells of serving the office of contractile canals for the transmission or circulation of a granular fluid.

On examining, by the aid of a good instrument with a magnifying power of from 300 to 400 diameters, according to the dimensions of the cells, and at a temperature of 25° to 30° Centigrade, a slice of tissue the cells of which presents filamentous nuclei (such as those of the full-grown epidermis of the leaves of the *Tradescantia virginica*, the hairs of *Salvia Sclarea*, of *Chelidonium*, and of *Erodium moschatum*, procured during the summer or autumn), the observer will not fail to recognize the presence of granules streaming in a transparent fluid through a series of canals formed by an extensible membranous matter, continuous with that of the nucleus, though of greater transparency. To view this structure better, the rays of light should fall on the object in a direction parallel to their course, whether it be ordinary daylight or artificial light. It will further appear that the diameter of these canals is often greatly reduced, and that the fluid circulating through them carries along with it only transparent granules of very great tenuity. Now, the existence of such canals within the cell-cavity has always been regarded by the majority of botanists as improbable; and taking this opinion in connexion with the minuteness of the phenomenon itself, it is easily conceivable that the structures just recorded have escaped the researches of micrographers. However, when the investigator has been made acquainted with these phenomena, it is not difficult to demonstrate them, and this even in cells of medium dimensions, provided they are sufficiently transparent and examined with adequate care and patience. To this end, it is enough to moisten the preparation without soaking it with water, to carefully avoid the presence of air which may adhere to the surface, and after covering it with the glass cover, to examine it assiduously and under those conditions with regard to temperature above pointed out. Should the canals not show themselves, gentle compression may be exercised on the preparation, and then the examination be renewed; for by this process the canals are separated and made to stand out from the cell-wall, in the centre of its cavity, where they display themselves and their anastomoses. It is much preferable to make out the existence of these canals without the aid of reagents; but they may be made more evident by the addition of a solution of iodine in iodide of potassium, which gives them a clear yellow or a reddish-brown colour, as it does to the nucleus. But this reagent, though preferable to alcohol or to the aqueous solution of iodine, does not afford a faithful image of the phenomenon, for it slightly contracts the component matter of the canals and deforms it. Besides, before the manifestation of the colour, there is greater or less delay, according to the condition of the fluid in circulation. It is therefore most important, when it is wished to make a critical examination, to abstain from the employment of this reagent, and, indeed, of any other; for, as we shall very soon discover, their vital movements, which such reagents destroy, are the most important of all their properties, and to be studied with the greatest advantage.

The canals existing in a cell derived from elsewhere than the hairs of plants may have various origins; but I shall first point out the characters of such as are in connexion with the nucleus, distinguishing those peculiarities in which they differ from the last-named organ. These canals, being constituted by the membranous matter of the nucleus, arise from the periphery of this organ, and present the greatest variety in size; but from the vital activity in them, and their consequent variability, it is difficult to determine their individual dimensions. Thus, there are some whose diameter is for the moment equal in width to half that of the nucleus, whilst others do not reach the twentieth or thirtieth part of the diameter of that organ. Their number varies equally with their dimensions: at one time a dozen may be seen in the epidermic cells of *Tradescantia virginica*, from six to eight in the epidermis of the flowers of *Lupinus albus*, of *Helleborus niger*, and of *Lilium album*, in the leaves of *Crassula*, in the epidermis and cellular network under the epidermis of the leaves of *Asphodelus luteus*, in the hairs of the young merithalli of *Lamium* and of Geraniums, &c. Lastly, a certain number always escape observation, inasmuch as they cannot be all brought at once within the focus of the lens, and because during the time of examination changes take place among them, both in respect to their relations and dimensions, and create an obstacle to the definite distinction of one from another.

Ordinarily these canals radiate from the nucleus towards the periphery to reach the inner wall of the cell. In this course, some decrease in calibre but slightly, others traverse the distance with uniform width, and almost all frequently anastomose together, either directly or by the medium of lateral offsets they may give off. By this arrangement a network is produced which varies in character in each cell, and is at one time suspended within the cavity of the cell, at another partially attached to the cell-wall. It also happens that at those points where the canals anastomose there is an enlargement, which in its appearance resembles a nucleus additional to the true one, or, in other words, it becomes a centre to and from which a certain number of currents converge or diverge. Before following these canals to their distribution on the cell-walls, we will recall some of their principal physical and chemical characters. They present themselves under the aspect of thin extensile filaments of very great transparency; their component matter has the appearance of a viscid mucus, and seems not to differ, except by its greater consistence, from that which constitutes the small floating flocculi which are observed in circulating or rotatory motion in the young cells of *Nitella flexilis* and of *Chara*, in the cells of the hairs of *Hydrocharis morsus-ranæ*, and in those of the petiole of *Sagittaria sagittifolia*, &c. The observer unskilled in the investigation of these canals experiences some difficulty in discovering them, by reason of their great transparency, and especially when they are sought for in tissues much loaded with water, where their refracting power differs little from that of the surrounding fluid. Alcohol of 86°, by acting upon them, slightly diminishes their transparency, and at the same time contracts them as it does also animal matter. If its application be continued, it is no unusual occurrence to see some of them, that are greatly distended, rupture and collapse, and retreat thereupon towards the nucleus, or, if the rupture takes place near the nucleus itself (which is a rare occurrence), towards the cell-wall.

Hydrochloric acid causes an equal contraction of them, and at the same time diminishes their limpidity. The nitrate of the binoxide of mercury contracts them in the same way, and imparts to them the same rosy hue that it produces with all other albuminoid matters. Liquid ammonia and the other soluble bases, when diluted, produce a contrary effect, causing them to swell up, and tending to dissolve them. From these characters it is evident that in chemical composition these canals resemble albumen, as well as the nucleus itself; indeed, it would be difficult to conceive it to be otherwise, even were no reagents employed.

This might be deemed the proper place to consider the internal causes which incessantly modify the appearance and relations of these canals; however, to avoid repetition, it seems preferable to defer these matters to the second part of this paper.

Hitherto only that portion of the nuclear apparatus which lies freely in the cell-cavity has received attention in the foregoing remarks; we will now proceed to follow its connexion with the cell-walls; and in order more correctly to delineate these relations, it is important to recall some facts concerning the cell-wall itself. As early as the year 1836, M. Girou de Buzareingues had regarded the cell-wall, apart from the thickenings of its external membrane, as composed of two distinct tunics, one within the other. Subsequently Harting investigated this subject, and especially studied the action of some chemical agents on the membrane which circumscribes the cell-cavity, as well as on the other two laminæ which, according to that observer, are deposited on its external surface. From these experiments he satisfied himself, as we moreover had done by our own researches, that the internal membrane, which he named the *ptychode*, behaves with iodine, alcohol, and acids precisely in the same manner as the nucleus. Hugo Mohl also entered on this same inquiry with his customary skill; and his researches went to prove that this internal membrane, which he called "*primordial,*" is to be met with in all cells that are not too old or thickened by deposits of encrusting matters. Lastly, Harting, in 1846, showed that the internal membrane adheres only feebly to the external wall of the cell. At the period (1845) when I directed my attention to this internal membranous layer, I was in ignorance of a portion of the labours which had been devoted to it; and it was in the course of my investigation of the nucleus and the intracellular canals that I was led to the discovery of this lamina of the cell in all growing as well as in mature cells when these latter are not too largely coated by encrusting deposits.

This lining-membrane of the cell, being immediately in contact with the external wall, cannot be distinguished whilst preserving its normal relations, and requires the action of reagents to display it. The solution of iodine in iodide of potassium colours it more or less deeply yellow, as it does the nucleus and its processes. In the same manner it is coloured red by the acid nitrate of mercury, and is contracted by the action of acids and of alcohol, indicating in these reactions its similarity in chemical composition to the nucleus and the canals diverging from it. When it has been detached from the external lamina of the cell by means of alcohol, it presents itself under the form of a delicate flexuose sac, of extreme tenuity, and without appreciable structure. However, the same appearances are not met with when the examination is conducted without recourse to reagents, as it may be in the cells of the transparent hairs of *Lamium*, where the lining-membrane undergoes spontaneous detachment at some points of its periphery, if the hairs are allowed to wither a little. In cells so treated, the relations of this inner membrane being only slightly modified, and its vitality not being destroyed, it becomes a more easy task to prosecute its study, and the observer may very soon and easily convince himself that it is hollowed out by minute canals permeating its substance, the most capacious of which outspread themselves upon its internal aspect, whilst the most slender constitute a close network of anastomosing tubercles within its thickness. Nevertheless it is not necessary, in the case of the cells of the plant mentioned, to wait for the partial detachment of this lamina; for the observer, when apprised of the existence of this structure, may satisfy himself of its characters whilst the membrane still retains its normal position.

When the primordial membrane is partially detached from the cell-wall, a very careful examination of the little spaces left between it and the external wall, where the separation is least wide, will reveal the presence of certain very slender filaments implanted in this outer wall; and upon slightly removing this same wall a little out of the focus of the instrument, these filaments may be perceived to form salient lines more illuminated than the rest of the cell-wall—a phenomenon which could not present itself if these filaments were situated in the detached portion of the primordial membrane itself. If I am not in error on this matter, this last fact affords an explanation of the origin of the materials of the cuticle, which, from its composition, can scarcely be derived from the cellulose wall upon which it is placed. However, if this opinion be admissible—and I grant it amounts only to a hypothesis—still there are facts to prove the permeation of the cellulose cell-wall by the tubular processes derived from the nucleus. Moreover, as these processes do form an anastomotic network in the primordial membrane, it seems fair to suppose that portions of them may penetrate to the under surface of the cuticle, or very nearly to it, and that the detachment of the primordial utricle from the cell-wall is the consequence of the rupture of some of the meshes of this network.

It has just been stated that the canals which usually radiate from the nucleus to the cell-wall break up into still smaller channels in the primordial membrane; this, however, is not always the case, for some of them, and often the most capacious, instead of stopping short at this lamina, penetrate it here and there to anastomose with other similar canals emanating from the nuclei of adjoining cells. This fact may be demonstrated by fixing, with great care, a delicate slice of the epidermis of the flower of *Tradescantia virginica* on a glass slide, allowing it to become half dried, so as to secure its adhesion, and then brushing it with a camel-hair pencil dipped in dilute solution of ammonia, which effects the removal of the cuticle. This done, a viscous network is displayed, which establishes a communication between all the cells of the epidermis, and mainly resembles the regular reticulations of some laticiferous vessels. In making these experiments, it frequently happens that a portion of this network gets removed with the cuticle: this circumstance seems to confirm the notion advanced, that the processes of the nucleus are prolonged as far as the cuticle; for if it were otherwise, it is not readily conceivable why these meshes should be removed with it from the soft-walled layer of subjacent cells.

The communication of the processes of adjoining cells through their walls has a physiological importance; for it explains how it is that the animal living matter which composes them is distributed in the different parts of the same plant, and becomes dislodged, as the cells advance in age, in its passage elsewhere, and principally to the periphery, to constitute young cells, where it is known this matter abounds.

[To be continued.]

VII.—*On the* Rhizocephala, *a new Group of Parasitic Crustacea.* By Dr. Fritz Müller, of Desterro*.

[Plate II.]

Rathke's 'Beiträge zur Fauna Norwegens' close with the description of two animals, *Peltogaster Paguri* and *P. Carcini*, which, even on reading the admirable memoir, appeared to me to be the most remarkable of the whole collection, and have since claimed one of the first places in the series of animals which I desired to investigate for myself. For this investigation an opportunity was recently afforded me by the discovery of two nearly allied species; its results were partly so surprising and out of the circle of our ordinary ideas, that, in communicating them, it is really a comfort to me to know of the existence of the two allied forms on the European coasts, and to be able to refer other naturalists to these in order to test my statements.

The head of these apparent worms, which is inserted into the body of the host, emits roots like those of plants—hollow tubes which, being much ramified, cling round its intestines; and their brood holds a middle place between that of the Lernææ and Cirripedes. They therefore constitute a new section of parasitic Crustacea, to which I give the name of *Rhizocephala* from the above peculiarity. It is to be expected that in these Rhizocephala a rich mine of new forms will be opened up, as each of the two Crabs which I have hitherto been able to examine in large numbers nourishes a species. Unfortunately I am destitute of all means of determining these animals; but they will be easily recognized by future visitors to our coast without any detailed description. Almost under every stone they will find a blackish-green, smooth-clawed, and uncommonly nimble *Porcellana*, and scarcely less abundantly, a small *Pagurus*, which seeks shelter almost exclusively in the shells of a *Cerithium*.

The parasite of the *Porcellana* may be called *Lernæodiscus Porcellanæ*; and that of the Hermit Crab, *Sacculina purpurea*. I shall describe first the two sexually mature animals, and then their larvæ.

Lernæodiscus Porcellanæ (figs. 1–3) occurs pretty commonly, usually single, rarely two together, attached to one of the anterior segments of the tail of its host, and often completely fills the space between the tail and the sternum. It has the form of a fleshy and pale-yellowish flesh-coloured disk, which may be upwards of 10 millims. in breadth by a little less in length. In front and behind, the disk is deeply sinuous, and on each side divided into from five to seven lobes, the usually enlarged ex-

* Translated by W. S. Dallas, F.L.S., from Wiegmann's Archiv, 1862.

tremities of which are also frequently sinuous. On the dorsal surface of the disk, which is turned towards the tail of the *Porcellana,* there are often smaller prominences, similar to the above lobes, near the margin. On the ventral surface, which is turned towards the sternum of the *Porcellana,* the eye is first struck by the ovary (Pl. II. fig. 2, *b*), which occupies nearly the whole surface up to the origin of the marginal lobes, but has posteriorly a broad and shallow sinus, and anteriorly a narrow emargination dividing it halfway down, and dilated into a clavate form at the posterior end.

Below the ovary (nearer the ventral surface) and near the anterior margin of the disk, there lie two very considerable roundish or reniform glands (fig. 2, *c*), of that peculiar translucent appearance that so frequently characterizes the testes of the lower animals; their efferent ducts, which are at first narrow, but afterwards dilated, very thin-walled and difficult to trace, run backwards on their inner side. I suppose that they open at the hinder margin of the ovary in the brood-chamber, which will have to be mentioned immediately. Likewise under the ovary, and corresponding therewith in its outlines, but filling up the anterior notch, there stretches a cavity with delicate walls, containing a reddish transparent fluid: that it is a single cavity is evident when it contracts; in the extended state, one might be misled into assuming the presence of a network of tubes passing between the separate groups of eggs, issuing from a vesicle situated in the anterior notch of the ovary, the colour of the thin stratum of fluid over the more prominent eggs becoming almost imperceptible, and distinct only in the furrows between them.

In the posterior sinus of the disk there is a considerable orifice, surrounded by a notched margin (fig. 2, *a*), through which water is seen to flow in and out with an alternate extension and contraction of the body. It leads to a wide brood-chamber, the extent of which is most easily ascertained when it is inflated by means of a fine-pointed glass tube: it is then seen to occupy the whole dorsal surface, except the anterior notch of the ovary, and to extend into the marginal lobes, which are merely diverticula of it. The brood-chamber is usually found fully distended with eggs, which adhere especially to its outer wall, and are all of the same age. When they approach maturity, the margin of the disk appears more transparent, and finally the marginal lobes and back are covered with black points, from the eyes of the young brood, which swims out simultaneously. Two days after the swarming, I again found in one animal fresh ova, in course of complete segmentation in the brood-chamber. The water flowing into the brood-chamber serves, in my opinion, only for the respiration of the eggs, which must pretty completely stop its access to the body of the mother. In many other Crustacea, also, the attachment of the eggs to the body of the mother may be necessary for the development of the brood, less on account of the protection thus afforded them than on that of the constant change of water; even nearly mature eggs of Crabs and Prawns separated by me from the body of the mother have always come to nothing, whilst the females kept in confinement have hatched with certainty.

In the anterior sinus of the disk is an arched chitinous shield (fig. 2 *s*) with concentric striæ, between which brownish-coloured particles are usually deposited. From its middle there springs a short neck, which pierces through the skin of the *Porcellana*. Within, it is surrounded by a strong chitinous ring, 0·2 to 0·3 mill. in diameter, which is continued into a serrated crown, dilated above, possessing a golden lustre. This crown is variously developed according to the age of the animal (*k*, figs. 2, 3). It is produced by the chitinization of the skin of the head. Single small chitinous lamellæ (fig. 3, *b*) are met with sometimes above the crown, beyond which the soft skin of the head extends but little. From the upper surface of the head, on which I found no trace of mouth, eyes, or antennæ, there issue numerous tubes (fig. 3, *w*), as much as 0·15 mill. in diameter, part of which, especially the outer ones, terminate cæcally at a very short distance, whilst the others, ramifying repeatedly, advance towards the intestine of the *Porcellana*, embrace this for a long distance, even into the thorax, and at last terminate in blind loops. Not unfrequently cords, more than 0·5 mill. in thickness, formed by the twining together of numerous separate tubes, are seen taking their course towards the intestine of the *Porcellana*. These roots, as they may be called from both their appearance and function, contain, in their delicate membrane, numerous fat-globules, which are distinguishable, by their much smaller and at the same time uniform size, from the fatty particles in the tail of the Crab.

That the roots are united through the neck with the large receptacle of fluid beneath the ovary is proved very simply and certainly by a circumstance which I was unable to explain before their discovery:—When the head of the parasite is removed from the body of its host, and sometimes even when the tail of the *Porcellana* is torn away from the thorax, an instantaneous and very striking pallescence of the *Lernæodiscus* takes place in consequence of the evacuation of the reddish fluid. Whether the cavity for the nutritive fluid, which can hardly be called the digestive cavity, commencing in blind roots, also terminates cæcally, I must still leave undecided, although a narrow process often seen behind the orifice of the brood-chamber makes me think an aperture in this place not improbable.

I looked for males of *Lernæodiscus* the more zealously as Rathke observed in the brood-chamber of *Peltogaster Paguri* a small Crustacean, his *Liriope pygmæa,* but hitherto without any result. In the fluid obtained from the above-mentioned large glands I have, on the contrary, seen motile particles, the exact form of which my microscope is not capable of showing. From their mode of moving, I scarcely hesitate to regard the fluid as semen.

Sacculina purpurea (Pl. II. figs. 4 & 5), the parasite of our small Hermit Crab, appears to be no less plentiful than the *Lernæodiscus.* After my attention had once been directed to it, I could obtain from the shells collected during a single ebb-tide thirty or more *Paguri* with the parasite attached to them. The parasite adheres, in the form of a thick, slightly bowed cushion, of a purple-red colour, which was observed more than 6 millims. in length and half that thickness, to the base of the soft abdomen, and on its left and more convex side; its somewhat thicker posterior extremity, with the orifice of the brood-chamber, is turned towards the head of its host, and therefore towards the mouth of the shell. The point of adhesion is on the concave side of the cushion, rather nearer to the posterior extremity; from above, the extremities appear to be rounded-off in a spherical form.

The parasite is just as much obliquely twisted as its host. If we regard the concave surface, by which the animal adheres, as the lower one, and determine the posterior extremity by the presence of the aperture of the brood-chamber, then, of the two sides, which are distinguished beneath by the intestine and ovary, and on the back by a shallow furrow, the left is most developed posteriorly, and the right anteriorly. In front the difference is inconsiderable; but posteriorly it is so great, that the orifice of the brood-chamber is completely displaced towards the right angle of the posterior margin. This orifice forms a small longitudinal fissure, and exhibits the same currents of water as in *Lernæodiscus.* On the left side, the posterior margin runs out into a more or less distinct acute angle. The intestine and the ovary which lies over it form a rather narrow stripe, diminishing anteriorly and posteriorly, which extends from the point of attachment forward nearly to the anterior margin, and backward to the orifice of the brood-chamber. The whole remainder of the cushion is brood-chamber. The approaching maturity of the eggs is betrayed by a paler and more translucent coloration.

The concentrically grooved shield at the point of attachment is but slightly developed; the golden crown in the interior of the host (fig. 6, *k*) differs from that of *Lernæodiscus* in that single broad branches issue from the ring, the wide ramifications of which gradually pass into the thinner skin of the head, whilst *Lernæodiscus* has acute and distinctly circumscribed teeth. The roots shooting from the head extend backwards upon the left side of the *Pagurus*, and form, between the hepatic tubes, a dense tuft of tubes springing from a few principal stems. From this tuft the hepatic tubes passing through it may easily be extracted, and it may thus be completely isolated (fig. 4 B, *w*). The colour of the tuft of roots is dark grass-green: it shines distinctly through the thin wall of the body of the *Pagurus*.

The larvæ of the two parasites have so many points of agreement, that I describe only that of *Lernæodiscus*, and shall merely call attention to the differences presented by that of *Sacculina*.

The larva of *Lernæodiscus* (fig. 6) is 0·2 millim. in length, 0·12 millim. in breadth anteriorly, and diminishes at first slightly, but in the last third more rapidly. At the posterior extremity it bears two short points. The slightly arched anterior margin runs out on each side into a short horn, somewhat bent backwards at the apex. The back is covered by a carapace which extends beyond the body in front and at the sides by 0·04 to 0·05 millim.; posteriorly it scarcely covers the origin of the two points, and also conceals only the base of the horns of the frontal margin.

On the lower surface there is, at a short distance from the anterior margin, a large, somewhat transverse eye, usually slightly emarginate in front, from which a strong nerve may be traced backwards, but which appears to be destitute of a refractive body. I cannot see the bristles at the sides of the eye to which Max Schultze has called attention in the young Cirripedia.

The point of origin of the three pairs of feet is situated nearly in the middle between the median line and the lateral margin; the foremost originates close behind the eye, the hindermost at the end of the second fifth of the length. The foremost has a thick cylindrical basal joint, and a short terminal joint with two long bristles; the second bears upon a thick basal joint a long outer (and anterior) branch with five, and a shorter inner one with three, long bristles; the third pair of feet is considerably shorter and weaker than the second; its outer branch bears four, and its inner one two, long bristles. The longer branches are annulated, but not distinctly jointed.

Between the feet of the middle pair there springs a triangular rostrum, with its apex directed backward. The wide intestinal canal, which advances forward a little beyond the rostrum, is still, during the first days, densely filled with brown yelk. Behind the last pair of feet, a slight constriction of the body is sometimes to be seen.

The larva of the *Sacculina* differs in having a much larger carapace extending far beyond the frontal horns and terminal points, in the want of the eye, in the more oval form of the body, and in its straight frontal horns, directed obliquely forwards. I also found in it the bristles near the anterior margin, which are wanting in *Lernæodiscus,* and behind the last pair of feet on each side of the intestine an accumulation of brown opake granules (urine?), of which also I can find nothing in *Lernæodiscus.*

From the descriptions just given, the following peculiarities may be indicated as characteristic of the Rhizocephala, which hold an intermediate position between the Siphonostoma and Cirripedia:—

Crustacea Rhizocephala.

Larva with three pairs of natatory feet, of which the two posterior are biramose, with lateral frontal horns, two points at the extremity of the abdomen, and a membranous carapace. *Mature animal* soft-skinned, inarticulate, destitute of eyes, antennæ, feet, and mouth (?). Head immersed in the host, hardened at the base into a chitinous coronet, taking up nourishment by means of rootlike cæcal processes. Hermaphrodites with motile spermatozoids (?), without ovisacs (like the Cirripedia), and with a wide brood-chamber open posteriorly.

GENERA.

1. *Peltogaster,* Rathke*.
2. *Sacculina.* Body unsymmetrical, sausage-shaped; head in the middle of the ventral surface. Larva eyeless, with two frontal bristles.
3. *Lernæodiscus.* Body symmetrical, disciform; head at the anterior margin of the disk. Larva with an eye, without frontal bristles.

EXPLANATION OF PLATE II.

Fig. 1. *Lernæodiscus* attached to the tail of the *Porcellana*; slightly magnified.

Fig. 2. A smaller specimen from the ventral surface, magnified 15 diameters: *a,* aperture of the brood-chamber; *b,* ovary; *c,* testes (?);

* After the lapse of more than fifteen years, the details of Rathke's descriptions have escaped me too thoroughly to permit my characterizing this genus, or even deciding whether *Sacculina* should not be united with it.

s, chitinous shield; *k*, crown. The soft part of the head is wanting.

Fig. 3. The portion of the *Lernæodiscus* which is situated within the *Porcellana*, magnified 25 diameters: *b*, chitinous lamellæ; *k*, crown; *w*, roots.

Fig. 4. *Sacculina purpurea*, magnified 3 times: A, from below; B, from the right side; *a*, *b*, *k*, as in fig. 2.

Fig. 5. The portion of the *Sacculina* situated within the *Pagurus*, magnified 15 diameters: *k*, crown; *w*, roots.

Fig. 6. Earliest larval state of *Lernæodiscus*, from beneath, magnified 180 diameters.

Fig. 7. Earliest larval state of *Sacculina*, from above, magnified 180 diameters.

BIBLIOGRAPHICAL NOTICES.

Manual of British Botany. By CHARLES CARDALE BABINGTON, M.A., F.R.S., F.L.S. &c., &c., Professor of Botany in the University of Cambridge. Fifth Edition, with many additions and corrections. London: Van Voorst, 1862.

THE 'Manual of British Botany' continues to maintain a steadily progressive character. Every page of the new edition bears witness to the industry and care of its author, and to his endeavour to keep pace with the advance of botany on the European continent. The Synopsis of Orders has been altogether remodelled, and is now arranged on the analytical or dichotomous plan so much used by French botanists. The descriptions of several of the more difficult genera and species have been re-written. Many improvements have also been made in defining the places of growth and range of the plants; and we meet with a welcome addition in the form of a glossary of botanical terms, which, like the accents now placed over the Latin names, will no doubt be found very serviceable.

Professor Babington thus announces his botanical creed:—"An attempt has recently been made greatly to reduce the number of our native species. The results seem to be so totally opposed to the teaching of the plants themselves, and the evidence adduced in their favour is so seldom more than a statement of opinion, that they cannot safely be adopted. Also, it has been laid down as a rule by some botanists that no plant can be a species whose distinctive characters are not as manifest in a herbarium as when alive. We are told that our business as descriptive botanists is not 'to determine what is a species,' but simply to describe plants so that they may be easily recognized from the dry specimen. The author cannot agree to this rule. Although he, in common with other naturalists, is unable to define what is a species, he believes that species exist, and that they may often be easily distinguished amongst living plants, even when separated with difficulty from their allies when dried specimens only are examined. He also thinks that it is our duty as botanists to study the living plants whenever it is possible to do so, and to describe from them—to write for the use of field- rather than cabinet-naturalists, for the advancement of a knowledge of the plants rather than for the convenience of the possessors of herbaria—also that the differences which we are able to describe as distinguishing plants being taken from their more minute organs, is not a proof that they constitute only a single species. It seems to be our business to decide upon the probable distinctness of plants before we attempt to define them; to make the species afford the character, not the character form the species" (preface, pp. iii. iv). That our author is no servile follower of the school of Messrs. Jordan and Boreau is sufficiently proved by a remark which occurs a few pages further on, where the writings of these eminent botanists are recommended as "valuable for the study of varieties, for many of their species can claim no higher rank;" and this is coupled with the useful caution that "it is necessary to warn students against the very common error of supposing that they have found one of the plants described in a foreign flora, when in reality they have only gathered a variety of some well-known British plant. The risk of falling into such errors renders it necessary to consult such works as those of Messrs. Jordan and Boreau with great caution, lest we should be misled by descriptions, most accurate indeed, but rather those of individuals than species. Amongst plants so closely allied as are many of those called species in some continental works, it is scarcely possible to arrive at a certain conclusion without the inspection of authentic specimens" (preface, p. vii.). The moderate views thus taken by Professor Babington in the matter of species are further illustrated by the changes which have been introduced into the 'Manual' itself, where, if, on the one hand, we find a certain number of plants promoted to the rank of species, on the other we find some, which in former editions appeared as such, reduced to mere varieties.

Much attention has evidently been given to the subject of introduced plants; and we are glad to see the marks of naturalization more freely used than in any former edition. As in the 'Flora of Cambridgeshire,' three signs are employed for the different degrees of "certainly," "probably," and "possibly" introduced. A few of the agricultural weeds (e.g. *Ranunculus arvensis*, *Fumaria micrantha*, *Chrysanthemum segetum*, and all the species of the genus *Papaver*) are marked as possibly introduced; but we observe that most of the so-called "colonists" are still allowed to pass as native.

The following is a summary of the principal alterations made since the fourth edition:—

In the genus *Thalictrum*, *T. calcareum* (Jord.) is added as a variety of *T. minus* (L.); *T. saxatile* of former editions now appears as *T. Kochii* (Fries), while a new species is added under the name of *T. saxatile* (Schleich.). *Papaver Lecoqii* (Lamot.) is accepted as a species distinct from *P. dubium* (L.). Instead of *Fumaria capreolata*, we have now three species, viz. *F. pallidiflora* (Jord.) [to which *F. Boræi* (Jord.) is joined as a variety], *F. confusa* (Jord.), and *F. muralis* (Sond.). *Barbarea intermedia* is new to the British list, but is marked as possibly introduced. Under *Viola sylvatica* (Fries) are described two forms—*a. V. Reichenbachiana* (Bor.), and *β. V. Riviniana* (Reich.), with the intimation that they are probably distinct species. *Moehringia trinervis* has been transferred to the genus *Arenaria*; *Arenaria leptoclados* (Guss.) takes its place as a species. The name *Hypericum anglicum* (Bert.) is still preferred to *H. elatum* (Ait.); but the plant is enclosed in brackets, as having very slender claims to be accounted British. *Ulex strictus* (Mackay) is reduced to a variety of *U. europæus* (Linn.). *Lotus tenuis* (Smith), which appeared as a species in the 'Flora of Cambridgeshire,' is once more joined to *Lotus corniculatus* (L.). *Lathyrus tuberosus* (L.) is added, with the brand of a possibly foreign origin. The genus *Rubus* has been thoroughly revised, and the number of species raised from forty to forty-five. *Dryas depressa* (Bab.) is reduced to a variety of *D. octopetala* (L.). *Lepigonum* now includes four species by the addition of *L. rupestre* (Kindb.) and *L. neglectum* (Kindb.). *Sedum purpureum* (Tausch) is now called *S. Fabaria* (Koch). *Galium parisiense* (L.) changes to *G. anglicum* (Huds.). *Galium elongatum* (Presl) is now included under *G. palustre* (L.). *Centaurea nigrescens* of former editions is reduced to a variety of *C. nigra*, under the name of *C. decipiens* (Thuill.). *Centaurea paniculata* (L.) adds another plant to those peculiar to the Channel Isles. Two *Hieracia* have changed name: *H. cerinthoïdes* is now called *H. anglicum* (Fries), and *H. stelligerum* becomes *H. floccosum* (Backh.). *Cicendia Candollei* (Griseb.) is now *C. pusilla* (Griseb.). *Lycium barbarum* (L.) and *Veronica peregrina* (L.) are added to the list of naturalized plants. *Ajuga alpina* is removed, with the remark that the plant figured in 'English Botany' seems to be a slight variety of *A. reptans* (L.). *Polygonum laxum* of former editions becomes *P. nodosum* (Pers.). *Callitriche pedunculata* (DC.) changes to *C. hamulata* (Kütz.); *C. stagnalis* (Scop.) is allowed as British, but only in the form of a variety. *Parietaria erecta* of former editions is now considered a form of *P. diffusa*, the true *P. erecta* of Koch not having occurred in Britain. *Gladiolus illyricus* (Koch) is added, and appears as a true native of Hampshire. *Luzula Borreri* (Bromf.) is just noticed, as an abortive state of *L. pilosa* (L.). The plant mentioned as *Potamogeton gracilis* (Fries) is now referred to *P. pusillus* (L.); *P. sparganiifolius* (Laest.) takes its place as certainly identical with Fries's plant from Lapland. *Carex ericetorum* is new. *Poa polynoda* (Parnell) is united to *P. compressa* (L.). *Festuca ambigua* (Le Gall) is admitted. *Triticum pungens* (Pers.) is another addition to the Grasses. *Triticum laxum* (Fries) is changed to *T. acutum* (DC.).

Equisetum Telmateia (Ehr.) becomes *E. maximum* (Lam.). *Allosorus crispus* (Bernh.) is now called *Cryptogramme crispa* (R. Br.). *Woodsia hyperborea* (R. Br.) takes rank as a species distinct from *W. ilvensis* (R. Br.). The genus *Pseudathyrium* (Newm.) is now merged in *Polypodium*. *Lastræa remota* (Moore) is admitted as a variety of *L. spinulosa* (Presl). *Athyrium fontanum* is now placed in the genus *Asplenium*. *Asplenium acutum* (Bory) is reduced to a variety of *Asplenium Adiantum-nigrum* (L.). *Isoëtes echinospora* (Dur.) is new; *Isoëtes Hystrix* (Dur.) is also new.

The chief alterations and amendments which appear in this edition of the 'Manual' will be gathered from what has been already said, and from a study of the preceding analysis. It only remains for us to observe that there is no other work of the kind in which so great pains have been taken to bring the nomenclature of our English plants into conformity with that adopted on the Continent; and it will be seen that not a few of the changes which appear in the edition now before us have been introduced with this aim. We must also remark that in no other English book can we find the same care bestowed on the discrimination of closely allied species and varieties; and, whatever be thought of the respective value of the different forms, no one can doubt the importance of a careful and discriminating study of varieties, inasmuch as it is only by this means that we can hope to attain to a more exact knowledge of species.

It is by a careful and judicious attention to matters such as these that Professor Babington's 'Manual' has become identified with the progress of British botany; and we have no hesitation in saying that the present edition is in every respect calculated to sustain the high reputation in which its author is so deservedly held.

British Conchology; or, an Account of the Mollusca which now inhabit the British Isles and the surrounding Seas. Volume I. *Land and Freshwater Shells.* By JOHN GWYN JEFFREYS, F.R.S., F.G.S. &c.

Nine years have elapsed since the publication of Forbes and Hanley's 'History of British Mollusca'—a period brief indeed in the history of a science, but long enough to have added many species of Mollusca to our fauna, and of these no sufficient description has as yet been given. The elaborate treatise to which reference has just been made will probably remain for some time the chief illustrated work upon the subject. The high price, however, at which it was necessarily published unfortunately placed it beyond the reach of very many, who have thus been hitherto debarred from following up the study of British Conchology; while its bulk has stood in the way of its utility, and the student has felt the want of a portable volume which should be his companion at the sea-side. The aim of the author whose Manual we are about to review is to supply this want, as well as to bring the history of the Mollusca up to our present state of knowledge, and no one has equal facilities for undertaking and satisfactorily performing the task. Possessed of an unrivalled and well-nigh perfect collection of British shells, and having, moreover, a first-rate conchological library, Mr. Jeffreys has those materials at his own command which previous writers have been compelled to glean from various sources, or search for through the cabinets of many widely scattered collectors. Moreover, he has had upwards of thirty years' close study of his subject, and is thus thoroughly master of it, as is evidenced in the easy flowing style which characterizes that portion of his work which is now before us.

The volume is divided into two parts,—the first consisting of an

Introduction, the second containing a descriptive account of the British Land and Freshwater Mollusca.

The Introduction, comprised in six chapters, furnishes much valuable information condensed into a small compass. It has evidently been drawn up with much care; and the history, habits, structure, and economy of the Mollusca are well handled. The following extracts will give our readers a fair idea of the contents. On hybridism we find the following information :—

"Although many surmises have from time to time been hazarded as to the production of abnormal forms of Mollusca by means of an unnatural union between individuals of different species, the only direct experiments or observations that appear to have been published on the subject have been made by French naturalists. M. Gassies, in his descriptive Catalogue of the Land and Freshwater Mollusca found near Agen, mentioned several cases of what he calls 'accouplements adultérins,' which he had observed between individuals of *Helix virgata* and *Helix Pisana,* as well as between those species and *Bulimus decollatus.* M. Gassies enclosed the snails, during a thunder-storm, in a vessel covered with metallic gauze; and he believed that the electricity with which the air was then charged induced the unnatural union. Great care appears to have been taken to prevent any error in the result, by selecting individuals which had not been previously fertilized, and keeping them, after fecundation, separate from any others. The product of these unions was as follows: the young of *H. Pisana* had perfectly white shells, their mother having the usual coloured bands; and the young of *H. virgata* had shells of a darker colour than that of their mother. In the other case, the product of the Helices which had been coupled with the *Bulimus* was various. Many had shells which were almost scalariform; the shells of others were pyramidal; but the greater part of them had shells exactly like that of their mother. The product of the *Bulimus* did not differ from their maternal form. M. Gassies had also observed the product of a union between *Helix nemoralis* and *H. hortensis,* in which the colour of the lips of their shells in each case varied indifferently from brown or rose-colour to milk-white. Prof. Lecoq and M. Miergue have celebrated the voluntary nuptials between individuals of *Helix nemoralis* and *H. aspersa,* as well as between *Pupa cinerea* and *Clausilia papillaris*; but these unions do not appear to have been blessed with any offspring."

To these instances of hybridism we may add that we have seen some hybrids which had been bred between *Helix Pomatia* and *H. aspersa* by an English conchologist.

Few subjects have greater interest than the wonderful provision which nature makes for the reproduction of lost members among the lower divisions of the animal kingdom. The following account is given of instances of this phenomenon as evidenced among the Mollusca: "Some Mollusca which had been accidentally deprived of their feet, tentacles, eyes, and even their entire heads, have been known to reproduce them. Nearly a century ago, the experiment of decapitating unfortunate slugs and snails was conducted on a wholesale scale on the Continent, and every philosopher was anxious to cut off a head. Even the great Voltaire followed the universal fashion; and his experiences were published in the 'Questions sur l'Encyclopédie.' In these he mentions having operated on twenty brown slugs and a dozen snails; and he afterwards records with great pride and satisfaction 'mes Limaces' and 'mes Escargots' showing their budding heads and horns, and doing as well as might be expected under the circumstances." Accident some years ago enabled us to verify the observations of Voltaire, Müller, and others upon this subject. Unaware at that time of the wonderful tenacity of life in the Helices, and being desirous of examining the jaws of *H. aspersa,* we suddenly decapitated a snail, while crawling, with a single stroke of a penknife. We believed, in doing this, that we had adopted a plan of killing the snail which would result in instantaneous death, while the mode of death was also best suited to our immediate purpose. The shell containing the carcase was thrown from the open window into the garden, while the head was dissected, and the jaws extracted and mounted. Nothing more was thought of the matter until, about six weeks subsequently, we lighted, while gardening, upon the identical snail-shell, which was easily recognizable in consequence of a repair, and to our astonishment noticed a thin filmy epiphragm closing the mouth of the shell. The mollusk was still alive; and on tempting it out by immersion in tepid water, the headless trunk was protruded from the shell. The poor animal's neck was healed over, and we found that we had been unintentionally guilty of a barbarous act of mutilation. We were, however, of course extremely interested in the result, and the snail was carefully kept for future observation. It lived for a year and two or three months. During this time it was occasionally dipped in milk, with the hope that nourishment might thus be imbibed through the pores of the skin. Under this stimulus, the snail would protrude its poor guillotined remains from the shell; there were, however, but faint signs of reproduction. The last time it was seen alive, the head was represented by a knob-formed projection, on which two minute tubercular eminences represented the upper antennæ.

The author gives a brief analysis of the various solutions which have been offered of the much-vexed question of the means by which the burrowing Mollusca penetrate stone, wood, cork, and other substances, and then proceeds to propound a new theory—new, that is, to modern times,—which we give to our readers without comment.

"I profess myself to be a follower of Sellius," a Dutch philosopher who wrote a learned treatise on the Ship-worm about a hundred and thirty years ago; "and I am convinced that the sole instrument of perforation, by the Mollusca, of stone, wood, and other substances is in every case their foot, or muscular disk, which is closely applied to the concave end of the hole, and is constantly supplied with moisture through the glandular tissues of the body. The strength of this organ may be easily tested by any one who tries to remove a limpet from its native rock, after having touched it, and thus given it notice of his intention. By this simple yet gradual process, the fibres of wood or grains of sandstone may easily be detached or disintegrated, time and patience being allowed for the operation. When it is considered that the hole made by an adult *Pholas* or *Saxicava* is only a few inches deep, and that an aged *Patella* scarcely penetrates a quarter of an inch into a limestone-rock, there can scarcely be a question that these mollusks have abundance of time to effect their purpose. It is said that even the hardest marble is not proof against the softest impressions, and that the big toe of St. Peter's statue in the Vatican has been nearly worn away by the lips of fair devotees. The osculatory process is not unlike that of suction."

In the second portion of the work a uniform plan has been adopted. The animal is first described, then the shell and its varieties; and these descriptions are followed by a commentary upon the range, habits, and nomenclature of the species in question. The different parts of the animal and shell are also invariably characterized in the same order—a methodical plan which has great advantages, and which ought always to be adopted in descriptive works on natural history.

Mr. Jeffreys's computation of the number of our inland Mollusca is almost the same as that of Messrs. Forbes and Hanley, the former enumerating 121, and the latter 122 species. There is, however, considerable diversity as to the means by which these numbers are arrived at. The author of 'British Conchology' has struck out of the list the following Mollusca, as being either merely varietal forms or erroneously recorded species:—*Pisidium obtusale*, Pfeiffer; *Pisidium cinereum*, Alder; *Pisidium Henslowianum*, Sheppard; *Arion flavus*, Müller; *Limax brunneus*, Draparnaud; *Limax tenellus*, Müller; *Helix aperta*, Born; and *Limnæus Burnetti*, Alder: and, on the other hand, he has given admission to the following:—*Sphærium ovale*, Férussac; *Pisidium roseum*, Scholtz, separated from *Pisidium pulchellum*, Jenyns; *Anodonta anatina*, Linnæus, separated from *Anodonta cygnea*, Linnæus; *Succinea elegans*, Risso, separated from *Succinea putris*, Linnæus; *Helix concinna*, Jeffreys, separated from *Helix hispida*, Linnæus; *Vertigo Moulinsiana*, Dupuy, now first recorded as a British species, having been taken by Mr. Jeffreys in the west of Ireland; and *Vertigo alpestris*, Alder, separated from *Vertigo pygmæa*, Draparnaud. We are unable to acquiesce in many of these changes, though in the majority of instances the decision which the author has arrived at appears to be fully justified. But Mr. Jeffreys is not content with species; in this work he introduces to British conchologists no less than *one hundred and eighty-four named varieties*. It has always appeared to us that the use of names as applied to varieties is most undesirable, and therefore should only be adopted in cases where the forms are so strongly marked as either to have already been characterized as species by previous describers, or at least to be possessed of features so greatly at variance with the type that the description of the normal form would of itself be insufficient for their identification. Names, for instance, have been given, we think, rightly by Mr. Darwin to distinguish the widely different forms of the variable species of Cirripedia; and in the case of British Mollusca, they may be retained with advantage in such genera as *Pisidium, Anodonta, Littorina,* &c.; but there is surely much reason to question the advisability of introducing varietal nomenclature on slight deviations of form and colour, in the wholesale manner which we find in this volume. For instance, there are distinguishing titles given to no less than five modifications of the well-known *Cochlicopa* (*Zua*) *lubrica.* These varieties are characterized as follows:—

"Var. 1. *hyalina.* Shell greenish-white.

Var. 2. *lubricoides,* Fér. Shell smaller and more slender.

Var. 3. *viridula.* Shell shaped like the last variety, but greenish-white.

Var. 4. *fusca.* Shell smaller and thinner, reddish-brown.

Var. 5. *ovata.* Shell much smaller, and oval; spire shorter."

The views of the author are at variance with those of previous writers upon the subject of geographical distribution. It is his opinion that the provinces as constituted by Milne-Edwards, Woodward, and Forbes are all too limited in area, and that the fauna of Europe should be divided into two provinces only—*North European* and *South European.* The division between these provinces he would mark by a "line drawn in the meridian of Bordeaux, which may be assumed as an arbitrary point of demarcation between the two extremes of climate in Europe," and which roughly defines the limits of the growth of the olive in France. A table at the conclusion of the volume shows the distribution of the British land and freshwater shells in these two provinces, their presence or absence in a fossil state in the Upper Tertiary formations, and their extra-European range. The illustrations consist of nine plates, which contain figures of the animal and shell of each genus described.

In conclusion, we cordially recommend this work to conchologists, and look forward to its completion, believing that the portion which relates to the marine species is yet more required than that which is now before us, and that its publication will give a healthy stimulus to the study of the British Mollusca.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

March 27, 1862.—Major-General Sabine, President, in the Chair.

"Theoretical Considerations on the Conditions under which the Drift Deposits containing the Remains of Extinct Mammalia and Flint-implements were accumulated; and on their Geological Age." By Joseph Prestwich, Esq., F.R.S., F.G.S.

In his former paper on the subject of the Flint-implements*, the author postponed the consideration of the theoretical questions, to

* See Annals, ser. 3. vol. iv. p. 230, for abstract; Phil. Trans. 1860, p. 277, for the entire memoir.

allow time for a fuller investigation of the physical phenomena. The points then sought to be established were,—the artificial make of the specimens,—their position in undisturbed ground,—and their contemporaneity with the extinct animals. The points for present consideration relate to the structural and physical phenomena, and to various theoretical questions.

In the present paper the author proceeds to show that the flint-implements are found along the line of existing river-plains at heights varying from 20 to 100 feet above the rivers, and that the beds of sand and gravel in which they are imbedded can be divided into two more or less distinct series, one continuous along the bottom of the valleys and rising but little above the river-level, and to which he proposes to apply the term "*Low-level Gravels,*" and the other in detached masses on the heights flanking the valleys, and at 50 to 200 feet above the rivers, and which he designates as the "*High-level Gravels* *." Both gravels consist of débris derived from rocks in the valleys through which the present rivers or their tributaries flow, and they both occasionally contain organic remains; both are, in fact, related to former plains and present valleys.

This structure is then shown to apply to the Waveney, where there is a terrace of gravel on both sides of the valley at a level of about 40 feet above the river, and to which position, but to a more lacustrine condition, the Hoxne deposit belongs. Sections are given of this valley, and also of the valleys of the Lark at Icklingham and of the Ouse at Bedford, showing the constancy of this structure. In the valley of the Thames the phenomena are more complicated and are reserved for future consideration, notice being merely taken of the implements found at Herne Bay and Whitstable.

Owing to the absence of marine newer and post-pliocene beds in the North of France, these gravels are better exhibited and more distinct, being free from rock-fragments and boulders foreign to their own origin and area. Hence it has arisen that this part of the geological series has been more investigated in France than in England. In the admirable review of the Quaternary formations by M. d'Archiac, two general conclusions are set forth. With the first of these the author perfectly agrees. It is that each large hydrographical basin, although the boundaries may not be marked by any important elevation, has its own exclusive *drift*, and that in no case is there a mixture of the transported materials of the separate basins. The author, however, dissents from the opinion that these drifts, containing the remains of large extinct mammalia, have in any way depended on or resulted from any general cataclysm destroying these creatures nearly simultaneously over wide continents and entombing their remains in the sand, gravel, and shingle of the valleys and in the earth of the caverns; neither can he consider the excavation of the valleys to be anterior to the spread of the drift-gravels.

* At the reading of this paper, the author used the terms "Terrace Gravels" and "Valley Gravels;" but he thinks it better to revert, with limitations, to terms which he suggested some years since, but has not hitherto defined.

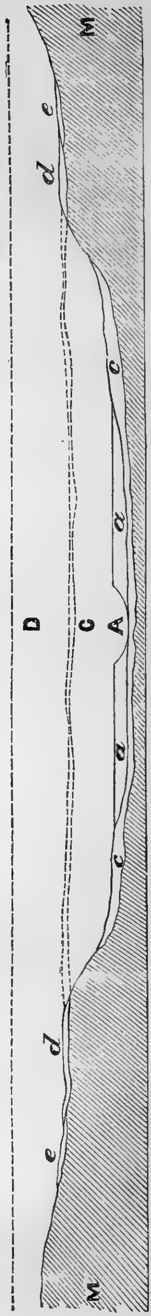
On the contrary, he refers the phenomena to long-continued river-action.

An account is then given of the valley of the Somme, and it is stated that the relation between the high- and low-level gravels, which could not be proved with respect to St. Acheul and St. Roch, has been made clearly apparent at Montiers near Amiens, by the opening of a new ballast-pit on the side of the railway, some 50 feet above the level of the old gravel-pits in the valley just below, and in which latter *flint-implements* were first found by the author in the spring of last year. In the upper ballast-pit a considerable number of land and freshwater shells and some mammalian bones have been found, but as yet no flint-implements. This deposit, as also the now well-known flint-implement-bearing beds of St. Acheul, are considered to belong to the high-level gravels, whilst the gravel of St. Roch and that of the old Montiers pits are placed with the low-level gravels. Both sets of gravels are also developed in the neighbourhood of Abbeville, and both there contain flint-implements; Moulin Quignon belonging to the higher level, and Menchecourt and Mautort (village) to the lower level.

In the course of last year M. Gosse discovered flint-implements in association with the remains of the Mammoth in some gravel-pits near the well of Grenelle at Paris. This bed belongs to the low-level gravel. The same gravel is also worked to the S.E. of Paris at the Gare d'Ivry, where, as at Montiers, it abuts against the hill-side. On the hill above, and 115 feet higher, there occurs at Gentilly a deposit of sand and gravel, with land and freshwater shells and mammalian remains, precisely like that at St. Acheul. At Charonne, on the opposite side of the valley and distant 4 miles, a similar deposit, corresponding in its height above the river, in its collection of freshwater shells, and in its mineral contents, is met with. No flint-implements have yet been found in these beds, but in every other respect they agree with the gravel of St. Acheul. These deposits, which have been described by M. Duval and M. Charles d'Orbigny, contain the same débris as the present Seine valley, and amongst it fragments of *granite* derived from the hills of the Morvan, at a distance of 120 miles from Paris.

It is then shown, by reference to the works of M. Leymerie, M. Cornuel and other geologists, that the valleys of the Seine and of its tributaries above Paris are occasionally flanked by heights capped with gravel containing at places remains of the Elephant, Deer, Horse, &c. In some instances these gravels rise to a height of 190 feet above the river, but the general height is from 60 to 150 feet. Sometimes they expand to a breadth of 4 to 5 miles, but they more usually form narrow belts. Various other French authors are then quoted, to show that the same structure prevails in the valleys of the Oise (where one instance of a flint-implement is recorded by M. de Verneuil), of the Marne, the Aire, the Aube, and their numerous tributaries; and in each instance it is shown that the materials, both of the high- and low-level gravels, are derived strictly from the district through which the valley passes; that only the Seine valley contains granite from the Morvan, the Oise slate-rock débris from the Ardennes, the Marne nothing older than oolitic débris, whilst the Thérain and the Somme valleys contain nothing but débris of the chalk and tertiary strata. The same rule applies to the English area; but the fact is not so apparent, owing to various conflicting elements pointed out by the author, who shows, by a map of the two countries, how great are the range and spread of these beds, and how large a proportion of our drift-gravels are of fluviatile origin.

The High-level Gravels.—From the facts recorded by the several independent observers abroad, and from his own observations in this country, the author arrives at a general proposition illustrated by the accompanying diagram, which shows,—1. D, a major valley or plain of denudation anterior to the excavation of the river-valley. 2. *e*, a non-fossiliferous drift on the slope and base of D. 3. C, the river-valley. 4. *d*, the high- and *c*, the low-level gravels. 5. *a*, recent alluvium. 6. A, the present river-channel.



The high-level gravels (*d*) appear on both sides of the valley, and their connexion before the excavation of C is pointed out. This is one of the points insisted upon by the author; the two having been generally considered as contemporaneous, or even sometimes the higher-level deposits as newer than those of the lower level. It is to be observed that the phenomena here referred to relate to broad valleys, and not merely to river-channels.

The *loess* is not shown in the diagram, otherwise the section represents the condition of the case on the supposition that all the parts are complete. But this rarely happens. Some low-level gravel is constant, but the high-level gravels are only occasionally preserved. Sections are then given to explain the cause of their absence—such as where the valley C being wider than the original bed of the old river which deposited the gravel *d*, the latter has been necessarily altogether removed.

That the formation of the higher gravels can be owing to the action of the present rivers is clearly impossible under existing conditions; for not only are they far above the level reached by the rivers at the highest floods, but also the sectional area of the valleys, compared to that of the present rivers, is so vast, that in no possible way, except by the sea, could they now be filled with water. Sections are given of the valleys of the Waveney, Ouse, Somme, and Seine, showing a disproportion between the rivers at their highest floods and the old valleys, on the average, about 1 : 500 ; and it is shown, with respect to the great flood of the Seine in 1658, when the waters at Paris rose to a height of 29 feet, that it would require a flood of at least one hundred times that magnitude to fill (with the water even in a state of rest) the valley of the Seine to the level of the high-level gravels of Gentilly and Charonne.

That the isolated beds of high-level gravels must at one time have been connected in length and breadth is evident from the circumstance of these detached parts having certain characters in common, and from the fact that if the deep valleys which they overhang, and the transverse valleys which they pass over, had then existed, they would have presented insuperable barriers to the deposition of the gravels at levels so much higher.

That the transport of this drift could have been caused by the bursting of lakes, by the sudden melting of the glaciers and snow of mountain-chains, or by the transient passage of a body of water over the land is not possible, because the spread of the débris would have been more general, would have held its course more irrespective of the existing watersheds, and would have shown an amount of wear in proportion to the distance travelled; whereas in each basin the débris is local, however low the watershed. None of the slate and oolitic débris of the Oise valley traverses into the valley of the Somme, notwithstanding the watershed between them is only six miles broad and eighty feet high.

There are two ways in which the author conceives the spread of the débris in the various directions and distinct areas could have been effected; the one by the rise of the land from beneath the sea, and the other by the action of rivers on a larger scale than the present ones. As the later tertiary deposits show the existence of seas or of lakes over the districts in question, it follows as a necessary consequence that when the land rose from beneath them, a mass of débris, in quantity and length of transport proportionate to the greater or lesser rate of elevation, must have been spread over the bottom of the channels along which the water flowed off. Nearly associated with the high-level gravels there are remnants of another drift which may have had this older and independent origin. This mode of formation could not, however, be applied to the valley gravels, as they contain freshwater shells such as live in rivers, with land shells and mammalian remains, proving the existence of a dry land.

The author concludes that the high-level gravels are the result of river-action which took place at a period before the excavation of the present river-valleys. With regard to the mode of formation of these gravels, he remarks on the materials being often transported a considerable distance,—the frequent presence of large blocks or boulders of the harder rocks,—the presence of a certain proportion of angular débris,—and the commonly confused bedding and contortions. He shows this to exist in England and in France, and supports the case by quotations from various French authors. It is then shown that in the valley of the Somme these phenomena are most marked and decisive,—large blocks of sandstone, some weighing four to five tons, and derived from tertiary strata twenty to forty miles above Amiens, being found in the St. Acheul gravels, and the beds being much contorted. These contortions do not depend on any pressure exercised by the blocks, but result from some disturbing power applied and removed. To illustrate this point reference is made to two sections in his former paper (Phil. Trans. for 1860, p. 299).

The author conceives that the only adequate cause to produce many of these effects is river-ice, the transporting power of which is well known, whilst he quotes the observations of travellers in Northern America to prove the power of such ice to pile-up the shore shingle in great conical heaps. That the old pleistocene rivers were also larger and more rapid than the existing rivers is evident from the great quantity of débris, the prevalence of gravels, the coarseness of the sands, and the general absence of mud-sediments. Another agent of considerable power is referred to, viz. ground-ice, but is reserved for consideration further on.

The Fauna of the High-level Gravels.—The organic remains are considered with reference especially to the climatal conditions of the period; and it is regretted that, owing to the scarcity of fossils except at a few places, and to the want of specific information with regard to the mammalian remains and the levels, the evidence on many points is unavoidably incomplete. The best-determined group is that of the Mollusca, in examining which the valuable assistance of Mr. Gwyn Jeffreys is acknowledged. The author gives a Table showing the group of land and freshwater shells inhabiting, in England and France, the area now described, from which comes out the striking result, that out of 109 living species 43 are found in the deposits of the high-level gravel period. There is a scarcity of Unionidæ and Paludinidæ, whereas Limnæidæ and Helicidæ are very common. In many places shells are scarce or altogether wanting; but this is common in all rivers subject to floods or bringing down much shingle. All the species are of existing forms, and all, with four exceptions, inhabit the same districts as formerly. Their range is then reviewed, and it is shown that though a considerable proportion of them are found in the South of France, a still larger proportion exist in Scandinavia, and that as many as thirty-five out of the forty-three species are met with in Finland, including the common forms, such as *Succinea putris, S. Pfeifferi, Helix hispida, H. nemoralis, H. pulchella, Pupa muscorum, Limnæus pereger, L. palustris, L. truncatula, Planorbis corneus, P. vortex, P. marginatus, P. albus, P. spirorbis, Bythinia tentaculata, Valvata piscinalis, Pisidium amnicum*, &c. From these and other facts it is concluded that, while there is nothing in the Mollusca to necessitate a climate different from that of the present day, there is nothing to require restriction to an identical climate, while at the same time the tendency of development of the group is rather in a northern than in a southern direction.

The several genera and species of Mammalia are then considered, the principal being *Elephas primigenius, Rhinoceros tichorhinus, Bison priscus,* with several species of *Equus, Bos, Cervus,* whilst the Reindeer is found in deposits of the same period; and an opinion is expressed that the evidence with respect to the climatal conditions furnished by the Mammalia, although slight, is more definite than that obtained from the Mollusca, and tends to show the probability of the climate at the period of the high-level gravel having been colder than that of these latitudes at the present day. The flora is scanty and of little avail. It is then remarked that if we had to depend only upon the organic remains for decisive evidence of the nature of the climate of the period under inquiry, we should at present fail to arrive at any safe and exact conclusion. If, however, these indications are taken in conjunction with the physical features, the conjoint evidence has weight and more preciseness; and the author concludes, from a review of all the facts, that there must have been a mean winter cold of not less than 20°, and possibly as low as 10°, or from 19° to 29° below the mean winter temperature (39°) of this part of Europe. The cave evidence would have helped this question.

The Flint-Implements.—These works of man are first discovered in beds of the high-level gravel period. The most ordinary shapes are the large spear-head form, either with a sharp point or a flat rounded one, and with the butt end sometimes blunt, and at other times chipped to an edge. With regard to the manner in which they came to be imbedded in the gravel, it can only be surmised from their condition, from our present experience, and by considering the uses to which they could possibly have been applied.

These conditions are then reviewed, and it is shown that the flint-implements rarely or never show indications of atmospheric weathering; that they are rarely worn, but are usually sharp and angular, like some of the large unworn flints which have been attributed to transport by ice; also that they are most common where the evidence of ice-action is the greatest, as at St. Acheul and Moulin Quignon. The climate of the period having been severe, it is essential to keep in mind the usages of tribes under like conditions at the present day. The mode of life of the Chipweyan Indians and the Esquimaux is then considered; and it is shown that a hatchet, an ice-chisel, a file and knives, of stone or metal, are all the instruments they need or use. It is further shown that when in winter the usually abundant supplies of Reindeer fail, these people resort commonly to fishing in the frozen rivers, and then use their ice-chisels for making holes in the ice. These implements are also in daily use for keeping open the water-holes. Analogous facts are quoted from Wrangel respecting Siberia. The author suggests therefore that some of the mysterious flint-implements (such as fig. 5, pl. 12, Phil. Trans. 1860) of St. Acheul may have been used as ice-chisels. Reasons are then assigned for their presence chiefly at particular spots; and reference is made to other forms of flint-implements, all of which admit of explanation, except those of a flat ovoid shape, common at Abbeville, which are unlike any instrument in use amongst any existing uncivilized tribes.

Notwithstanding the probable severity of the climate, it was one by no means unsuited to the existence of man, whilst the character of the contemporaneous animal life of the period was perfectly fitted for his support and sustenance.

A difficulty has been raised because hitherto no human bones have been found in these gravels; but when it is considered how scanty is the population in northern latitudes, and how disproportionately numerous are the great herds of Deer, Oxen, and other animals (fossil remains of which are yet comparatively rare), this fact, taken in conjunction with the foresight of man, indicates how small are the chances of finding his remains. Nevertheless in other deposits probably of the age of these gravels, such as some of the caves near Liège described by Schmerling, the scattered bones of man have been found in association with a like mammalian fauna.

The Low-level Gravels.—Connected with this subject is the excavation of the valleys, and the duration of that operation. The author mentions how he hesitated to assign at first a much higher antiquity to the higher gravels than to the lower gravels, or rather, admitting a difference of age, to decide whether the excavation of the valleys might not have been effected by some more powerful agency acting through a short interval of time, and by so much contracting the period by which the St. Acheul deposit preceded that of St. Roch; but after repeated visits to Amiens, and looking at the question from every point of view, he finds himself unable to discover a sufficient explanation in the direction first sought, and obliged to adopt, in part, views differing materially in some points from those he at first thought to be the more probable. The low-level gravels have been frequently described, and the author confines himself chiefly to pointing out the difference between them and the high-level gravels. The climate at the one period has been described as one of considerable severity; but there is evidence to show that in some part of the pliocene period, previous to that time, the cold was still more severe. At the period referred to the greater part of England was under the sea, whereas Switzerland and the greater part of France had emerged at an earlier or a miocene period, and there is no sufficient proof of their having been subsequently submerged. This was the period of the wonderful extension of the old European glaciers, which descended in the Swiss Alps, the Jura, and the Vosges to within 1200 or 1000 feet of the sea-level, the existing glaciers standing at 3400 to 3500 feet. M. Leblanc has calculated that such a difference of level might be accounted for by a reduction in the mean annual temperature of $12\frac{1}{2}°$ Fahr.; but the author questions this, as the gradients of the glacier beds were much less after they had emerged from the mountain-passes. The growth of the old glaciers is rather the result of the great cold than a measure of it. Still it can be conceived that their growth would be checked when the temperature had risen from the extreme cold to a point $12\frac{1}{2}°$ below the present mean annual temperature. This would reduce the mean annual temperature here to $37\frac{1}{2}°$,—that of Moscow and Quebec, with which the climate at the higher gravel period has been before compared, being respectively 40° and 41°,—and would agree with what has been considered the probable mean winter temperature of that period, viz. one between 10° and 20°.

Taking this as the starting-point, the effect of such conditions with reference to the quantity of ice and snow stored up during this period of cold, and to its effect on the river-discharges for many years afterwards during the period of the valley gravels, has to be considered. The melting of the winter snow would necessarily cause spring floods. Another cause of floods is the fall of rain whilst the ground is still frozen. These causes, combined possibly with a larger rainfall, must have afforded to the old rivers, either permanently or, at all events, during spring-time, a volume of water far exceeding any present supply, and given them more of a torrential character. Instances are quoted from Sir R. Murchison's 'Russia' and Wrangel's 'Siberia,' and others, to show how this is still the case every spring in northern countries, causing a rise in the rivers of from 10 to 40 feet, and inundating the adjacent valleys.

Other forces, however, besides an increase in the water-power, seem required to account for the excavation of the great valleys; and the author thinks that cold and ground-ice have performed a very important part in the operation. In support of this view, he adduces the opinion of Arago and the observations of M. Leclercq and Col. Jackson, both of whom show how constantly this ice is formed in cold climates in rivers with stony and gravelly bottoms, such as the old post-pleiocene rivers must have been. Amongst other observations given are those of M. Weitz, who states that in the north of Siberia the formation of ground-ice can be seen in the rivers at a depth of 14 feet and more, and that in "rising from the bottom the masses of ice bring up with them sand and stones, and let them down at places far distant from whence they came;" and he concludes "that not only does the current occasion a change in the bed of the river by its erosion of the looser soil, which it carries from one place to deposit in another, but that the ice, which forms at the bottom of rapid rivers in very cold countries, tends also to effect a change in the beds of those rivers."

Another agent would co-operate with the last; this is the freezing of the ground and the rending of rocks by frost. Taking extreme cases, Crantz shows to how great an extent this operates in Greenland; Dr. Sutherland gives some still more striking instances on the shores of Barrow Strait, and Sir J. Richardson on the Mackenzie River. Even in our country, the disintegration produced during one severe winter on a fresh vertical section of chalk is very striking. A remarkable instance is quoted from Sir R. Murchison's 'Russia,' of a long terrace of angular blocks of limestone broken up and left by the winter-ice 30 feet above the summer level of the Dwina near Archangel.

With all these combined operations, the author still doubts whether, without an uplifting of the land, the effects in question could have been produced; and he shows that the coasts of this part of England and France are fringed here and there by a raised beach, which he correlates with the low-level gravel of Abbeville, whilst the high-level gravel of St. Acheul is correlated with beds occupying on the coast a level higher by 50 to 100 feet, marking the difference of level between the two periods. The effect of this slow elevation would be to increase the velocity and erosive power of the rivers. This action, with the other agencies before alluded to, operating upon the successive portions of the substrata, has gradually worn even those deep and long valleys through which so many of the rivers of these districts flow. According to variability in the rate of elevation, to intervals of repose, or to deflections in the current and velocity of the river, there may exist intermediate levels or terraces of gravel, and variations in the inclination of the slopes, which may add much to the complexity of the problem.

The Fauna of the Low-level Gravel.—Of the forty-three species of Mollusca found in the higher gravels, thirty-four occur also in the low levels, together with seven others, making a total of forty-one species. Added to these, there are eight marine species found at Menchecourt, with the *Cyrena fluminalis* of the Nile and of Grays. With this one exception, they are all common living species of England and France. As with the former group, there is nothing to give a definite clue to the character of the climate of the period. The general absence of southern forms, and the preponderance of such as have a wide northern range, may, however, be noticed. With regard to the Mammalia, the number of determined species is small, and the general argument follows nearly the same line as that relating to the Mammalia of the higher gravels. As with the Mollusca, most of the species are common to the two series, whence it is inferred that there was no great or sudden break, and that the change both of conditions and of climate was transitional. There is one genus only, viz. the *Hippopotamus,* about which some difficulty has been felt with reference to the condition of climate. Four tusk teeth of this creature have been found at St. Roch, and in this country its remains are found associated with those of the Reindeer. Without pretending to explain the difficulty, the author does not see why, if the other large Pachyderms were fitted, as they are now known to have been, by warm covering and special adaptation to inhabit cold climates, this extinct species of Hippopotamus should not also have been so adapted.

The physical phenomena point to an increased volume of water in the rivers, and want those marked indications of ice-action seen in the high-level gravels. Still, boulders of considerable size were transported. From this fact, and the general balance of evidence furnished by the fauna, and also from the contraction of the excavation as the valleys became deeper, the author infers a gradual amelioration in the temperature, ending in the present climatal conditions.

Flint-implements.—The author observes that flint-implements are nowhere so abundant in the low- as they are in the high-level gravels. The pointed lance-shaped form with blunt butts of the latter is almost wanting in the former, whereas the ovoid disks of Menchecourt are rare at St. Acheul; again, flakes or flint-knives are common in the low-level gravels and rare in the higher beds. Of the twenty-four specimens found in the low-level gravel at Paris, twenty-two are mere flint-flakes. The author is disposed to attach some value and significance to this difference of form, and observes that, admitting the climate to have become less severe during the low-level gravel period, it would follow that the necessity of having the strong ice-chisels would have diminished. In all these cases we are of course much limited to conjectures, seeking to make them in accordance with what we know of life under like conditions, and guided by the probabilities of the concurring circumstances. The mode of distribution of the flint-implements at the two periods certainly seems to afford some grounds for believing that the difference of form may arise from difference in the pursuits and occupations of the primitive tribes by whom they were used—pursuits necessarily and primarily influenced by the climate and life of the period.

Concluding Remarks.—The question of time is then entered upon, and it is shown that the flint-implements must be carried back through the periods of the low- and of the high-level gravels, and that they must be considered to be antecedent to the excavation of many of our great river-valleys. All these phenomena indicate periods of long and great changes. The author only slightly touches upon the formation of the *loess*, which he concludes to be the result of temporary floods; and he remarks that, so far as the question of the antiquity of the fluviatile gravels is concerned, little value need be attached to the additional element presented by this covering of loam and brick-earth. This deposit is succeeded by the alluvial beds of the valleys connected more immediately with our own times. With regard to a measure of time, the author does not consider that either the excavation of the valleys or the life evidence of the periods furnish available data; nor does he admit the formation of the channel between England and France in the calculation; and he gives reasons to show that this channel is of older date than generally assumed, and that the separation existed at the time of the high-level gravels, and had attained somewhat of its present dimensions at the time of the newer gravels. Most of the land and freshwater shells and the Mammalia had crossed over at a period anterior to this; and, as even now at the Island of Saghaleen in lat. 52° N., the narrow strait freezing during the winter would admit of the passage of large land animals and man during the cold periods following the more extreme glacial conditions.

The author, however, suggests two new modes by which he conceives that eventually some approximate and more exact estimate may be made both of the age of the high-level gravels and of the lapse of time since the extreme glacial period, and embracing therefore the several periods under consideration. At present the evidence is only sufficient to indicate the possibilities of the problem, but it will need many years of careful observation before sufficient data can be obtained for accurate calculation.

1st. With the high-level gravels there are connected a number of sand and gravel pipes, perforating the underlying chalk to the depths generally of from 5 to 50 feet, and from 1 to 10 feet wide, or more. As these are caused by the slow action of carbonic acid in the water gradually percolating through the overlying porous beds, dissolving the chalk or other calcareous strata, and gradually letting down the superincumbent drift, it is evident that, if the rate of solution and removal can be determined, one element for the calculation of a certain period will be obtained. In this, various meteorological questions will have to be considered.

2nd. In conducting observations on the temperature of deep mines, wells, &c., certain discrepancies in the increment of heat at increasing depths and at different places have been noticed. No explanation of these anomalies has been offered. The author suggests that they may arise from disturbing causes originating with a former period of intense cold. At Yakutsk, where the ground is now frozen to a depth of 382 feet, the permanent line of 53° Fahr. would, taking at an average an increase of 1° for every 60 feet, be found at a depth of 1642 feet. If, from some geological change, the mean temperature of Yakutsk were raised to that of our own climate, this line of 53° would undergo a vertical displacement of 1550 feet. The time required for its uniform re-adjustment over a large area would depend upon various conditions, the chief one being the conductivity of the different strata. The question, therefore, arises, whether traces of perturbation in the temperature of the outer part of the earth's crust in these latitudes, resulting from the action of the extreme cold of the glacial period, may not yet exist, and, if so, whether they may not admit of exact determination with reference to the time elapsed since the removal of the disturbing cause.

In conclusion, the author thinks that in the present state of the inquiry it would be premature to attempt to fix even approximately the lapse of time attaching to the flint-implements. It is obvious, however, that our present chronology with respect to the first appearance of Man must be very greatly extended; but, like a mountain-chain in the distance, its vast magnitude is felt before an exact measurement of its height and size can be taken.

Attention is then directed to the remarkable uninterrupted succession of life from the pleistocene period under review to the present time—a succession so large and important, that it is not possible to imagine the occurrence of any intervening catastrophe of such a nature as to destroy the life of the period over this part of Europe at any recent geological period. There are difficulties in the problem, especially the disappearance of the larger animals; but the remarkable and convincing feature in the case is the transmission to our time of so large a proportion of the small and delicate land and freshwater shells, which even now follow almost precisely the same law in their distribution as they did at these latest geological periods.

Looking at the special nature of the glacial period, and seeing its exceptional character, the author feels strongly impressed with the belief that its effect has possibly been to give increased rigidity and immobility to the flexible crust of the earth, and to produce a state of equilibrium which might otherwise have been of long and slow attainment, whereby it has been rendered fit and suitable for the habitation and pursuits of civilized man*.

ZOOLOGICAL SOCIETY.

February 11, 1862.—Dr. J. E. Gray, V.P., in the Chair.

Description of some New Species of Spoggodes and of a New Allied Genus (Morchellana) in the Collection of the British Museum. By Dr. J. E. Gray, F.R.S., V.P.Z.S., F.L.S., etc.

The genus *Spoggodes* was established by Lesson on a coral that was described by Esper under the name of *Alcyonium floridum*. It is characterized by the whole of its substance being membranous, very loosely cellular within, and covered externally with a layer of fusiform spicula which are most abundant round the cells.

M. Milne-Edwards, in his 'Coralliaires,' only describes a single species.

The species of the genus in the British Museum may be divided into two groups or subgenera.

I. *The polypes crowded together at the end of the branchlet, and the groups more or less surrounded by larger spicula of the branchlet.* Spoggodes.

1. Spoggodes florida.

The coral pale purplish-red (in spirits); stem thick, much branched, strengthened with very slender elongate purple spicules; the branchlets short, clustered at the end of the branches, and forming convex heads or cells; cells fringed with the very slender elongated spicules, and furnished with white, only partially contracted polypes.

Alcyonium floridum, Esper, Pflanz. iii. 49, *Alcy*. t. 16, dry.

Xinia purpurea, Lamk. Hist. A. s. V. ii. 401, from Esper.

Neptea florida, Blainv. Man. Act. 523, from Esper.

Spoggodes celosia, Lesson, Ill. Zool. t. 21; M.-Edwards, Coralliaires, i. 129, t. B 1. f. 1.

Spoggodea celosia, Dana, Zoophytes, 626, t. 59. f. 4.

Hab. Australia; Sharks' Bay (*Mr. Rayner*); Philippine Islands (*H. Cuming, Esq.*).

* In this and his former paper the author has used the term "pleistocene" in the sense of post-pleiocene, including also some beds placed in the newer pleiocene.

2. Spoggodes spinosa.

The coral whitish, forming roundish spinose masses; the stem thick, slightly branched, with very numerous short branchlets; the spicules white, very unequal, some large and thick; the terminal branchlet furnished, on the inner upper edge, with curved (in spirits) partly retracted purple polypes, which are surmounted and protected by the large opake-white spicules of the branchlets.

Hab. New Guinea.

This species is easily distinguished by the large size and opake-white colour of the spicula and the purple colour of the polypes.

II. *The polypes isolated in the prominent isolated spiculose subcylindrical cells, scattered on the sides, or forming tips of the branchlets.* Spoggodia.

3. Spoggodes unicolor. (Woodcut, figs. 1, 2.)

The coral uniform pale yellowish (in spirits); the spicules very slender, whitish yellow; stem erect; branches scattered in all directions, spreading, tapering, with few short tapering branchlets; cells distinct, distant, spreading, subcylindrical, sometimes very slightly contracted at the base; mouth surrounded by five or six unequal prominent spicules, the one on the outer side of the cell being generally the longest; polypes retractile.

Hab. Bellona Reefs, in 17 fathoms (*Rayner*).

4. Spoggodes divaricata. (Woodcut, figs. 3, 4.)

Coral pale whitish (in spirits); stem thick, slightly branched, with very numerous crowded ramuli forming roundish lobes; the ramuli divided at the top into three or five diverging cylindrical cells; the cells of the several branchlets forming a sort of roundish-topped cyme; polypes contracted (in spirits), rose-coloured.

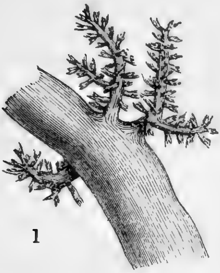
Hab. New Guinea (*Capt. Sir Edward Belcher, R.N., C.B.*).

5. Spoggodes ramulosa. (Woodcut, figs. 5, 6.)

The coral dark brown-red (in spirits); stem thick, much branched, strengthened by slender, elongated-fusiform, dark-brown-red spicules; the branchlets numerous, elongate, slender, much branched, with the cells scattered on their sides; cells distant, subcylindrical, and fringed on the edge with unequally prominent spicules, the outer spicules being generally the longest and most prominent; the polypes pale yellowish, being generally nearly contracted into the cells, rarely prominent.

Hab. Bellona Reefs, at 17 fathoms.

Some of the polypes on the lower part of the branchlets seem to be somewhat crowded. This species is easily known from *S. florida* and *S. unicolor* by the general colour of the coral and by the slenderness and length of the branchlets. It agrees with the former in the coral and spicules being red, and the polypes being more or less prominent and of a different colour from the coral, and with the latter in the form of the cell; but the cells are very differently disposed, and of a slender, attenuated form.



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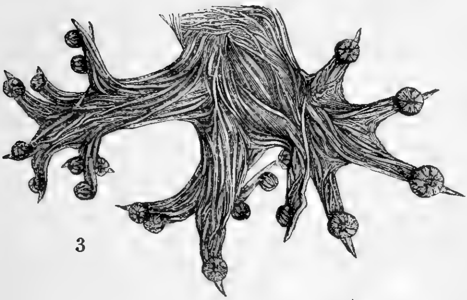

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We have in the British Museum a new form of the "Alcyoniens armés" of M. Milne-Edwards (Coralliaires, vol. i. p. 127), which, in my idea, form a family that may be called *Nepthyadæ.*

This coral differs from the three genera of this family mentioned by Milne-Edwards, in the lower part or stem being coriaceous and destitute of any spicules, and in the upper part being spiculose, and furnished with short clusters of polype-cells, giving it much the appearance of the *Fungi* called *Morchella* and *Helvella*.

MORCHELLANA.

The coral subclavate, coriaceous, subcalcareous, and loosely cellular

within; the stem subcylindrical, elongate, hard, coriaceous, and minutely granular on the surface.

The head formed of numerous, irregularly dispersed, short-lobed prominences, which are covered at the end with diverging conical prominent polype-cells,—the lobes and cells being strengthened with superficial fusiform spicules, slightly covered with the skin of the coral; the polypes entirely retractile.

The whole substance of the coral is loosely cellular, and the lobes of the head are brittle and easily broken off when in spirits. The base of the stem is furnished with some large tubular fibres, which seem to act as roots to attach it to rocks.

The spicules on the edge of the polype-cells are rugulose or spinulose.

MORCHELLANA SPINULOSA. (Woodcut, p. 72.)

Hab. Indian Ocean.

NOTES ON SOME SPECIMENS OF CLAVIFORM PENNATULIDÆ (VERETILLEÆ) IN THE COLLECTION OF THE BRITISH MUSEUM. By DR. JOHN EDWARD GRAY, F.R.S., V.P.Z.S., F.L.S., &c.

Since my paper, entitled "Revision of the Family *Pennatulidæ*, with description of some New Species in the British Museum," was printed in the 'Annals and Magazine of Natural History' for January 1860, we have received several specimens of club-shaped Sea-Pens (*Veretilleæ*) which further illustrate the species of this group.

Professor Milne-Edwards, in the first volume of his 'Coralliaires,' published in 1857, divides the Claviform *Pennatulæ* into three genera, thus—

1. LITUARIA, with a distinct, well-developed, quadrangular central stony axis.

2. VERETILLUM, with a rudimentary hard central axis.

3. CAVERNULARIA, without any hard central axis, but with four large longitudinal central cells.

Dr. Herklots, in his "Monograph of the *Pennatulidæ*," in the 'Bijdragen tot die Dierkunde' for 1858, divides them into four genera, adding the genus *Sarcobelemnon* to the above list. The species of *Lituaria* and *Sarcobelemnon* are found in the Indian and Australian Oceans, and those of *Veretillum* and *Cavernularia* are confined to the Mediterranean.

The *Veretilleæ* in the British Museum appear to belong to only two genera, viz.—

1. VERETILLUM. The club with a short thick base, with four more or less large longitudinal cells in the centre.

2. LITUARIA. The club with an elongated base, and with a strong, subquadrangular, central, more or less stony axis.

The former group seems to be synonymous with the genera *Vere-*

tillum and *Cavernularia* of Milne-Edwards and *Sarcobelemnon* of Herklots. I call the first genus by the name *Veretillum*, because I find that the specimen of *Pennatula Cynomorium* which we have in the British Museum does not appear to have any rudiment of an axis, and has the four large longitudinal cavities in the centre of the coral which are described as characteristic of *Cavernularia* and *Sarcobelemnon*. Can the septa between these cells have been considered as the rudimentary axis?

Veretillum.

The pen club-shaped, with a short, thick, fleshy base; the upper part of the club short and thick, or more or less tapering, covered with close longitudinal rows of polypes; the interspaces between the polypes marked with very close, opake, imbedded granules; the opening of the polype-cells, when contracted, transverse; the middle of the coral furnished with four quadrangular tubes, and without any hard central axis.

1. Veretillum Cynomorium.

Veretillum Cynomorium, Pallas, Spic. Zool. t. 13. f. 1–4.

We have a single specimen of this species in the British Museum, which I believe is the specimen described by Ellis, on the Sea-Pens, as *Cynomorium* (Phil. Trans. 1765, vol. liii. 434, t. 13. f. 3); for it has the label on it, written by my late uncle who died in 1806, like the label on the specimen of *Siren* which was presented by Ellis. It certainly has no appearance of any hard central axis, unless the rather hard septa between the central cells may be considered as an axis; if they are, then the same kind of axis is found in each of the other species which I have referred to this genus.

2. Veretillum Australasiæ.

Sarcobelemnon Australasiæ, Gray, Ann. and Mag. N. H. 1860, v. 24, t. 4. f. 1.

The polypes far apart.

Hab. Australia; Port Essington (*J. B. Jukes, Esq.*).

This specimen chiefly differs from the *V. Cantoriæ* in the substance of the coral being harder, and in the cells of the polypes being further apart and more scattered, not appearing to be placed in such regular and close longitudinal rows. The specimen seems to have been placed in very strong spirits when first collected, as almost all the polypes are retracted, and the base of the club is wrinkled, as if strongly contracted, and the cavities in the axis are smaller; but all this may have been produced by the sudden and great contraction of the animal at the time it was preserved.

3. Veretillum Cantoriæ.

Cells of polypes close together, in regular longitudinal series.

Hab. Penang (*Dr. Cantor*).

We have a large series of specimens of this species from Penang, where, I am told, they are collected for food. They differ exceedingly from each other; and if they are all of the same species, as I suspect is the case, it shows how difficult it is to give a character that shall define the species of the genus. Some are short, thick, oblong, rounded at each end, varying from $2\frac{1}{2}$ to 3 inches long, with a short thick base to the club of about half an inch long. In most of the specimens of this form, the polypes are retracted; but in one, some of them are expanded.

In the second group the club is much larger, varying from 3 to 7 or 8 inches long, and is attenuated upwards. The base of the club is short and thick, as in the former group of specimens. The polypes are generally expanded; they are much more slender and more elongate than the polypes of *Lituaria australis*.

Probably the length and tapering form of these specimens may be dependent on their having been placed originally in weaker spirits. The size of the cavities or tubes in the specimens also differ; they are largest in the short broad specimens, but very distinct in all. I am therefore inclined to believe that there are only two distinct genera of the Claviform Sea-Pens.

Lituaria.

The pen elongate, the upper part slender, tapering, with close longitudinal rows of polypes; the interspace between the polypes covered with close longitudinal rows of distinct circular pores; the opening of the polype-cells, when contracted, longitudinal; the lower part elongate, subcylindrical, smooth; the axis hard, stony, distinct, well developed, quadrangular.

The lower part of the coral, which is destitute of polypes, is elongate, often one-third and rarely nearly half as long as the upper polype-bearing portion of the club; the length of the stem, as compared with the club, appears to differ, within certain limits, in different specimens of the same species from the same locality, but it is always larger and more slender than the same part in the genus *Veretillum*.

The specimens of this genus in the British Museum appear to separate themselves into two very distinct groups, which may represent so many species, or may only depend on the manner in which the specimens have been preserved, or even on the strength of the spirit in which they were at first immersed.

In four specimens from Penang, collected by Dr. Cantor, which are slender and white, all the polypes are entirely contracted, leaving a compressed slit over the cell, except in one of the small specimens, in which a few of the polypes are partly exserted; they are pale brown. In one of the specimens the fleshy part of the base is thickened, and has contracted so much that the hard axis is exserted nearly an inch beyond the base. In this specimen the base of the club is much shorter and thicker than in the others. From this specimen I am led to believe that the length and slenderness of the club in the genus, when in spirit, is preserved by the rigidity of the internal axis. These specimens are probably the *Lituaria phalloïdes* of Milne-

Edwards (Coralliaires, vol. i. 217), founded on the *Pennatula phalloïdes* of Pallas (Misc. Zool. t. 13. f. 5, 6, 7, 8).

The second group of specimens were collected by Mr. Rayner in Sharks' Bay, Australia. They are three in number; they are softer and less contracted than the preceding; the pores on the surface are more distinct, and are furnished with more or less dark polypes, which are all expanded. The polypes in one specimen (which is in the most perfect condition) are all entirely of uniform black-brown colour. In one of the other specimens (also in good condition) the polypes are pale brown, with a broad black lower ring at the upper part of the tubular body, near the base of the arms. In the other specimen (which is imperfect) the polypes are all pale brown, like the coral.

In all the three specimens the polypes at the lower half of the club are further apart than they are at the tip; this is especially the case in the specimen which has the dark ring on the polypes, in which the polypes in the lower part of the club are very far apart and few in number, and appear as if placed in longitudinal lines. I should propose to call this species provisionally *Lituaria australis*.

MISCELLANEOUS.

On the Animal of Zonites excavatus, *&c.*

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

GENTLEMEN,—In the first volume of my work on 'British Conchology,' which contains an account of the Land and Freshwater Mollusca, *Zonites excavatus* is one of the very few species of which I could only give a meagre and unsatisfactory description of the animal. I am now fortunately enabled to supply this deficiency, having last week found and observed live specimens of the species in question near Tunbridge Wells; and this new locality will also be interesting to those who study the distribution of the British Mollusca.

Body slender, greyish white, with three or four raised lines along the neck: *mantle* closely covered with milk-white specks: *tentacles* diverging; upper pair rather long and cylindrical, coarsely granulated; lower pair short: *foot* thick, obtusely rounded in front, and gradually narrowing behind to an angular or keeled point. The slime is rather copious and iridescent.

In the same spot were *Zonites alliarius, Z. nitidulus, Z. purus, Z. radiatulus, Z. fulvus,* and *Helix rotundata.*

The pulsations of *Z. alliarius* varied within the space of ten minutes, having from 48 to 56 beats per minute.

I am, Gentlemen,
Yours faithfully,
J. GWYN JEFFREYS.

25 Devonshire Place, Portland Place,
June 4, 1862.

On the Occurrence of Gyrodactylus elegans *in Shropshire.*

To the Editors of the Annals of Natural History.

Gentlemen,—I have to record another locality for the occurrence of this singular and highly interesting parasite, which, though first discovered by Nordmann, some years ago, has only recently (January 1860) been known to occur in this country, having been found on Sticklebacks in the Hampstead ponds by Mr. Bradley (Journal of the Proceedings of the Linnean Society, 1860, vol. v. p. 209). Dr. Spencer Cobbold has also recorded the occurrence of *Gyrodactylus* in great numbers in the Serpentine. With these two exceptions, I am not aware of any other recorded localities for the *Gyrodactylus*.

I first observed this parasite in May last, on the pectoral fins and the tail of some young Sticklebacks (*Gasterosteus leiurus*), which I had hatched from a nest of ova brought home from a ditch on the Eyton moors. On close examination of the father-fish, I discovered that he was literally covered all over the surface of the body with *Gyrodactyli*; there must have been two or three hundred of these creatures infesting him. I found, on the death of the fish, that his gills were likewise full of them. I subsequently examined freshly captured specimens from another ditch which abounded with *Gasterosteus leiurus* and contained also a few specimens of the much more uncommon *G. pungitius*, and found *Gyrodactyli* on most of them, only in moderate numbers.

When once the eye has become acquainted with these minute parasites on the fin of a fish, their detection by means of a lens is an easy matter. All the specimens I examined were of the same species. I suspect that careful observation will determine the *Gyrodactyli* to be not uncommon parasites upon various freshwater fish.

I remain yours truly,
W. Houghton.

Preston Rectory, Wellington, Shropshire,
June 6, 1862.

Experiments on the Migrations of the Entozoa. By MM. Pouchet and Verrier.

One of the authors, in a work published in 1859, gave a careful *exposé* of the doctrines of the naturalists who have studied the metamorphoses of the Entozoa and their peregrinations, in Germany and Belgium. The result of such an investigation, they say, is to raise great doubts upon these points; and they quote the opinion of M. Davaine, "that the question still waits for a sound criticism and fresh investigations."

A naturalist asserts that he has succeeded nine different times in producing Tapeworms in the intestines of the Dog, by administering *Cœnuri*. The authors have had as much success as this experimentalist; indeed, their success has been too great, for they sometimes obtained more than they had sown.

After briefly describing the supposed relation between the *Cœnurus cerebralis* of the Sheep and the *Tænia serrata* of the Dog, and the cycle of development by which this is considered to be set up, the authors proceed to discuss the difficulties in the way of these views.

Cœnurus cerebralis, according to Siebold, Van Beneden, and others, is the larva of *Tænia serrata*. On the contrary, this *Tænia serrata* is produced by *Cysticercus pisiformis*, according to Küchenmeister, Van Beneden, Baillet, and Siebold himself, or by *Cysticercus cellulosæ* and *C. tenuicollis*, according to other statements of Siebold. This produces a great embarrassment.

Referring to the general view that the *Tæniæ* found in the intestines of the Carnivora are due to Cystic worms inhabiting their prey, the authors inquire how the Sheep, which never devours animal food, sometimes has its intestines so filled with *Tæniæ* as to be absolutely obstructed. This was the case in an epidemic occurring in 1852 amongst the sheep in the environs of Rouen.

Amongst the causes tending to produce uncertainty in the results of experiments are the natural frequency of the animals which are said to be communicated, and the practice of some experimentalists of administering worms at several times: the unsuccessful experiments also should be noted; but of these frequently no account has been taken.

With the view of rendering their experiments exact, the authors counted the number of heads or *Scoleces* administered each time, and always ascertained that they were completely developed and alive.

In a dog which had swallowed *Cœnuri* sixteen days before, the authors found *Tæniæ* of only 2 millimetres in length, whilst others measured 20 millimetres. In the same time an experimentalist obtained *Tæniæ* which had reached a length of 80 millimetres. In another case, when the experiment had lasted twenty-three days, they found in the same dog *Tæniæ* of 4 millimetres in length, and others which had reached the length of 60 centimetres. It is impossible that the scoleces implanted on the same vesicle, and all of the same age, should have produced *Tæniæ* presenting such a difference of size as this; but the authors remark that, had they adopted the plan of administering the worms several times, such an experiment would have appeared a positive demonstration.

They administered to a dog sixty scoleces of *Cœnurus*; in eleven days its intestine contained thirty-six *Tæniæ*. In another case, sixty scoleces were given, and in eleven days fifty-one *Tæniæ* were found. But in a third case, in which the dog also received sixty scoleces, seventy-eight *Tæniæ* were discovered in its intestine at the end of sixteen days. Another case gave results calculated to raise still greater doubts. One hundred scoleces of *Cœnurus* were given to a young dog taken from its mother and carefully isolated. Twenty days afterwards its intestine contained 237 *Tæniæ*, the size of which varied from 4 to 60 millimetres. Other experiments afforded absolutely negative results.

The authors also made experiments as to the production of the *Cœnurus* in the Sheep by the administration of proglottides of *Tænia serrata*. To each of two young sheep they administered ten segments of *Tænia serrata*, all containing a number of perfectly mature eggs, in which the embryo, furnished with its hooks, could be distinguished. These sheep never presented any of the phenomena of staggers, which are stated to occur from the fifteenth to the twentieth day after administration. Not to be in too great a hurry, they were kept for four months. Then, although they appeared perfectly healthy, they were killed in order to allow the examination of the brains: no trace of *Cœnurus* could be detected. From this, and considering the doubts arising when the assertions of experimentalists are attentively examined, the authors do not hesitate to affirm that the progeny of the *Tænia* of the Dog never arrives at the brain of the Sheep.

Whilst denying the necessary transmission of the Entozoa as described by most modern zoologists, the authors recur to the old notion that the Cystic worms are produced from germs of *Tæniæ* which have found their way into places not fitted for them.—*Comptes Rendus*, May 5, 1862, p. 958.

On the Early Stages of Microdon mutabilis. By M. Elditt.

An enigmatical animal, which appears to be a Mollusk, and yet, on closer examination, exhibits many characters foreign to the Mollusca, and presents few points for comparison with other animals, was known to some of the older zoologists, such as Aldrovandus, but was first described and figured by Von Heyden in 1823. At p. 1247 of the 'Isis' for that year is Von Heyden's memoir "Ueber ein sonderbar gestaltetes Thierchen," which he found in 1818 at a considerable elevation on the Hoche Mountain, under the moist bark of an oak-stump standing near water. Only one example could be found. Von Heyden thought that it was not a larva, but rather a Mollusk which would prove a new and very remarkable genus. In the following year Spix described, before the Academy of Sciences in Munich, a new genus of terrestrial Mollusca to which he gave the name of *Scutelligera Amerlandia*, because he found it at Amerland, on the Stahrenberg Lake, in the interior of old rotten oak- and pine-stumps still rooted in the ground, always in company with the Hercules and Red Ants ('Hesperus,' No. 295). In 1825, Von Heyden called attention, in the 'Isis,' to the great resemblance between the animals described by Spix and himself, but expresses his opinion that their characters are those of two nearly allied but distinct genera. For his animal he proposes the name of *Parmula cocciformis*. In 1832, Schlotthauber discovered the animal described by Spix in the neighbourhood of Göttingen, and, following its development, found it to be the larva of *Microdon mutabilis*. In 1839 he communicated to the Meeting of Naturalists in Pyrmont a full description of the metamorphoses of this species, which he proposed publishing; but it seems never to have been printed.

The author, in 1844, met with bodies resembling coffee-beans, with a reticulated surface, on the inside of the bark of oak-stumps in the Neuhauser Forest, from which he obtained specimens of *Microdon mutabilis*. He afterwards found single pupæ in similar stumps inhabited by ants, and finally, also a larva, which, however, soon died. M. Sauter has also met with these larvæ; and Dr. Hensche, whilst residing at Kreuth, found amongst earth-dwelling ants three Mollusk-like animals, which he preserved in spirits, and which turned out to be larvæ of *Microdon*.

As the *Microdon mutabilis* is a British species, it might interest some of our entomologists to look out for the singular larva here referred to, as the nature of its metamorphosis, and especially its relation to the ants with which it seems to be always associated, appear to be by no means cleared up.—*Schriften der Königl. phys.-ökon. Gesellschaft zu Königsberg*, 1862, *Sitzungsberichte*, p. 9.

On a New Species of Bird of the Genus Lipaugus *of Boié.* By P. L. Sclater, M.A., Ph.D., F.R.S.

Lipaugus subalaris.

Viridescenti-olivaceus, dorso imo, ventre et cauda cinerascentioribus, cauda fere tota cinerea; crisso albicante; pilei semicristati plumis interne nigris: gutturis et pectoris plumarum scapis conspicue flavicanti-albis: plumis axillaribus et subalaribus læte citrino-flavis: alis fusco-nigricantibus, extus dorso concoloribus: rostro et pedibus nigris.

Hab. In rep. Æquatoriana, ad ripas fl. Napo.

This *Lipaugus* will be easily recognized by the beautiful bright yellow colour of the axillaries and under wing-coverts and the slightly crested head, the feathers of which are black underneath. In structure it appears to be a member of the group *Aulia*: the outer and middle toes being completely united to the end of the second phalange, and the form otherwise resembling that of *Lipaugus hypopyrrhus*. The single example in the collection of the British Museum, acquired in 1857, is labelled "Rio Napo."—*Proc. Zool. Soc.* May 28, 1861.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 56. AUGUST 1862.

VIII.—*On the Age of the New South Wales Coal-Fields.* By the Rev. W. B. Clarke, M.A., F.G.S. &c.

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

Gentlemen,

In the February Number of the 'Annals' (No. 50) you have printed a communication from Professor M'Coy of Melbourne, in which, under the head of the "Upper Palæozoic" and "Mesozoic" Periods, he introduces some remarks reflecting upon the differences of opinion existing between himself and me respecting the position of the Coal-beds of New South Wales, and marking by *italics,* not only in the text, but in the notes, certain expressions which appear to me as unjust to himself as they are also to me.

When the paper, from which the portion is republished, first came out, I replied in the postcript of a "Review of Recent Geological Discoveries in Australasia" (a copy of which I herewith forward to you), read before the Philosophical Society of New South Wales in November 1861, to the italicized passages in Professor M'Coy's essay of which I complained; and in the body of my paper I made reference to the state of the question as to the evidence obtained. You will, probably, be willing to do me the justice of allowing the readers of Mr. M'Coy's remarks to know what may be said on the other side. But I hope you will also allow me to add in this communication a brief reply to the notes in pp. 142, 143, 144, which I had not seen till I read them in your Journal.

The existence of the differences of opinion between Mr. M'Coy and some geologists at home, as well as here, is too well known to make necessary any further recapitulation of them than may be found in my publication above mentioned.

Mr. M'Coy, in 1847, maintained that our New South Wales coal was "*Oolitic*," and as recently as August 18, 1857, he stated before the Select Committee of the Melbourne Parliament that the coal in Victoria, which he considers the same as that in New South Wales, is "*really to be compared to those thin Oolitic coal-fields on the Yorkshire coast.*" There can be no mistake as to this being the position he assigned to our Coal-beds *less than five years ago.*

To this I was all along opposed; and, from circumstances in the experience of numerous other geologists (among them Jukes, Stutchbury, Dana, &c.), as well as my own, in common with them, I held the opinion, right or wrong, that our New South Wales coal is not "oolitic," but very much older, lying as it does over an enormous area in immediate juxtaposition with and succession to beds which Mr. M'Coy and other geologists in England have regarded as "Palæozoic" and *Lower* Carboniferous.

All Mr. M'Coy's knowledge of the fossiliferous evidence on this question, previously to his arrival in Victoria, was derived from the examination of collections I had sent to England. Since his arrival, his attention has been directed to the palæontological evidence collected in Victoria; but he has never yet set foot on the New South Wales territory, and consequently knows nothing whatever, by observation, of the position of the Coal-beds of this colony. I admit, nevertheless, it is *possible* he may be right in his views, and that all observers in New South Wales have been wrong. But when he quotes, in his note at p. 142, evidence from Victoria, and puts in italics the assertion that "*no such sectional evidence has been found by Mr. Selwyn, the Government Geologist* [of Victoria], *in his careful surveys of the coal-bearing sections of Victoria and Tasmania,*" it must be borne in mind that this assertion is without any weight as concerns Victoria, because Mr. Selwyn himself has stated in print, in the same 'Catalogue of the Victorian Exhibition, 1861," in which Mr. M'Coy's original paper appears, that "the *only fossils* that have been found" in the Upper Palæozoic rocks of Victoria are a *Cyclopteris* and *Lepidodendron*, and even the position of these is assigned as "*only provisional;*" "they may," he says, "be Lower Mesozoic." How, then, can "sectional evidence" from Victoria be used in argument, seeing that there no *zoological* fossils to compare with those of New South Wales? As to Tasmania, Mr. Gould agrees with me rather than with Mr. Selwyn.

I have published a list of beds at Stony Creek, near Maitland, in which the Palæozoic fossils are found over and below and around a set of coal-beds having the same general dip and disarrangements as the supposed older beds; and in the Coal-beds occur the plants which Mr. M'Coy, up to 1857, considered the equivalents of those in the cliffs near Scarborough. In Mr. M'Coy's note he rejects this list, because a section of the neighbourhood for twelve miles or more had been exhibited to show the *position* of the Coal-beds, and this was not drawn on equal scales, and because a fault occurs at Bed No. 5, as any one could see from the fact of the dip mentioned at the head of the list. But this fault, which cuts through all the beds alike, could not put younger beds under older.

Mr. M'Coy thinks I have relied solely on this section; but there are many other localities in New South Wales which speak as mysteriously as Stony Creek, though no particular notice of them has been as yet taken in discussions. There does not appear to me anything more anomalous in finding an intercalation or a colony of so-called Jurassic plants in so-called Lower Carboniferous beds, than in finding the Carboniferous fauna amidst the Belemnite-beds of Savoie. But I am quite ready to give up Stony Creek on sufficient proof that its evidence is not trustworthy.

A kind of charge against my *honesty* is alleged in the note at p. 143. This demands an explanation. In 1849 I requested the late Admiral P. P. King to take with him to England some additional New South Wales fossils. Among them was a supposed *Lepidodendron*, found by my late friend Leichhardt about seventy-five miles from the coal-beds of Mount Wingan, and only a short distance from another locality where the supposed Jurassic fauna exists. Mr. M'Coy rejected this, not solely because it did not come from the *Glossopteris*-beds, but (though he says nothing about it in his paper) because, as I did not find it myself, it was not admissible in evidence, and because it was probably a European specimen, being like *L. tetragonum* of the English coal-fields! It is clear, therefore, that, in 1849, Prof. M'Coy did not believe in the existence of any Upper Palæozoic plants in New South Wales.

Since that time, Mr. Stutchbury and myself collected such *Lepidodendra* abundantly, as may be seen by reference to our Geological Reports. One was figured by Mr. Stutchbury in 1853. In 1835, Sir T. L. Mitchell discovered one. In 1852 I found, in the same beds at Goonoogoonoo with the *Lepidodendron*, a *Knorria* and a *Syringodendron*, which Mr. M'Coy himself saw and recognized at Melbourne in 1860; and in 1855 I exhibited at Paris a *Sigillaria*, not formed from "*misconceptions of portions of ordinary Mesozoic forms*," as is hinted in the note at p. 143, but acknowledged to be genuine articles of the New South Wales flora, though certainly the late Professor E. Forbes doubted the Leichhardt specimen to be a *Lepidodendron* *; and

* Lectures on Gold, Lect. 2. p. 53.

since that, Mr. Salter has pointed out to me, in a letter, that there are essential differences between this plant and ordinary forms.

Whether, therefore, we are all right or all wrong, the sonorous periods in which Professor M'Coy introduces his Gipps Land *Lepidodendron* as the mate of the "only characteristic Palæozoic Carboniferous genus," and "of the same species as the *only Palæozoic coal-plant* ever collected in New South Wales," "found by the lamented Leichhardt near the borders of Queensland," *hundreds of miles from the beds containing the* (*as I believe*) *Mesozoic plants,* weigh but little with those who know (as Mr. M'Coy himself must know) that the actual position of the *Lepidodendra*-beds is as much in the dark as the antiquity of the *Glossopteris*-beds.

These beds are not actually identical. *And I have never said they were**; but I have held the opinion that they are both parts of a descending Carboniferous formation; and I know, from actual observation, that if the *Glossopteris*-beds lie immediately over the Lower Carboniferous fauna in the Illawarra and on the Hunter, so the *Lepidodendron*- and *Syringodendron*-beds lie over the Palæozoic Carboniferous fauna of the Peel River, for which Mr. Odernheimer's memoir in the 'Quarterly Journal of the Geol. Soc.' may be taken in evidence without consulting my own Reports. At this moment, Mr. M'Coy does not *know* with any precision what stratigraphical relationship exists between the beds with *Lepidodendra* and those with *Glossopteris*; nor does he *know*, from observation or geological sections, how far they are apart. A *Lepidodendron* has been reported to me from the *Glossopteris*-beds of Newcastle by the inspector of coal-fields; and from the same locality *a Palæozoic fish,* named by Agassiz and figured by Dana, was taken in a bed of shale filled with all the distinguishing plants of Professor M'Coy's *Oolitic* flora.

The discovery of a Secondary formation in Queensland during

* I have already affirmed the contrary. Neither in the list I gave of supposed genera in 1847, and of which some are held not to be verified, nor in the subsequent remarks upon it, is there any statement to show that they all came from the *same* beds. On the contrary, the localities mentioned are numerous and ranging over a very extensive area. It would be uncandid in the highest degree not to admit that there may have been *misconceptions* of genera in that list, made at a time when no reference could be had to collections for comparison. But *Lepidodendra* are mentioned from localities where they have since been verified. The "*Ulodendron* from Pine Ridge, Wellington," also agrees in geological position with *Lepidodendra* from numerous other localities. There are but *five* members out of the *twenty* that can justly be excluded. It must also be remembered that at that time I was single-handed, without a fellow-worker, and with no acknowledged palæontologist to appeal to. Moreover, greater mistakes than any alluded to have been made by *palæontologists of eminence.*

the present year, under my auspices, and by a friend of mine, the particulars of which I have given in p. 27, 'Recent Geological Discoveries,' &c., has not helped us out of our dilemma. Mr. M'Coy sees in it a total overthrow of my positions, and states that the Wollumbilla fossils "*are the marine equivalents of exactly the same age as that he assigns to the plant-beds,* i. e. Lower Mesozoic, not older than the base of the Trias, and not younger than the lower part of the great Oolite."

In these fossils the Professor detected "numerous *Lower Oolite, Liassic,* and *Triassic* forms, and among them a distinct species of the *Muschelkalk* genus *Myophoria,* &c." Now, if they are "the marine equivalents of exactly the same age" as the Scarborough Oolites, which was Mr. M'Coy's plant-horizon in 1857, how came the Liassic and Triassic, and especially the Muschelkalk species there? This apparent paradox is adroitly veiled under the word *Mesozoic,* which word has gradually crept into the discussion, and took precedence in 1860. "Mesozoic" everywhere supplants "Oolitic" in Professor M'Coy's present essay, and he speaks of his having held the same views respecting the "Mesozoic" plants in contradistinction to the Palæozoic fauna *fourteen years* ago, though, ten years after, he maintained the supremacy of the "*Yorkshire Oolite.*"

It is, notwithstanding this convenient merging of the Scarborough horizon in Mesozoic indistinctness, perfectly clear that if I have adopted "a new view" (p. 144, *note*), so has Professor M'Coy; and as he is happy in knowing that I have done so, I am equally happy at finding that he is getting below the Oolite into a region where, perhaps, our views will meet after all.

Judging from my own examinations, and from the admission of Mr. Selwyn, I do not believe there is at present any evidence on which can be founded a thorough comparison in Victoria with facts patent in New South Wales.

In chap. xiv. of my 'Researches in the Southern Gold Fields of New South Wales,' I have stated as distinctly as I could the natural divisions in the series comprising the beds *above, with,* and *below* the coal-seams of that colony; and in the 'Quarterly Journal of the Geol. Soc.' vol. xvii. p. 358, &c., I have repeated that arrangement, specifying *only* the plants determined by M'Coy, Morris, and Dana in each division.

Now, according to my view, the Victoria Coal-beds belong to the upper and perhaps second division of the New South Wales series. In Gipps Land I know, from my own researches, that there do exist limestone-beds with fossils of Palæozoic age, *probably upper*; and it is in another part of that large region that Mr. M'Coy's *Lepidodendron* was found! But under the Victoria Coal-beds no such deposits have been found by the geologists of that colony as occur in New South Wales, in the Illawarra, or about Maitland on the Hunter River. And from what I personally know, I believe the Gipps Land Upper Palæozoic Fauna is lower in the series than the beds just alluded to. Mr. Dana considered those Hunter-River beds to be either Carboniferous or Permian. If so, the beds above, including the coal-seam, may range from Permian to Triassic, or even higher. That is what I am willing now to admit, and, further, that it is *possible* the Wollumbilla rocks may be the equivalents of the Wianamatta, or upper, division of the New South Wales Carboniferous series.

But this at present is a matter of conjecture. Acknowledging the value of that discovery, and rejoicing to have been able to assist in it, I repeat that, at the present time, we do not know whether it bears or not on the actual subject of the controversy.

No palæontologist has yet compared the Queensland Carboniferous flora with that of New South Wales or Victoria; and we have yet to learn the accuracy of the information which I have collected and am now collecting by the aid of observers on the Maranoa and Fitzroy Downs, all of which, however, tends to show that the Wollumbilla "Lower Mesozoic fossils" come from a higher horizon than the *Urosthenes-* and *Glossopteris*-beds of Mulubimba.

Professor M'Coy states that I requested him to "determine the geological epoch to which the Wollumbilla fossils belong." I have never, in the recent controversy respecting the Coal-fields, done otherwise than request his determinations of fossils, thinking it due to him to lay all fresh information before him, and being willing to defer in *palæontological* questions to his judgment. But I retain to myself the right of forming an opinion as to the structure of a country with which I am familiar, and which he has never seen.

It is under this consideration that I now demur to the admission of inferences from the palæontology of distinct and widely separated districts without regard to the order or succession of deposits.

In conclusion, I think that I do not act otherwise than consistently in considering the question still an open question; and though much has been done to reconcile apparent differences, much more remains to be done before any dogmatic opinions ought to be proclaimed.

I have the honour to be, Gentlemen,

Your obedient servant,

W. B. Clarke.

St. Leonard's, New South Wales,
April 26, 1862.

IX.—*On* Entoniscus Porcellanæ, *a new Parasitic Isopod Crustacean.* By Dr. Fritz Müller, of Desterro*.

[Plate II. figs. 8–16.]

The genus *Bopyrus* has hitherto passed as the extreme member of the series of Isopod Crustacea, stunted in development by a parasitic existence. Much further removed from the mode of life and structure of the free Isopods, and from its own youthful form, is a parasite of the same *Porcellana* round the intestine of which *Lernæodiscus* twines its roots, and in the branchial cavity of which, it may be remarked, in passing, a *Bopyrus* not unfrequently takes up its abode.

The female of this parasite lies in a thin-walled sac between the liver, intestine, and heart of the host; its head has lost both eyes and antennæ, and taken the stomach up into itself; the thorax has become an irregular inarticulate sac beset with enormous brood-laminæ; the long, vermiform, and extremely mobile abdomen has sword-shaped legs; and, swelling out above it in a globular form, as if in a hernial sac, the heart lies at the base of its first segment!

As the first-known internally parasitic Isopod, I have given the animal the name of *Entoniscus Porcellanæ*.

The female (Pl. II. fig. 8) attains a length of from 10 to 15 millimetres. The head forms a whitish, soft, roundish mass, about 1 millim. in length and 1·5 millim. broad. Above, it is divided somewhat like a brain, by a shallow longitudinal furrow, into two convex halves, between which a short rounded lobe springs before and behind. A little before the middle of the rather flat under surface, the mouth is seen, in the form of a minute longitudinal fissure; and around this are various lines, probably indications of oral organs which were more distinct at an earlier period. The resemblance of the head to a brain is further heightened by irregular furrows which pass through it, giving it the appearance of convolutions. If the outer skin be torn to pieces, these are found to be due to numerous conical cæca, to the fatty contents of which the head is indebted for its white colour, and which may correspond with the cæca described as the liver on the anterior part of the intestine of *Bopyrus*. Antennæ and eyes are not to be found in mature females; in a younger specimen I once saw a pair of short thick processes above the single lower lobe, which were probably remains of antennæ.

Bending upwards, the head forms an obtuse angle with the thorax, and is capable only of an inconsiderable vertical movement. The long, sacciform, inarticulate thorax appears to be quite shape-

* Translated from Wiegmann's Archiv, 1862, by W. S. Dallas, F.L.S.

less; it is almost entirely filled by the liver and ovaries, which immediately strike the eye by their vivid coloration, the former being of a splendid deep orange-colour, and the latter reddish violet. The liver consists of two tubes, about 0·2 to 0·3 millim. in width, placed close together on the ventral surface, which commence cæcally at the posterior extremity of the thorax, and extend to the head. The ovaries occupy the back, upon which they project in irregular eminences, leaving anteriorly as much free space as the liver does behind. Feet I have generally entirely missed finding, even in young females, which, from their less-developed brood-plates, are more easily examined for them. Sometimes, however, and, indeed, not in very young specimens, I found one or two, in the form of short, pointed, conical points, curved backwards and beset with small scattered bristles. The brood-plates, on the other hand, are developed into enormous, much-folded, lobate and slit membranous lobes. When I could count them distinctly (for frequently they appear as a single, large, almost inextricable laminar frill), I found six pairs! They are permeated by narrow arborescent ducts, into which the biliary secretion from the ruptured liver may sometimes be driven by the pressure of the glass cover, and contain extremely numerous, densely aggregated, fatty globules.

If we are astonished, even in *Bopyrus*, at the quantity of eggs which accumulates under its broad shield-like thorax, this is still more surprising in *Entoniscus*: the eggs form irregularly aggregated masses, often equal in width to the length of the thorax, which they sometimes far exceed both before and behind, so that not unfrequently the whole body is completely concealed in them. And whilst *Bopyrus*, like other Isopods, allows each brood to become perfectly developed and to escape before laying new eggs, *Entoniscus* accumulates a whole series of consecutive broods about it simultaneously; so that the material for the whole developmental history might be obtained from the brood-leaves of the same animal.

The thorax is followed by a much thinner and extremely mobile six-jointed abdomen, of very variable length, sometimes much shorter than, sometimes more than half as long again as, the thorax. These differences in its length arise chiefly from the first two segments, which are produced into long cylinders. In an animal 14 millim. in length, I find the length of the first abdominal segment 2·3; of the second, 2; of the third, 1·2; of the fourth, 0·32; of the fifth, 0·25; and of the sixth, 0·38 millim. The thickness of the first segment was 0·25, and that of the last 0·2 millim. The first five segments each bear a pair of inarticulate, sword-shaped feet, without any bristles, near their posterior extremity; those of the third pair are the longest, and reach to the extremity of the penultimate segment. The feet can not only be raised and depressed, but also extended laterally. The last segment of the abdomen is truncated at the apex above, and has on its lower surface a V-shaped notch reaching to its middle. On the ventral surface of the first and second abdominal segments, and less developed on that of the third, there is on each side a very prominent contractile fold of skin; its strongly undulated margin contains a vessel-like cavity, which is continued into the margin of the corresponding foot.

At the base of the first abdominal segment its dorsal surface bears a hernioid diverticulum, of about 0·5 mill. in length and the same in height; in this is the heart, which pulsates rather sluggishly.

Although in the structure of the female the cæca at the commencement of the alimentary canal, the two hepatic tubes, and the heart situated at the base of the abdomen scarcely remind one of *Bopyrus*, the affinity to that Isopod shows itself unmistakeably in the males (Pl. II. fig. 9), which, as in *Bopyrus*, are the almost constant companions of the female, but are much more diminutive, and therefore may easily be overlooked amongst the immense masses of the eggs. In general there is only one of them; in a single instance I saw two walking about upon the body of the same female.

The male is about 0·8 millim. in length, or scarcely 3–4 times the length of the newly hatched young; in the middle of the thorax the breadth attains nearly $\frac{1}{3}$ of the length; and from this point the body diminishes slightly in front, and greatly behind. The thorax is distinctly separated into seven, and the abdomen into six segments; but the boundary between the head and the first thoracic segment is indicated only by a deep lateral constriction. The head is trapezoid in form, with rounded angles; its height is about equal to the shorter of the parallel sides, and to the half of the longer posterior one. It bears a pair of short, inarticulate, flat, quadrangular antennæ; by the inner side they spring from the lower surface of the head, the anterior side coincides with the frontal margin, the posterior is nearly parallel to this, and the outer side runs obliquely backwards and outwards. On the anterior obtuse angle, there stands a group of short bristles, curved inwards. The eyes are often wanting; when present, they are moved backwards from the head nearly to the posterior margin of the first thoracic segment, which coalesces with it. The triangular rostrum originates at the hinder limit of the head; its apex lies between the origin of the antennæ.

The six anterior thoracic segments bear near the margins feet reduced to nearly sessile, inarticulate, roundish lumps, with which, however, the animal moves pretty quickly from place to place. The seventh segment has no feet, but bears on each side at the posterior margin a wart-like process, and on this the genital orifice.

The abdomen, which is much diminished posteriorly, has no appendages, as in the males of two other *Bopyridæ* found here; the last segment is distinguished from the rest by its greater length, and is beset with minute spines at the extremity.

Of internal organs, the most striking are two wide, brownish, contractile hepatic tubes, which commence cæcally in the first or second abdominal segment, and extend to the second thoracic segment. Between these runs the intestine. Above the intestine and liver is situated on each side a wide tubular testis, which extends forward from the genital orifice already mentioned, through three or four segments, and usually has an external lateral diverticulum in each. The heart is seen pulsating close behind the liver.

The larvæ (Pl. II. fig. 10) are as like those of *Bopyrus* as the males. The flat oniscoid body is about 0·2 millim. in length, and half that width; the greatest breadth is at the second and third thoracic segments, from which the body narrows posteriorly to 0·04 and anteriorly to 0·06 millim., the width of the nearly straight frontal margin. Of the length, about $\frac{1}{5}$ is occupied by the head, the remainder is taken up in equal parts by the thorax and abdomen, each of which is distinctly divided into six segments. The head bears above, near the hinder angles, two roundish, black eye-spots, apparently without refractive bodies, and beneath, two short, thick, biarticulate anterior antennæ, of which only the terminal bristles project beyond the margin of the head, and two longer posterior antennæ, which spring just under the eyes, and reach to the base of the abdomen; these are six-jointed; the penultimate joint and the last setiform one are the longest. In the mouth, which is situated near the hinder margin of the head, I could only distinguish two jaws. Close to the anterior margin of the head a roundish spot, emarginate in front, and composed of pale round granules, is seen; it reminded me of the spot which is observed in the head of many Amphipoda (very distinctly in the *Gammarus ambulans* of the Pomeranian peat-bogs, and also in *Leptocheirus pilosus*, Zadd.).

The five anterior segments of the thorax bear similar feet, originating near their margins; in these may be distinguished two long cylindrical basal joints, a short third joint, a thickened, ovate palm, of the length of the first basal joint, and a slightly curved powerful claw, which is fully half as long as the palm. In the sixth pair of feet, which does not originate so near the margin, only three joints can be distinguished, namely, a cylindrical basal joint, a minute second, and an elliptical terminal joint, the latter 0·04 millim. in length, and half that breadth. This pair of feet is usually applied close to the body, with the basal joint turned inwards, and the terminal joint backwards.

The abdomen bears, first of all, four pairs of natatory feet with a crescentiform basal joint, which is attached nearly by the middle of the convex side in such a manner that one horn, which is a little the shorter, is directed inwards and somewhat backwards, and the other forwards and outwards. The distance between the horns is 0·03 millim. The outer horn bears a lancet-shaped terminal joint, which fits exactly into the emargination of the crescent, and bears at its obliquely cut-off extremity three bristles of about twice the length of the joint. Sometimes this terminal joint is distinctly smaller on the fourth pair than on the three preceding ones; but usually they are all alike. On the inner horn of the three anterior basal joints there is a single bristle; sometimes I found all these bristles of equal length, rather longer than those of the terminal joint; but more frequently the second and third perceptibly shorter, and the last only one-third of the length of the first. The fifth abdominal segment bears a narrow and short appendage, without any bristles (fig. 15), which is cleft into a longer interior and a shorter exterior point. Lastly, at the sides of the last abdominal segment, there are appendages of considerable size, with a thick basal joint and two slender biarticulate terminal branches, of which the outer is slightly the longer. The last, spiniform joint of this branch is straight; a shorter spine occurs externally at the apex of the basal joint and of the first joint of the branch.

The little animals do not creep with much activity, but swim very rapidly. Their dorsal natation, combined with the long bristles of the swimming-feet and the forked appearance of the tail, owing to the lateral appendages, gives them a distant resemblance to *Cyclops*.

The female of *Entoniscus* is so placed in the interior of the *Porcellana* that its head lies concealed amongst the cæca of the liver; it then passes backwards and beneath the heart to the extremity of the cephalothorax, the brood-leaves even reaching sometimes pretty far into the abdomen. The entire animal, including even the head and mouth, is rather closely embraced by a membranous sac, which is continued posteriorly into a narrow efferent canal, and may be traced as far as the suture, between the sternum and the free segment, which, in the *Porcellanæ,* bears the rudimentary fifth pair of feet. This enveloping sac is probably produced by the young *Entoniscus,* in its passage into the interior of the *Porcellana,* not breaking through the soft membrane of this articulation, but carrying it in before it. Thus, regarding this as residing in an inversion of the external skin of its host, it might be called an external parasite, like *Bopyrus* and other Isopods, although it buries itself between the liver, intestine, and heart, and is entwined by the convolutions of the seminal ducts.

Not unfrequently there are two, and I once found even three, *Entonisci* in the same *Porcellana*.

Safely enclosed in the enveloping sac, the male of *Entoniscus* does not require the sharp-clawed clinging feet of the male of *Bopyrus*; and the female has a sufficient security for the conjugal fidelity of her mate in his club-feet, which render it impossible for him to make an excursion into the open sea.

With regard to the occurrence of this parasite, I have yet one circumstance deserving of notice to mention, namely, that *Lernæodiscus* and *Entoniscus* frequently occur on the same *Porcellana*. Having noticed this relation, and knowing well how deceptive estimates of comparative numbers are without actual counting, I kept a record of the parasites of 1000 *Porcellanæ* examined between the 4th of July and the 1st of August. Fortunately this investigation was facilitated by the circumstance that *Entoniscus* also is recognizable from without, as, when the tail is strongly bent back, the liver, or the ovaries, or the eggs between the brood-leaves, or even the black eye-spots of the young brood shimmer through the articulation behind the sternum. *Lernæodiscus* occurred in 84, and *Entoniscus* in 49, of these 1000 *Porcellanæ*; hence we ought to find the two parasites together in 49×84 in a million, or 4 in a thousand, whilst they did occur together 21 times*, and therefore five times more frequently than the frequency of each individual species would lead one to expect. The explanation of this frequent common occurrence, I believe, may be that *Lernæodiscus* prevents a close approximation of the tail and sternum, and thus facilitates the access of the young *Entoniscus* to the ventral surface of the *Porcellana*.

EXPLANATION OF PLATE II. figs. 8–16.

Fig. 8. *Entoniscus Porcellanæ*, female, after the removal of the eggs from the brood-leaves, magnified 15 diameters: *e*, ovary; *h*, heart; *l*, liver.

Fig. 9. Male: *a*, magnified 15 diameters; *b*, magnified 90 diameters; *h*, testes; *l*, liver; *a*, eyes.

* In this neither the younger *Entonisci* not recognizable from without, which afterwards occurred in *Porcellanæ* bearing *Lernæodiscus*, nor the *Porcellanæ* harbouring *Entoniscus* and bearing only the golden coronet of cast *Lernæodisci*, were counted.

Fig. 10. Larva taken from the brood-leaves of the female, magnified 180 diameters.
Fig. 11. Foot of the male.
Figs. 12–16. Feet of the larva: 12, from the last thoracic segment; 13, from the first; 14, from the third; 15, from the fifth; and 16, from the last abdominal segment.

X.—*Notice of the Discovery, by* the Barão do Castello de Paiva, *of the Fossil* Helix coronula *recent, and of other new Land-Mollusca, in Madeira.* By R. T. Lowe, M.A.

Ten or twelve years ago I showed the proportion between the apparently extinct or yet undiscovered recent shells of Caniçal, and those of the same deposit which had been then found living in Madeira, to be as 10 to 35 or 38, *i. e.* as 1 to $3\frac{1}{2}$ or $3\frac{4}{5}$,—*i. e.* very nearly 29 or 27 per cent. (See Prim. Faunæ et Floræ Mad. ed. 2. App. p. xiv.) However, even this per-centage had been plainly on the wane—reduced directly by the discovery, in 1855 and several following years, at three or four points along the north coast of Madeira, by Mr. Wollaston and myself, of living *Helix tiarella,* Webb, and affected, doubtless, indirectly by that of *H. sphærula,* Lowe, γ *major,* found alive in Porto Santo by myself, and of the peculiarly Porto-Santan fossil, *H. Lowei,* Fér., living at a considerable depth below the surface in the Ilheo de Cima, off the east end of Porto Santo, by Sr J. M. Moniz. To these two latter facts, indicative of the probability of still further actual diminution of the ratio between the extinct and still existing shells of Caniçal, I may add my own discovery in Madeira proper, two years ago, of a living species (*H. delphinuloides,* Lowe) so nearly allied to the very abundant and characteristic Caniçal fossil *H. delphinula,* that the occurrence of that remarkable species itself recent in Madeira may be somewhat confidently looked for.

I am now authorized by my excellent and zealous friend, the Barão do Castello de Paiva, to announce some late discoveries of his, still further tending in the same direction. One of these is that of a living *Helix* (*H. galeata,* Paiva, MSS.) so remarkable in form and aspect that my first impression was a ready acquiescence in the Baron's proposal to bestow on it, as an entirely new species, the very appropriate name of *H. galeata,* referring appositely to its peculiar helmet-like or beehive shape. A close comparison, however, of his shells with numerous examples of the Caniçal fossil "*Helix calva,* Lowe (var. fere major)," Prim. ed. 2. App. p. xiii., has since led me to believe it to be rather a singularly convex extreme form of that variety, differing, indeed, remarkably from the usual aspect of the shell in question in its peculiar globosely conoidal shape, elevated cupola or dome-like spire, flattened volutions, and distinct fine superficial spiral lines (like those of the common normal recent var. *a*), but passing so gradually into the flatter normal forms of *β major*, through certain intermediately convex examples of the latter, that, considering also the width of varietal range exhibited already under *H. calva*, I cannot venture to go further than regard it as constituting at most a third var., *γ. galeata*, of that species.

Several examples of this fine and interesting shell were found, late in the spring of 1861, by a man employed in collecting for the Baron along the new Levada da Fajãa dos Vinhaticos, in the Ribeiro do Fayal, towards or near the place where I discovered, two years ago, *H. delphinuloides* (Ann. Nat. Hist. July 1860).

2. The discovery of two recent living examples, in Madeira proper, of *H. coronula*, Lowe (a shell only hitherto known as a fossil of the South Deserta, or Bugio) is a second and still more important addition, by the Baron's persevering industry, to the existing Molluscan Fauna of Madeira. They were found, two or three months ago, along the south coast of the island, to the east of Funchal, "on declivities above the sea between the Garajão or Caniço and Sta Cruz," unwittingly, by a collector employed by the Baron de Paiva, who himself happily detected them amidst a miscellaneous heap of various other living Madeiran submaritime Pneumonobranchiates, consisting chiefly (as I myself observed) of *Achatina tornatellina β, Helix bifrons, H. polymorpha α, Cyclostoma Moniziana*, &c., such as occur usually along the south coast of Madeira to the eastward. One of the examples is considerably more convex than the other, which is also frequently the case in the South Desertan fossils, and is pale chalky white, like *H. tiarella*, Webb; whilst the other is of a brownish flesh-colour, like *H. delphinuloides* usually. The sculpture altogether, and especially the spiral grooves and cancellations underneath, are in both examples less distinct than in the fossil shells from the Bugio; but they are both more decidedly bicarinated than the latter. The animals were almost colourless or pale subpellucid whitish ash, tinged with very pale ochraceous or raw sienna, strikingly different from the peculiarly dark or blackish animals of *H. tiarella*. These two most rare and interesting shells have been generously added by their fortunate discoverer to my own collection.

On revision, therefore, of the list in my Appendix above quoted of the Caniçal fossils, the only absolute corrections will be the insertion of *H. tiarella*, Webb, in the right-hand column of recent homologues at p. xiii., reading, moreover, *H. arcinella α* & *β* for *H. fausta β. minor* and *γ. minima*, and *Achatina Cylichna* for *A. truncata* (a name preoccupied by Gmelin) in the left-hand column at p. xiv., and adding *Cyclostoma flavescens,* Lowe, to both columns.

Thus the apparently extinct or yet undiscovered living shells of Caniçal will now stand to the recent of the same deposit in the diminished ratio of 9 to 36 or 39, *i. e.* of 1 to 4 or $4\frac{1}{3}$, *i. e.* 25 per cent. exactly, or $23\frac{1}{4}$ very nearly.

But if the fossil shells of the entire Madeiran group, consisting of Madeira, Porto Santo, and the three Desertas, be regarded as one whole, it is evident, from the facts above mentioned, that the proportion between the apparently extinct and recent shells in these deposits, considered jointly, will be much more considerably reduced than it appears in the above corrected list confined to Madeira proper. For thus, in fact, there will remain no characteristic or conspicuous fossil shell undiscovered recent, except *H. delphinula,* which, however, may itself be reasonably expected to reward, with the few other minuter species, the close researches of some future naturalist.

3. *Helix tetrica,* Paiva.

T. supra nigricans vel latissime nigro fasciata, depresso-discoidea, subplanata, carinata, solida, undique confertissime granulis distinctissimis albidis prominentibus grosse scobinata; carina acuta, expressiuscula, vix limbata, subsupera; spira convexo-depressa, subplanata, pulvinata, sc. anfractui ult. antice tumidulo superimposita; anfractibus convexiusculis, penultimo antice subdepresso, sutura distincta; umbil. maximo, aperto, patulo, spirali, $\frac{1}{3}$ diam. maj. latitudine æquante.

Diam. maj. 13–15, min. 11–12, alt. 7–8 mill; anfr. 7–8.

Hab. in ins. Deserta Australi in præruptis excelsis maritimis "inter lichenes."

A fine and certainly new species of the *H. polymorpha* tribe, very distinct from *H. senilis* β*, to which, when sent to me last year by the Barão de Paiva, I at first referred it, by reason of its large wide open umbilicus and much coarser granulations. In both these points, with the addition of its flattened discoidal shape, it is also quite distinct from *H. polymorpha* or *H. pulvinata.* A few examples were found by a man collecting for the Baron "on the S. Deserta, or Bugio, amongst lichens on the seacliffs," in the spring of 1861. The colouring is precisely that of *H. polymorpha,* var. β. *nigricans,* subvar. 1 or 3,—viz. dark coffee-brown above, relieved only in two of the four specimens before me by a pale line along the keel and suture. Beneath,

* Lowe, Syn. Diagn. in Ann. and Mag. ser. 2. vol. ix. p. 116; and Catal. Moll. Mad. in Proc. Zool. Soc. (1854), part xxii. p. 189. Supposing, however, *H. senilis,* Morelet, in Journ. de Conch. (1851) ii. 353, to be a good species, *H. senilis,* Lowe, must be changed into *H. salebrosa.*

all of them are pale, with two broad dark-brown bands, the upper of which is subdivided into two or three in two of the examples.

4. A *Physa*, which in degree of ventricosity is intermediate between *P. acuta*, Drap. t. iii. f. 10, 11, and the more elongated or slender common Canarian shell so called by Webb, has been also given to me by the Baron de Paiva, as found in the Rib. dos Soccorridos and that of Gonçalo Ayres, near Funchal. It closely resembles "the rare long-spired var." of *P. fontinalis* (L.), Forbes and Hanl. iv. 142, t. 122. f. 10.

Lea Rectory, June 25, 1862.

XI.—*Notice of a new Species of the Carabideous Genus* Mormolyce. By J. O. Westwood, M.A. &c.

The confirmation of genera, established upon unique species, and often even upon single specimens, by the discovery of additional members of the group, is always satisfactory, and, in the case of very extreme types of form, highly interesting with reference to the question of the development of particular organs or portions of organs, as well as to that of the modification of form resulting from geographical distribution or other analogous causes.

The genus *Mormolyce*, founded by Hagenbach upon one of the most remarkable types of Carabideous insects, has long been known only by a single representative, *M. phyllodes*, a native of Java. Its relations have, as may easily be conceived, been the subject of much discussion, the genus having been placed in the great division Truncatipennes, as well as in that of the Thoracici. Instead of the compact, robust form which is typical of the Carabidæ, we have an attenuated structure, with slender limbs, indicating great weakness of locomotive powers, united to a slightly developed oral structure, proving the insect to be destitute of those predaceous habits which are so eminently characteristic of the family as to have earned for them the sectional name of Adephaga. We must suppose a *Carabus* or *Harpalus* to have been both drawn out longitudinally and flattened out laterally, so that the elytra present great flattened dilatations extending beyond the body in the form of two rounded spatulæ, —the whole represented best by a piece of the thin kind of gingerbread known by the name of "jumbles."

Although originally known as a native of Java, specimens of *M. phyllodes* have been received from Malacca; and with the latter there has been found associated a considerable number of individuals of a distinct species, of which the following diagnosis will indicate the chief distinctions from the previously known species.

M. Hagenbachii.

M. capite postice in collum longissimum subcylindricum attenuato; prothorace elongato-hexagono, angulis anticis porrectis conicis; lateribus spinis tribus æque distantibus armatis (spatio inter spinam posticam et basin fere dimidium prothoracis æquante); elytris foliaceo-dilatatis, angulo basali in lobum transversum antice truncatum porrecto, dilatatione magis cordiformi, latitudine maxima ante medium posita; antennarum articulo secundo longitudine latitudinem ejus duplo superante; scutelli apice rotundato.

Long. corp. unc. $2\frac{1}{2}$, ad apicem elytrorum unc. $3\frac{1}{6}$; capitis lin. 9; prothoracis lin. $7\frac{1}{2}$; elytrorum ad apicem suturæ lin. 14; lat. elytrorum ante medium lin. 17.

Habitat Malaccam in insula Sumatra.

The fact of this species being found in the same locality with *M. phyllodes* forbids our regarding it as a geographical variety; whilst the specific characters given above equally militate against its being a local modification, such, for instance, as occurs in many species of *Carabi* or *Harpalidæ*, respecting which so much discussion has recently taken place amongst Continental entomologists.

The specific name given above was suggested by Mr. Adam White, in honour of the original founder of the genus.

XII.—*Notes on Cambridge Geology.* By Harry Seeley, F.G.S., Woodwardian Museum.

I. *Preliminary Notice of the Elsworth Rock and associated Strata*.*

One of the last labours in England of Mr. Lucas Barrett was the production of a geological map of the country around Cambridge. Of the Lower Secondary deposits, he therein coloured the Kimmeridge Clay, Upper Calcareous Grit, and Oxford Clay. The chief novelty in this was the introduction of the Calcareous Grit; for Professor Sedgwick, many years before, when riding in the neighbourhood of Conington, had somewhere seen a drab-coloured deposit, which, without dismounting, he very na-

* Communicated by the Author, having been read at the Meeting of the British Association at Manchester, Sept. 1861. This paper was to have been incorporated with one on the Strata of England between the Portland and Great Oolites, an intention reluctantly postponed. It will be followed by four papers which were to have been other chapters in the scheme:—1. On the Kimmeridge Clay; 2. On the Tetworth Clay and Coral Rag; 3. On the Rocks of the Oxford Clay; and 4. On the Oxford Clay.

turally supposed to be an outlier of the Shanklin Sands; and so it continued to be regarded until Mr. Barrett discovered that it was really a member of the Oolitic series. On what grounds it was determined to be the particular rock mentioned, or Calcareous Grit at all, I am not aware, unless, indeed, it were from Dr. Wright's speculation that Lower Calcareous Grit had a probable existence in this district; nor have I learnt why the clay above was mapped as Kimmeridge Clay. Some fossils were collected and placed in the Woodwardian Museum. So remarkable was the assemblage, and in some respects so unlike what would have been anticipated, that, after a careful examination of the specimens, I could not but suspect that, in the haste with which the north-west corner had been mapped, something must have been wrongly interpreted. Accordingly, at the first opportunity, I established myself in the village of Elsworth, and proceeded to investigate the nature and relations of the rock on which it stands.

Elsworth is four miles and a half due south of St. Ives—the well-known locality for Oxford Clay,—nearly the same distance due north of Bourn, and about eight miles W.N.W. of Cambridge. The country about is, on a small scale, quite hill and valley, the village of Elsworth itself being built in a rather deep hollow. The hills are mostly of boulder clay, while the valleys produced by its denudation often expose the stratified beds beneath. A brook runs through the village, and ultimately finds its way into the Ouse.

As the streamlet flows between the principal rows of houses, its banks were naturally the first places examined; and here and there along them was seen peeping out a reddish-brown calcareous rock, highly charged with iron-shot oolitic particles, and very hard, but readily separating by cracks into small pieces. It extends throughout the length of the village, and at its southern end dips under a hill of dark-blue stratified clay; to the north it is denuded: this is the nearest approach to a section to be seen. I wished, however, to see the rock where it had not been weathered, as also to obtain fossils from the clay above; and so the Rev. H. Dobson, the rector, kindly granted permission to sink the necessary pits through the rock. The first attempt was a failure; for, though a very promising site was selected within four yards of an exposure by the roadside, it was found, after a large excavation had been made, that the whole deposit was bouldered away. The next trial was more successful; and, singularly, though in the immediate vicinity of the other, there was no trace whatever of the drift clay. We sunk through six feet and a half of a dark-blue laminated clay, which here and there contained a layer, of chocolate- or ferruginous colour, abounding in minute crystals of selenite and sulphate of barytes, and became extremely hard as we descended. Every now and then, specimens were met with of the *Ammonites vertebralis*, in which the body-chamber was filled with calcareous matter, and the rest of the shell pressed flat, forming what well-diggers call "shapes;" some specimens were also found of the *Gryphæa dilatata*. From these fossils I was inclined to regard the deposit above the rock as Oxford Clay instead of Kimmeridge—a conclusion afterwards in some degree confirmed by the abundance in which the latter fossil occurred in another section. Indeed, the fossils from the clay immediately above were scarcely to be distinguished from those in the clay below. And so, instead of Upper Calcareous Grit, the phenomenon presented appeared to be that of a limestone dividing two beds of Oxford Clay.

Continuing the digging, the rock was reached; and here, where protected, its appearance is very different from the weathered aspect seen by the brook-side. It is a dark-blue homogeneous limestone, which I can compare to nothing but the unseptarious cement-stones of the clays. The oolitic grains were abundant, and as deeply ferruginous as though they had been exposed to the air; while scattered irregularly about, branching and interlacing, were masses of undecomposed iron pyrites. A rock of undivided structure, such as that described, will be easily understood to be difficult to work; and I cannot convey a better idea of its hardness than by stating that, during the ten hours during which two men continued thumping away at it, they succeeded in breaking a five-foot iron crowbar, the iron of one pickaxe, and the handle of another, and did not get up a quarter of a hundred-weight of fragments; and yet it is so easily decomposed by the weather as to be utterly useless for road-mending, building, or any economic purpose.

Before the deposition of the superimposed clay, the rock appears to have been much denuded, and consequently its thickness is very variable. It is commonly about 3 or 4 feet, though in some places not less than 7 feet. The clay immediately above it is of a reddish brown, and, judging from its contents, appears to be coloured by the rubbing up of the rock below. But 7 feet must not be supposed to be the total thickness of the deposit; for on the top of it is a clay of about 5 feet in thickness, and then an upper rock of 18 inches, which forms the surface, and above which, at the places where exhibited, there is very little clay. This middle clay is of a brown-black, and is nowhere well exposed; where best seen, it contained numerous specimens of a small variety of *Ostrea Marshii*. The rock above it has all the outer characters of that below, being equally rusty and quite as oolitic—except, however, at one point, where, getting a section in a ditch, it was found to be yellowish white, more sandy, and almost free from oolitic particles. The fossils here were few, but, under the slightly altered conditions, differed a little from those met with in other places. In general they are very similar to those of the inferior deposit, though including some forms which, so far as yet explored, have served to distinguish it.

This thickness of about 14 feet appears here to form the entire mass of this peculiar rock. And yet, in tracing the brook to the south, I found in its bed three successive layers of a hard whitish-grey rock, of 6 or 8 inches in thickness, occurring in the clay at heights above the rock of Elsworth of about 7, 15, and 20 feet. However, these only contain a few *Gryphæa dilatata*, and resemble more than anything else layers of hard, dark Lower Chalk. There is nothing to suggest any connexion with the Inferior beds; but it is just possible that they represent the extreme limits of strata which may elsewhere thicken and unite with them. The dip to the south seems to be about one foot in two hundred.

Having become thus far familiar with the exhibition of the rock about Elsworth, I endeavoured to discover whether it were merely local, or a regular stratum which might serve as a boundary between great thicknesses of clay.

From the great accumulation of the clay, sinking for water here is scarcely more profitable than sinking for coal would be; and therefore in the small neighbouring villages there are few deep wells. However, some have been attempted. One of these was at a point rather more than three miles S.S.W. of Elsworth, and sunk to the depth of 150 feet. They dug through 84 feet of a hard dark-blue clay, from which many Ammonites were obtained; but, as the well was made thirty-six years ago, these are not now to be heard of. Below this they came upon 14 feet of alternate bands of stone and sand (the stone was full of small shells), and an extremely hard grey-blue rock, which they had to get up with chisels and blacksmith's hammers, working for six months before they got through it.

The dip of the Elsworth rock has already been given as one foot in two hundred, and the distance of this digging from Elsworth as about 16,000 feet; therefore, if the rock extended continuously, and preserved the same angle of dip, it ought to be found, at this distance, at a depth of 80 feet; and so, when a rock is found there, at that depth, of a thickness, hardness, and appearance identical with that of Elsworth, I must urge that the evidence approaches the conclusion that in both places the rock is one and the same. In Papworth Everard, a village a mile and a half to the west of Elsworth, a rock was met with in a well-sinking at a depth of 7 feet, but not pierced. Papworth is on higher ground, but the rock at Elsworth dips to the east; hence this stratum will probably be a band some depth underneath it.

Northwards from Elsworth to St. Ives, the country is perfectly flat, and occupied at the surface almost continuously by gravel, the rock having disappeared, probably by denudation. But, on approaching St. Ives from the south, a ridge of high land is seen flanking the town on the west; and on carefully exploring a brick-yard at the base of it, I found abundant remains of a rock which an old brickmaker told me once extended continuously all over the pit to a thickness of 3 feet, quite at the surface, and sometimes parted into two beds by an intervening layer of clay.

Where visible, the rock here is much weathered, but is the same kind of reddish-brown deposit, full of oolitic grains, which occurs at Elsworth. It has long been mistaken for drift, and, as such, is alluded to in the 'Oolitic Echinodermata;' but, though quite at the surface, thin, and often overlain by boulder-clay, there cannot be the least doubt that it is a solid rock of Secondary age accumulated on the clay below. Passing a little to the east, I learned that, in another brick-pit there, a rock had formerly existed, but was now all removed at the surface, having dipped down into the clay to the east of the pit. And still further to the east, at the point where the roads branch to Needingworth and Somersham, it appeared that, in another brick-yard, they sometimes, when digging, came down upon a floor of hard stone, which they have never attempted to get through. To one going over the ground, the conclusion is irresistible that the rocks mentioned at all these pits are one deposit dipping down to the east; but whether this rock is an extension of that of Elsworth, or another bed inferior or superior to it, is a very complex question, difficult to answer.

Rather more than two miles N.N.E. of the last-mentioned pit, and three miles from the pit exposing the rock at St. Ives, is the Bluntisham cutting of the Eastern Counties Railway. This is a piece of high land, which has been cut through to a depth of about 40 feet, and yet the base of the cutting is so elevated that the line descends towards St. Ives at an incline of one foot in less than two hundred; so that the rails here cannot be less than 50 feet higher than they are two miles to the south. Now, in this cutting, just below the surface, is found a rock, of a grey-blue colour and unknown thickness, which was so hard that it had to be blasted in laying the railway drain. I have a fragment, containing iron-shot oolitic grains and shells, quite resembling the rock of Elsworth. It extended continuously for distances of about 100 feet, when, as I was informed, short intervening spaces occurred, in which it was so soft that "one could put his arm in and move it about,"—a circumstance probably indicating a water-bearing stratum at no great depth beneath.

The question here arises, Is this calcareous band identical with that of St. Ives, above which it would seem to be at least 30 feet? If this is assumed, it is clear that as the Elsworth rock dips south, it *cannot* be identical with the stratum at St. Ives, which also would dip south, and therefore be at a very great depth beneath it. Another conclusion from this assumption would be, that the fossils in the clay at Bluntisham should be identical with those of the clay above the rock near St. Ives; while we should expect a considerable difference between the fossils of the St. Ives limestone and that of Elsworth. But neither of these conditions is met with.

Although the clay at Bluntisham is capped with boulder clay, and the fossils of both, which were collected for me, are mixed together, and are therefore to be appealed to with great caution, I think it can yet be said with confidence that they indicate a zone above that of St. Ives; while, after some hours' work in the St. Ives rock, I only obtained, in nineteen, three species not previously met with at Elsworth. This must be conclusive that the Bluntisham rock is superior to that of St. Ives, while it strongly suggests that the latter is not far removed from the zone of the Elsworth limestone. The few fossils from the clay above the rock at the latter place are such that there can be no doubt that the rock beneath is not inferior to that of St. Ives: it may be superior or on the same parallel; while the alternatives with respect to the Bluntisham bed are that it should either be continuous with or inferior to it. Thus, then, we shall have the point of upheaving force greatest either between Elsworth and St. Ives, or at some unknown place further north. If the latter condition obtained, the St. Ives rock would be inclined to the horizon; and as the bed at Bluntisham is in elevation apparently only 30 feet above it, it would, even if the angle of inclination were less than that of the Elsworth bed would lead us to expect, become, when it reached Bluntisham, either coincident with the deposit there or many feet *above* it. Moreover, the Elsworth rock would be 100 feet above that of St. Ives. The fossils, however, as has already been seen, indicate conclusions very different; and so the supposition may safely be dismissed. The point of least resistance in the upheaval, then, was between Elsworth and St. Ives; and therefore the rock, which rises to the surface at Elsworth, must dip down again somewhere to the north in the St. Ives neighbourhood. Hence the question stands thus: Is the Bluntisham rock (or are both it and the St. Ives beds) a continuation of those at Elsworth? If the supposition be adopted that the two northern bands represent the Elsworth beds, it will be seen that the apparently thick stratum of Bluntisham becomes very thin at Elsworth, being represented by the layers mentioned in the bed of the brook, and that they have ceased to exist at Bourn. The only fact bearing against this view is, that, so far as known, the fossils from the clay above the rock at Elsworth are not identical with those from the clay near Needingworth, but very different. If the other view is taken, the St. Ives rock will be an inferior band separated by a considerable thickness of clay from that above. Now, if the upheaving force met with anything like the same amount of resistance to the north which it did to the south, it will be clear that as Bluntisham is 3 miles north, and Elsworth about five miles south, of St. Ives, there ought to be an anticlinal outcrop of the St. Ives rock in the neighbourhood of Fenstanton, that is, two miles south of its St. Ives outcrop, where it should dip south into the clay, so as to pass under the rock of Elsworth. However, as Bluntisham is on high ground, it will be necessary to allow a further extension of a mile or two north, to balance its height. And so it is highly probable that the pressure from below was greatest very little to the south of St. Ives. Now, in the village of Conington, a mile and a half north of Elsworth, and three miles and a half south of the pit showing the rock at St. Ives, a well was sunk to a depth of 250 feet; and herein, after digging for 100 feet, a rock was pierced 5 feet in thickness. It has already been shown that the rock will dip south. If we suppose this incline to be the same as between Elsworth and Bourn, when the rock reached St. Ives, it would only be 18 feet below the surface; and as no rock is found there at that depth, and as the angle of the incline may be expected to increase as the plane inclined approaches nearer the central action of the inclining force, and also as some allowance must be made for possible difference of heights at the places mentioned, the evidence will be perfectly conclusive that this deep-seated rock of Conington is really the "old red rock" of St. Ives brick-yards, and, therefore, that the Elsworth rock, 130 feet above it, is essentially identical with the limestone at Bluntisham. And this explains the discrepancies between the fossils from the clay above the rock at St. Ives and those met with in the clay at Bluntisham, while the characteristic fossils of the Elsworth clay are, so far as is yet known, identical with those of the latter place. At present I have no further evidence of the extension, in a longitudinal direction, of the Elsworth rock, which has thus been traced for a distance of eleven miles, with every circumstance to indicate that it extends far both to the north and to the south of these limits.

It will, however, be readily seen that this argument is not necessarily infallible; the facts on which it is founded are too few for it to claim to be more than an inductive guess. Indeed, seeing that it is built fundamentally on the assumption that the rocks at Elsworth and Bourn are the same, it might be quite wrong. All the facts certainly appear to be in its favour; but it must not be forgotten that simplest explanations are often truest; and in this case, if we suppose the country flatter than the preceding argument required it to be, the deep-seated rock at Bourn (80 feet) would be continuous with the deep-seated rock at Conington (100 feet); and therefore the rock at St. Ives would be the Elsworth rock, and the band at Bluntisham probably identical with those in the bed of the Elsworth brook. Nothing but its simplicity is known in support of this hypothesis, which is only mentioned here as a contingency which has not been overlooked. Even should it be ultimately proved true, the result would in no way affect the principal object of this paper, except in giving the arguments greater weight, by showing that the Elsworth rock is really lower in the Oxford Clay than it is now supposed to be. Meanwhile I adopt the explanation previously given as the true one.

It has already been seen that the St. Ives rock dips to the east; therefore the Elsworth beds also will dip in the same direction, and hence the clay to the east will be above the latter deposit.

Two miles eastward of Elsworth is Boxworth*; and here the land rises so that one can see over the Elsworth valley and the country north and north-east of it. Now, on the easterly slope of this hill is a brick-yard; and here also is a rock, about a foot and a half thick. The workmen call it "flint," a name I have also found given in the surrounding district to the septarious concretions of the clays. It is dark blue, very hard, and divided into layers, much as is the Elsworth rock. The only specimen of it I saw was a slab from the upper part, about six inches in thickness, which consisted of two layers—an upper dark-blue one, with a few small shells scattered about in it, and a lower pale-brown layer composed almost *entirely* of shells, chiefly univalves. From the rock I only succeeded in obtaining, in a determinable condition, *Ammonites biplex*, part of another Ammonite, apparently *alternans*, *Pecten lens*, and a new species of *Pecten*, also found at Elsworth, *Alaria bispinosa*, and *Cerithium muricatum*. In the clay beneath I found a single specimen of *Ostrea deltoidea*, another of *Gryphæa dilatata*, and two or three of an Oyster nearly resembling *O. læviuscula*, hereafter to be described as *O. discoidea*. This same Oyster occurs somewhat sparingly, with

* Pronounced *Els'er* and *Box'er*. Papworth is sounded *Parper*.

the *Gryphæa dilatata*, in the clay at Elsworth, and also sparingly, with the *Ostrea deltoidea*, in the clay to the north-east, at Willingham. Thus the Boxworth rock is a stratum above the Elsworth rock, just as the St. Ives bed is beneath it.

It was seen that the Elsworth beds dipped to the south; and consequently the clay in that direction will also be above them. Seven miles south of Elsworth is Gamlingay; and here, in a brick-yard near the bogs, I heard of a rock about a foot and a half thick, seven feet below the level of the pit. From the clay above were obtained single specimens of *Ostrea deltoidea*, *Gryphæa dilatata*, and *Ammonites biplex*. Also, in a brick-yard at the top of Tetworth Hill, the *Ostrea* and *Gryphæa* were found abundantly in unexpected combination with *Serpula tetragona* and portions of *Ammonites Achilles*, which occurs at Bluntisham and in the bed of the Elsworth brook; and beneath was a floor of rock, covered with water at the time I was there; the rock was said to be white, and 18 inches thick. Between these two pits there is another; but during my short stay I failed to get any characteristic fossils, except two or three *Gryphææ dilatatæ*; from this circumstance, and as it is in a hollow, it is probable that the rocks at Tetworth and Gamlingay bogs are the same, and that this is the clay beneath, but at present it is impossible to say so with certainty. Supposing it should be so, I should be still less inclined to express an opinion as to whether this Tetworth rock is the same as that of Boxworth; though, so far as the evidence goes, the natural conclusion would be that it is the same. They are clearly deposits in very nearly the same position, and are mutually inclined; so that, had they extended continuously, and been different beds, there ought to be a second rock in the vicinity of Boxworth; but, as this has not been met with, the probabilities are strong, taken in conjunction with the other circumstances, that the outcrops are both of the same stratum. Above this I know of no other stone bands for a long way up; but there is another one beneath the lowest yet mentioned.

Six miles west by south of Elsworth is St. Neots; and a little to the south of the latter place, near Eynesbury, in laying the plates of the Great Northern Railway, a rock was cut down to. The uppermost band, of about 8 inches, was removed: it held beneath a large quantity of water, which produced the singular effect of giving all the workmen who drank of it the ague. Below this bed of stone was another of clay, and then another of the rock; but whether there were any further alternations was not determined. The rock is described as having the aspect of Cornbrash. In the well at Conington, 150 feet below the St. Ives rock, another rock was reached, but not pierced, a small supply of very *salt* water being obtained: it is just possible that this rock may be that of St. Neots. There can be no doubt that it holds a place at least that depth below the rock of St. Ives; for the prevailing fossils at St. Neots (*Ammonites spinosus, Duncani,* and *athletus*), which occur almost to the exclusion of other forms, will, with *Ammonites coronatus,* indicate a bed much lower than that of St. Ives, which has *Ammonites cordatus, Lamberti, Eugenii,* &c., as most common. A considerable thickness of strata is probably represented by this change of life in time. Therefore, notwithstanding the circumstance that Prof. Buckman has given the *Ammonites Duncani* and *athletus* (St. Neots fossils) as occurring in the same highest bed of clay with *Ammonites Mariæ* and *Goliathus* (St. Ives fossils), it will be readily granted that the St. Neots rock is lower than that of St. Ives; and this being so, it cannot but happen that it dips to the east, passing under Elsworth; and therefore, if persistent, it ought to occur that the St. Ives rock, by a synclinal, should again crop out somewhere S.W. of St. Ives, while both it and the Elsworth rock should occur between Tetworth and St. Neots. Though I have gone over the whole of this country with some minuteness, it must be reserved for a future paper to say whether they are to be seen or not. But the whole of Huntingdonshire is much obscured by gravel; so that, in the absence of brick-yard evidence or wells, the chances of detecting them would be slight.

Such, then, so far as is yet observed, is the succession of clays and stone bands in the east of Huntingdonshire; but, from observations made in Bedfordshire, there appears to be a great thickness of clay beneath the lowest zone here seen; and therefore it would be premature to conclude that the St. Neots rock is identical with the Kelloway rock, which may yet be found lower down. This being so, the Elsworth and other rocks cannot but be regarded as strata high up in the Oxford Clay, and probably of similar importance with that occurring near its supposed base—conclusions which, it will presently be seen, are also indicated by the fossils.

Facts of no less interest than the succession of rocks are presented by the succession of the clay, which by them is separated into well-marked subdivisions, each distinguished by a peculiar assemblage of fossils. But not only do the organic remains differ, but as the series of strata is ascended a gradual transition is observed from those forms characterizing lower beds to those occurring higher up, until at last some of the peculiar fossils of the Kimmeridge Clay are found blended with those of the Oxford Clay; and further on, the true Kimmeridge Clay itself is met with, as at Cottenham. In the absence of the Coral Rag, this great succession has the appearance of one deposit, admitting, however, of subdivision into the parts characterized by *Gryphæa dilatata*, by this species and *Ostrea deltoidea* associated, and by the latter fossil and *Exogyra virgula*.

In this country there is nothing to indicate that the middle group should rather be added either to the upper or the lower of these beds. In the South of England, Mr. Pease Pratt added it to the Oxford Clay—a conclusion in which he has been followed by the gentlemen of the Geological Survey. But if it is contended that at Upware, midway between Cambridge and Ely, the Coral Rag occurs beneath the Kimmeridge Clay, it must also be confessed that we are ignorant of what fossils may occur at the base of the clay there, while, on the other hand, the Elsworth rock clearly separates the clay above from the *Gryphæa-dilatata* clay below; so that, did the Elsworth rock attain the thickness of the Coral Rag, there could not be a question about the claim of the middle clay to be considered distinct and intermediate between the Kimmeridge and Oxford Clays. Nor, as it is, can there be any doubt about it, seeing that duration in time is not represented by thickness of deposit, but by change in life; and in this respect the palæontological evidence is conclusive. The fact, too, of the existence of an isolated reef of Coral Rag will be evidence that other deposits must have been made around it. It is therefore proposed to distinguish the stratum as the *Tetworth Clay*.

The fossils from Bluntisham, which it must be remembered are from the lowest part of the clay, are *Gryphæa dilatata* abundantly, *Ostrea deltoidea* rarely, *Ammonites alternans, biplex, serratus* (which is erroneously given in Morris's Catalogues as from the Oxford Clay of Huntingdonshire), and an Ammonite figured by D'Orbigny as the female of *Duncani*, but which is neither that species nor *spinosus*, which latter form has, in the adult state, the characters of its youth, only more developed, while this bears to it much the same resemblance that *Callovicensis* has to *A. Duncani*; and *Belemnites excentricus*. To these may be added, from Elsworth, *Alaria bispinosa, Lima pectiniformis, Pecten lens*, and *Ostrea discoidea*.

Of course it is certain that the agencies depositing strata have ever acted without intermission; and therefore it is that all rocks can only over a limited surface preserve the same lithological characters. Clays being the most persistent of strata, because the most flocculent and therefore widest spread, are less likely to thin out than limestones; and yet it singularly happens that the Tetworth Clay has only been noticed in a few places, and never in company with the Coral Rag, which appears to have a much greater extension. The explanation would appear to be this:—The deposition of the Coral Rag and its associated grits must have occupied a long period of time: this has usually been regarded as equivalent to the ages required for the change of the fauna of the Oxford Clay to that of the Kimmeridge; it must at least have occupied a large part of that period; and its absence as a representative of time would be indicated by a corresponding break in life. Now, in the country between Elsworth and Cottenham, where the Coral Rag does not occur, it has been seen that there is no break in life: hence there cannot be a great break in time; and so the Coral Rag must be present as a period, although it has ceased to exist as a calcareous formation. The clay, then, must represent it; and hence the Tetworth Clay will be regarded as the argillaceous contemporary of the Oxford Oolite; and therefore it results that the Elsworth rock is directly underneath the Coral Rag, on the one hand, and above the Oxford Clay, on the other; so that the only remaining question about its position is to determine whether it is rather to be classed with the Oxford Clay or with the Lower Calcareous Grit. And this is a problem of some difficulty, since there is no calcareous grit in this district for comparison.

If the Tetworth Clay were replaced by Coral Rag, the Elsworth rock would then be a calcareous bed at the base of it, and apparently forming part of it; but it would also be an Oolitic stratum at the top of the Oxford Clay, and *identical* in lithological structure with similar beds occurring lower down, from which, as already remarked, its species differ but little. In estimating the weight of the fossils as influencing the question, it must not be forgotten that many species are peculiar to clay, and others to limestone; so that, as the gap between the Oxford Clay and Calcareous Grit cannot be very great, there will almost necessarily be many forms in common between the Elsworth rock and the Grit above, which would not occur in the Clay below, while the same cause would prevent the Oxford-Clay fossils living on into the rock above.

The species of the rock are numerous. A good proportion of the forms are peculiar. The following list will serve as indicating the general character:—

Ammonites vertebralis.	*Ammonites Herici.*
—— *biplex.*	—— *canaliculatus.*
—— *perarmatus.*	—— *Goliathus,* var.

It is to be noticed that all these species occur in the Oxford Clay of France, while only two of them have yet been published from the Calcareous Grit. Besides them, there are two new forms, and the *Ammonites Rüppellii* of Münster from Solenhofen, which species must not be confounded with the Corallian *Ammonites Rüppellensis* of D'Orbigny, being nearly related to the *A. biplex.*

The Belemnites are *hastatus* and *tornatilis,* both of which occur in the Oxford Clay below, but neither, so far as I have collected, in superior beds. The *hastatus* is an inflated variety.

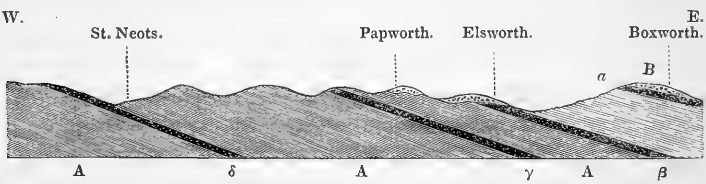
The Gasteropoda are *Pleurotomaria reticulata,* a fossil of the Calcareous Grit and Kimmeridge Clay in England and of the Oxford Clay in France, being identical with the *Pleurotomaria Münsteri* of D'Orbigny; *Pleutomaria amphicelia,* a new and peculiar species resembling the Inferior-Oolite *P. ornata*; *Littorina perornata,* a new form intermediate between the Inferior-Oolite *L. ornata* and the Corallian *muricata* (I believe that it occurs in the Coral Rag, Calcareous Grit, &c.); a new species of *Littorina,* a new *Cerithium,* and a *Phasianella.*

The bivalves are extremely numerous, and the new species many. A few only need be given now. Among the new species are *Avicula pterosphena* and *Gryphæa elongata.* Among the known species are *Pecten fibrosus* (including *vagans*); *Terebratula ornithocephala, T. perovalis,* and *T. sphæroidalis*; *Pecten lens* and *Pecten vimineus*; *Gryphæa dilatata*; *Lima pectiniformis*; *Avicula expansa, A. ovalis,* and *A. elliptica*; *Trigonia costata,* and a slight variation of Dr. Lycett's variety *decorata* of *Trigonia clavellata*; *Astarte ovata, A. lurida, Opis Phillipsii,* and a variety of *Myacites recurva.* Although most of these species occur in the Coral Rag and Calcareous Grit, I think, when the circumstances already pointed out are remembered, and also that many Coral-Rag forms range down to the Cornbrash, the fossils will be regarded as far more closely linked to the beds below than to the equivalents of strata above. When one remembers the superposition, I see no ground whatever on which the conclusion need be disputed; and therefore the Elsworth rock will be placed as about the highest zone of the Oxfordian series.

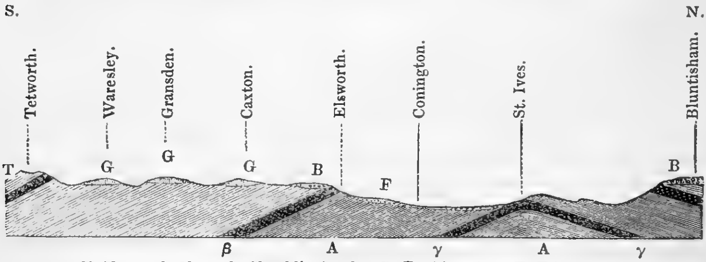
There are, then, in this district at least three well-marked rocks dividing the Oxford Clay, to the different zones of which it will be necessary to apply distinctive epithets when the whole succession shall be satisfactorily elucidated. It would be beyond the object of this paper to add anything further on either the rocks or clay zones; but as it has already been mentioned that the Upper Elsworth rock differs somewhat in fossils from the lower bed, it may be remarked that the circumstances which most attract attention are the presence in the upper band of numerous masses of *Serpulæ,* a difference in the Brachyurous Crustacea, in the spines of *Cidaris,* in the enormous size of *Gryphæa dilatata* (some being 11 inches long), the absence of *Gryphæa elongata,* the presence of plates of a Star-fish, the greater abundance of *Littorina perornata* and of *Pleurotomaria reticulata,* species of *Perna,* many *Ostreæ gregariæ.*

These distinctions may be but local, but in this locality they will be found constant. In the lower bed are some shell-less Annelides.

It ought to have been previously mentioned, that at Over*, a few miles east of St. Ives, and west of the Kimmeridge Clay, the *Belemnites excentricus* and some other fossils have been met with, identical with those of Bluntisham; and therefore it might be expected that the Elsworth rock should crop out near Holiwell, which is an intermediate point between Over and St. Ives. Now, in the collection of Mr. James Carter of Cambridge is a series of fossils, collected for him twenty years since, which he believes came from Holiwell. The series contains *Ammonites Herici* and many Elsworth fossils, as also some few new forms and several which Elsworth has not produced and probably does not contain, such as *Dysaster bicordatus* and *Holectypus hemisphæricus*, these two species being very abundant. The lithological character of the bed is quite the same as that of the Elsworth rock. I do not insist upon a necessary identity; for the locality is not given with that certainty which such an assumption ought to require; and the pits being now abandoned and filled in, verification will be impossible. The fact must go for what it is worth, and, judging from circumstances in the country to the north-east, where there are other outcrops of rock, it will not be worthless. It may indicate an interesting synclinal between St. Ives and Over, which is probably a consequence of a vast downthrow fault known to exist far to the east.



a, Boxworth rock; *β*, Elsworth rock; *γ*, ?St. Ives rock; *δ*, St. Neot's rock; A, Oxford Clay.



T, Tetworth Clay; G, Shanklin Sands; B, Boulder Clay; F, Flint gravel.

Thus it has been endeavoured to illustrate a succession which will hereafter be elaborated at more appropriate length.

* Pronounced *Uv'er*.

XIII.—*On the Functions of the Nitrogenous Matter of Plants.* By M. L. Garreau.

[Concluded from p. 43.]

II. *Of the Circulation.*

The intracellular circulation observed by Corti, and since studied by Treviranus, Amici, Robert Brown, Schultz, Raspail, Meyen, Slack, Pouchet, Dutrochet, Schleiden, Steinheil, Becquerel, Dujardin, Schacht, Trécul, Hugo Mohl, &c., in a small number of plants, has been hitherto generally regarded as a simple motion of rotation, and as peculiar to certain plants. But, from the constant presence of living nitrogenous material in cells in course of growth, the modifications in form that it undergoes, and the vital movements with which it is endowed, and which we shall presently point out in detail, I hope to show that we have not always to deal with a simple act of rotation, and that this movement is as general as the cell. All plants, and their parts, in which the nucleus and its appendages are readily discoverable, are suitable for the study of the vermicular movements of the intracellular circulation; and it is sufficient to select for examination a hair or a thin slice of tissue, in the conditions before indicated, to demonstrate this beautiful phenomenon. One plant in which it displays itself under the greatest variety of form is the *Salvia sclarea.* This vigorous labiate plant has its surface everywhere covered over, and particularly its young merithalli, with large hairs, beautifully transparent, and formed by two or three superimposed cells, the septa between them being also perfectly translucent. If a small slice of the hairy epidermis of this plant be examined under water, the canals through which the circulation is carried on are perceived at once in the hairs fringing the section; and on following attentively their course from the periphery, or from any other point, towards the central nucleus, the granules which stream through them may be noticed making their way to the nucleus, whilst some of them are driven against the lateral and opposite portions of the canals in which they circulate. The rapidity of these currents is augmented by heat, and varies in each canal: it is almost inappreciable at 10° Cent., but considerable at 25° to 30°; the granules in one stream sometimes traverse the half of the long diameter of a canal in a few seconds, whilst those in others occupy some minutes in accomplishing the same distance. Again, in some canals the circulation becomes arrested for a moment, and sometimes this stoppage is instantaneous. All these centripetal currents are equally distinguishable both through the anastomosing canals and through those that do not anastomose; and, during their continuance, these canals are some of them stretched like rigid threads across the cell-cavity, whilst others are slack and more bulky.

On my first observation of these currents, I speculated on the causes of the movements; but I might have probably ended with the simple recognition of the fact of their existence, had not the cause itself been unfolded to my observation, viz., the power of contraction. On seeing this strange phenomenon, which I looked upon for a long time with that restless curiosity which astonishing and entirely unexpected circumstances produce in the mind, I was disposed to attribute it to some illusion; but at length I was *perforce* obliged to yield to evidence obtained by observations repeated 500 times during a period of ten years, upon the *Salvia* named and on very many other plants, and all of which have led to the same results. The contractions of the canals usually proceed progressively, in such a manner that the granular fluid is propelled gradually onwards—a dilatation larger or smaller appearing in advance of the contracted portion, and preceding it, until the granules reach the nucleus, where their course is arrested until they coalesce with it. In their progress towards the nucleus, these dilatations are frequently retarded in their course by the spots where anastomosing canals meet; and they do not reach the nucleus until after they have proceeded upwards, downwards, or laterally, according to the disposition of the anastomosing parts. Whilst these contractions continue, the canal, contracted behind and much dilated in front, seems to outstretch itself, and to be thrown into undulations or folds, which are most numerous near the nucleus. It might be supposed at first that, as is seen in most of the membranous processes of the hairs of the pumpkin or gourd, and in those of still very young cells, the membraniform, soft, very extensible material is a viscid matter which has an inherent motion towards the nucleus; but if we observe a canal having a direction parallel to the axis of the cell, and bearing an anastomotic branch perpendicular to it, the latter is gradually pushed towards the nucleus, forming a more and more acute angle; and when the contraction is past, as relaxation slowly succeeds, it is seen to resume more or less closely its original relations, and form anew a right angle to the canal it communicates with.

Nevertheless, in citing this example, it is not my intention to assert that the canals have a permanent fixed position; for this is not in accordance with fact, since we know that the organic matter they are composed of is susceptible of movement and of displacement. The distinguished observer Meyen seems to have obtained the first perception of a portion of the movements which take place in the living matter of cells; but his conclusions testify to his having made observations under unfavourable conditions; for he assumed them all to result from the currents of the intracellular mucilaginous matter which successively coalesced and separated from each other. But there is no question that this naturalist would have given a better description of them if he had persevered in the examination of what he saw, varying the subject and the conditions of observation; for he then might have convinced himself that most of these currents take place in actually contractile canals, through which the numerous granules circulate with a greater rapidity than the centripetal movements of the soft matter which constitutes them—a fact which could not take place if they were transported with this matter; moreover, he would have likewise witnessed the minute granules circulate in tense and completely motionless canals, the contents of which received their impulse from contractions remote from the communicating canals. Hugo Mohl has certainly seen some of the facts that I have remarked; for he recognized the existence of minute canals in the intracellular animal matter which he calls the protoplasm; and Slack, whilst denying the existence of canals in certain cells, remarks on the subject of the circulation in the cells of *Hydrocharis morsus-ranæ*, "The small globules follow the larger; and occasionally one of the green globules crosses the cell in a current of still more minute particles, forcibly traversing a canal which can scarcely admit them." The canals which are formed in the animal azotized material of a cell do not always contract themselves gradually; it is not uncommon to see several of them at a time, by a *brusque* movement, drive forward the granular fluid that they contain. Under such circumstances these canals insensibly enlarge; and whilst the fluid that is to be propelled by their contraction flows through them, they may often be seen to change their relative position, and to undulate like imperfectly stretched cords until they acquire an increased rigidity and an enlarged capacity; then they become outstretched, assume a dull-white hue, and contract once or oftener in succession. After these contractions have occurred, the partially emptied canals, more elongated than formerly, occasionally reunite in a bundle, fixed on one hand to the extremity of the cell, and on the other hand to the nucleus—a bundle which then simulates a mucilaginous-like axis without distinction of parts. However, if the observation be pursued, after half-an-hour or sometimes more, according to conditions which I have found it impossible to appreciate distinctly, these same canals fill themselves afresh and resume their contractility. Such is the mechanism by the aid of which the granular fluid contained within the living azotized material flows from the periphery towards the nucleus.

There likewise exists a centrifugal movement, which goes on by a series of slower contractions, also less marked, and of variable rapidity in different canals. The nucleus itself contracts; but its contractions are slow and gradual, and its movements are only appreciable through its changes in relative position and volume; for when these contractions take place, it is seen to diminish almost insensibly in magnitude, and to assume a dull-white tint, undergoing at the same moment an inconsiderable amount of displacement. At the least, this organ, suspended like the canals and the viscous currents in the cell-cavity, suffers displacements to a much less limited extent than is generally imagined: this depends on causes inherent in the contractile and extensile properties of the nucleus and its appendages. I have not as yet succeeded in determining whether the granular fluid can return from the centre to the periphery through the whole of the canals that it has traversed to reach the nucleus; but we may convince ourselves that, among the parallel canals through which the circulation proceeds, it is in some of them centripetal, in others centrifugal. But as the canals are all in connexion with the nucleus, we must assume that this organ is capable of effecting partial contractions, as the canals themselves can do; for otherwise, if its whole mass were acted upon at the same moment, it would not be conceivable how centripetal and centrifugal currents should proceed simultaneously.

The fluid in circulation is ordinarily limpid; however, in plants having a white latex, such as *Campanula pyramidalis, Sonchus oleraceus,* &c., it has a certain degree of opacity; and in *Chelidonium majus,* yellowish granules are interspersed within it. Consequently it may at least be supposed, if it be not admissible as a legitimate conclusion, that the matters contained in the laticiferous vessels derive their source from the granules of the nutrient fluid within the cell-cavity. The granules carried forward in the currents are of two sorts: one, tolerably numerous and nearly spherical, congregates in the nucleus in much greater abundance than in the canals; the other occurs in molecules of extreme tenuity and less regular in outline, which seem to be slightly more dense than the fluid in which they float; for in *Tradescantia virginica* and *Erodium moschatum,* plants in which they are readily discernible, they are more aggregated at the lower part of the canals than at their centre.

The nutritive fluid not only moves through the canals which float freely within the cell-cavity, but also in those which constitute a network in the primordial membrane, and in those of less size which are obliquely distributed on its internal surface.

To detect this portion of the circulation, considerable patience and care are required. The canals in which it goes forward are, by artificial light, more transparent than the membrane they permeate; and in tracing their course little dilatations may be observed to slowly form and presently vanish; in these we have the counterparts, on a minuter scale, of those dilatations seen to arise during the contractions of the free canals stretched across the cell-cavity.

Lastly, to sum up this list of facts, if a still fresh hair be selected, having however the primordial membrane of its cell detached to a very limited extent from its cellulose wall, the same movements are discernible in the unbroken filaments connecting those two laminæ of the cell; only, owing to the extreme tenuity of these filaments, the saccular dilatations are very minute, though always visible by a magnifying power of 300 or 400 diameters. The whole of the movements going forward within the intracellular nitrogenous material are arrested when the cells are immersed for a few minutes in an aqueous solution of sulphate of strychnine, containing one part of the salt in 200 parts of water. The acetate of morphine, of the same degree of dilution, produces similar effects, though not in less than double the time taken by the strychnine. The transparent hairs of *Erodium moschatum*, from the young merithalli, are well suited for making these observations on. The same may be said of the hairs of *Chelidonium majus*, *Glaucium glaucum*, of the cellular tissue of the epidermis of *Sedum*, and of that of the petiole of *Dipsacus fullonum* and of *Arum*, &c., except that in the last-named examples it is less easy to study the phenomenon, because their vital movements are more obscure, and their cellular walls less transparent.

The movements that take place in the nitrogenous matter of cells are not limited in their effects to the circulation of the granules contained in the canals and nucleus, but produce also an incessant fluctuation in the aqueous fluid which surrounds them and fills the cells, and so cause a movement of rotation of the same character (though less marked, it is true) as that observed in the cells of *Chara*, *Nitella*, *Hydrocharis morsus-ranæ*, of *Stratiotes aloides*, &c. Still it is very visible, the liquid having numerous small molecules suspended in it, if attentively observed; and its course may be detected in the hairs of Labiatæ, &c. Thus there are two sets of distinct movements within the interior of cells,—one spontaneous, due to the contractility of the living material itself; the other passive, dependent on displacement of the surrounding liquid.

In the exposition just made of the mode of existence of the living matter of cells, of its proper movements, and of those it impresses on the fluid surrounding it, our investigations have been restricted to only that portion of it which enters into the formation of the nucleus and of the canals and contractile filaments; however, in many plants, and among others in the epidermic cells of young Arums, in the hairs of Umbelliferæ and of Boraginaceæ, in the epidermic cells of the leaves of *Scolopendrium officinarum* vel *undulatum*, the azotized or living material loses the characters detailed, and is represented only by filaments which emerge from a semifluid mass and stretch themselves towards the primordial membrane, exhibiting changes of position very slowly, and impressing some movement on the fluid bathing them. It is a fact that most physiologists who have interested themselves in the rotary movement which occurs in the cells of *Chara* attribute it to other causes; but in our opinion there is only one true explanation of it, as pointed out by Schleiden, Hassall, and Hugo Mohl, who have rightly perceived its mechanism, and attributed it to the dense fluid which occupies the inner wall of the cell-cavity. Dutrochet and Donné have inspected its cause in the nearly mature merithalli of plants,—the first-named in the course of attempts to suspend its course by means of poisonous agents, and the second in recognizing the spontaneous movements of detached and vermiform fragments of the primordial membrane. Nevertheless these naturalists seem to assign an influence to the green globules which they do not possess; for these chlorophyl-granules are scarcely apparent in the very young ramifications of *Nitella flexilis*, and are entirely absent in the cortical cells of the rhizomes of *Chara*. Nevertheless the circulation is very much more active in those parts than in merithalli of greater maturity, wherein the green globules more abound. They, in fact, contain a nitrogenous plastic material, filled with excessively minute molecules, which creeps along the wall of the tube, and impresses upon the aqueous liquid in contact with it, and loaded with globules, a similar movement. What proves that such is the cause of the motion in young cells is, that though this nitrogenous matter be more dense than the fluid with which it is bathed, it raises itself and moves along the tube contrary to the action of gravity, and advances with incomparably greater velocity than that of the fluid which accompanies it in its course. In proportion as the merithalli are developed, this matter gets fixed to the primordial membrane, in the formation of which, indeed, it takes part, and which, though adherent to the cell-wall, propels onward the enclosed liquid of the cell, not, as has been suspected, by the aid of vibratile cilia, but by tolerably rapid undulations similar to those produced on the surface of water ruffled by a gentle breeze.

If, instead of limiting the examination of the vital movements of the nitrogenous matter in the interior of the cells of phanerogamous plants and of some Characeæ, we extend it to Cryptogamia generally, both vascular and cellular, it will be found that this vital act, whilst the subject of various metamorphoses, presents itself in individual organisms of determinate form, which have for a long time been confounded with Infusoria.

The antherozoids of *Chara, Nitella,* of Ferns, Mosses, Equisetacæ, Hepaticeæ, &c., have been well studied, and described in relation to their development, forms, and vital endowments, by Thuret, Nägeli, Suminski, Pringsheim, Derbès and Solier, and others. Let us examine and discover whether the spontaneity of movement with which these organisms are endowed be open to question, and whether their origin in the metamorphosis or development of the living proteine matters of the cells be still a debatable point. For ourselves, we have examined them in several *Charæ,* in *Nitella flexilis,* in *Marchantia polymorpha,* &c.; and both the contractility and spontaneity of their movement have appeared so decided that we have no hesitation in saying, with all deference to those naturalists who deny them these properties, that their observations must have been made at inopportune seasons.

The zoospores of *Vaucheria clavata,* mistaken by Nees von Esenbeck for Infusoria, have been examined with respect to their origin by Meyen, whilst Unger and Thuret have presented an accurate history of their organization. Likewise the sporozoids of different Fucaceæ have been studied by Decaisne and Thuret, particularly by the latter observer, who has investigated with the greatest care both their organization and their vital endowments, in a large number of species. Now, on contemplating these locomotive organisms we shall perceive that, if the living nitrogenous materials seen in movement within the cells of phanerogamous plants have not the determinate form of Infusoria, like that of the animalcular beings of antheridia and zoospores, there exists nevertheless between the two the signs of a common parentage. And it is a striking circumstance that the actually living and moving zoospores proceed, so soon as fixed by one end, to change their shape and to develope cells; but although dead so far as concerns our view, by reason of the screen which conceals them from our research, still their substance carries on a latent mode of life, and elaborates a plant which in course of time resuscitates the motile organisms. Is not this circle of life sufficiently remarkable to attract the highest attention of micrographers and physiologists? for does it not seem to reveal to us the true nature of plants? It is true that the differences between the Algæ and the immense majority of other plants are very wide; still we must not seek after the affinities between them in accessory functions, but in the movements and principal functions of their nitrogenous matters.

These movements are visible in all plants in process of growth, but exert no marked action upon their cell-walls, because these last are too resistant. However, in *Oscillariæ* (some of which are elongated in the form of worms, whilst others are coiled in spirals) we meet with novel conditions of existence, by the operation of which the living matter of those plants, without any perceptible change of nature, subsists without the presence of that cuticle or epiderm which limits their motions. Suppose, for example, an *Oscillaria* to be enveloped in a more resistant cellulose coat, and we shall realize to our minds the presence of all the organic elements of a ligneous fibre. Or suppose, again, a similar covering imposed upon *Amœba diffluens*, and we shall recognize in it all the elements of a parenchymatous cell. Granting that the nitrogenous matters within the cells of plants possess the property of motion and of reproduction like animals, do they, let us next inquire, partake those other functions which belong to the latter?

The proteine matter of plants, which serves for the development of that of animals, has hitherto not been completely separated from the organic and inorganic elements with which it is associated; but we have elsewhere shown that it tends to isolate itself in seeds containing earthy and alkaline phosphates.

On analyzing the gluten obtained from cereals we discover the same animal and mineral substances, very little modified, as are found in our own tissues. If this same gluten be brought into contact with a globule of yeast, it becomes entirely transformed into a mass of globules resembling those of the fungus, which is itself composed, with the exception of its scarcely visible enveloping lamina of cellulose, of the elements of gluten, and in the same proportions.

On cautiously removing the endochrome of the merithalli of *Chara*, the same chemical compounds, besides the fatty matters and the traces of starch, are discoverable. And, indeed, the fact seems well established that there is no difference between the composition of the living matter of plants and that of animals.

It is, notwithstanding, true that the proteine matters of plants are constantly impregnated with cellulose, whilst those of animals are only exceptionally so, as in the example of Tunicata and *Diselmis*.

In the views we propound regarding the vital movements and the chemical composition of the proteine material of plants, it is not our intention to maintain that animals and plants are organized in the same manner, and have the same sensibility; the only principle we advance is that the living matter of plants and animals has a similar chemical constitution, and that this material in plants performs essential functions similar or analogous to those of animals.

It has for a long time been the general belief that plants, reversing the rule prevailing in animals, respire carbonic-acid gas, which they extract from the soil or withdraw from the atmosphere, and that whilst they assimilate its carbon they throw off its oxygen—or that, in other words, a plant seems to respire by the medium of an asphyxiating agent. However, when we consider that the Fungi, the majority of Algæ, the Orobancheæ, the roots, stems, flowers, the green fruits, &c. of all phanerogamic plants constantly give off carbonic acid as a result of a process of combustion between their carbon and the surrounding oxygen, we must feel obliged to admit that plants respire like animals, and that the final result of the respiratory act consists, equally in the two, in the decarbonization of their fluids or of their tissues, and in the production of heat.

M. Bérard, in a prize thesis of the Academy of Sciences, has shown that green fruits, even the youngest, exspire, whether in sunshine or in the shade, notable quantities of carbonic acid. I have moreover proved, in a series of memoirs published in the 'Annales des Sciences Naturelles,' by means of numerous experiments, that buds and the young shoots succeeding them, adult leaves, &c. consume a portion of their carbon by the aid of the surrounding oxygen, or of that which they form within their tissues; and that this function, which diminishes in activity as the leaves grow old, is more marked when it proceeds under the influence of a higher temperature. These facts, confirmed as they are by the most recent researches, establish clearly enough that plants are endowed with a respiratory function like that of animals, extending over the day as well as the night. At the same time it must be granted that their diurnal animal respiration is rendered more or less obscure in its results, as it can be accomplished by the aid of the oxygen derived from the decomposition of the carbonic acid it produces, and which it incessantly gives off within the laminæ of their tissue or in the atmosphere. It is very easy to demonstrate this double interchange by placing a green plant or the leaves of one in a limited amount of atmospheric air, and in the presence of some solution of baryta, when the latter will be soon covered with a pellicle of the carbonate of that earth; whereas if the experiment be performed under the same conditions, omitting the baryta, no trace of the carbonic-acid gas will be discoverable.

It is equally easy to establish the relation that subsists between this act of animal respiration and the development of caloric from it as a natural result. We may here recall some experiments made by De Saussure, Dutrochet, and Adolphe Brogniart, as supplementary to those which we can ourselves adduce in support of the same truth.

Dutrochet has demonstrated ('Annales des Sciences Naturelles,' 1845, p. 5) that all parts of plants possess a degree of heat superior to that of their surrounding medium, and that the elevation of temperature noticed in the *Arum*, the *Caladium*, &c., is only a more marked manifestation of a phenomenon common to all living beings. But this phenomenon itself is nothing more than a feeble reflex of a more material fact, viz., that of the chemico-vital combustion of carbon by oxygen. Thus, in the instance of plants as of animals, the respiratory act has for its final appreciable result to carry off carbon and to raise their temperature; and these two effects are intimately correlated in both sets of organisms; for the researches of De Saussure show that tubers, roots, ligneous stems, &c., give off only one-half of their volume of carbonic acid in the twenty-four hours; whilst those of Dutrochet have demonstrated that the heat belonging to those parts is scarcely appreciable.

The former of these observers has remarked that in monœcious flowers the males consume more oxygen than the females; and the latter has noticed that their temperature is also more elevated. The researches of Sennebier on the heat of *Arum maculatum*, those of Schultz on *Caladium pinnatifidum*, those of Goeppert on *Arum dracunculus*, of Brongniart, Vrolicke, and Vriese on *Colocasia odora*, as well as those long ago made by Lamarck, and our own on the spadix of *Arum italicum*, establish most distinctly the cause of the phenomenon and its relations with the oxygen and the carbon consumed. The following Table of the heat of certain plants, and of the quantity of carbonic acid expired by them during a certain time, represents the approximative results arrived at by Dutrochet and other observers:—

Name of plants.	Oxygen consumed in 24 hours.	Observer.	Medium heat.	Observer.
Green Pear	0·50	Bérard.	0·06	Dutrochet.
Green Pear	0·70	Id.	0·06	Id.
Plum (*Reine Claude*)	1·60	Id.	0·09	Id.
10 grs. of leaves of House-leek	0·20	Garreau.	0·03	Id.
Spathe of *Arum maculatum*...	4·00	De Saussure.	0·22	Id.
Spadix of do......................	38·00	Id.	4·60	Id.
Stamens of do.	135·00	Id.	7·00	Id.
Pistils of do......................	10·00	Id.	1·50	Id.
Flower of the Gourd	7·60	Id.	0·50	De Saussure.
Boletus aureus	7·50	Id.	0·45	Dutrochet.

From these facts, derived from different sources, it is at once evident that a well-marked relation subsists between the quantity of carbon consumed and the elevation of temperature produced. These results, it is true, are deficient in that degree of precision that researches of this nature should possess; for it is to be regretted that De Saussure and Bérard have neglected to indicate exactly, as Dutrochet has done, the mean temperature at which the observations have been conducted. Notwithstanding this omission, however, the relations pointed out are real.

The following Table, conveying the results of our own observations, moreover shows the relations subsisting between the oxygen consumed and the degree of heat emanating from its union with the carbon in the plant :—

Respiration of the spadix of *Arum italicum*, at the temperature of 20° Cent., and during the period of its sexual activity.

	Heat of spadix.	Medium heat hourly.	Oxygen consumed.	Volume of oxygen consumed; the organ being taken as the unit.
h. m.			cub. cen.	
1st hour { 3 30 / 4 30	2·5 / 3·9	3·2	39	11·1
2nd hour { 4 30 / 5 30	3·9 / 7·6	5·3	57	16·2
3rd hour { 5 30 / 6 30	7·6 / 8·9	7·8	73	21·4
4th hour { 6 30 / 7 30	8·9 / 7·7	8·3	100	28·5
5th hour { 7 30 / 8 30	7·7 / 4·2	6·0	50	14·2
6th hour { 8 30 / 9 30	4·2 / 1·2	2·7	20	5·7
Mean		5·3	56·8	
Oxygen consumed in the 6 hours		...	339	

It may be objected that the production of carbonic acid within the vegetable tissue, and that of the caloric which results from it, are the consequences of a purely chemical action, and not of a physiological process. But if we consider that the researches of Théodore de Saussure, of Bérard, and of Dutrochet have been made on living organs in process of growth, that parts of plants when broken or bruised up cease to form carbonic acid, as the experiments of De Saussure, Frémy, and ourselves demonstrate, and, lastly, that the death of the tissue, as evidenced by the persistent loss of movement of the nitrogenous living material, involves the cessation of the development of this gas, the conclusion is inevitable that its formation is the consequence of a vital act. What, in conclusion, along with the causes just enumerated, convinces us that the animal respiration of plants has its seat in the living nitrogenous matter which is seen in circulation within the cells is the relation which exists between the quantity of this matter contained in a living organ and that of the carbonic-acid gas exhaled.

The subjoined Table, taken from our first memoir on the respiration of plants ('Annales des Sciences Naturelles,' 1851, p. 5) appears to bear out this assertion:—

Matters examined.	Temperature.	Acid exspired in 24 hours.	Observations.
White pith of Elder	17°	0·0	The yeast was spread on unsized paper, and suspended in the air of the apparatus.
Wood of oak, in fine chips	17	0·0	
Carrot	17	0·8	
Fresh alburnum of Elder	17	4·5	
Do. do. of Horse-chestnut	18	5·0	
Root-fibres of Groundsel	17	5·5	
do. of Mercurialis	17	7·0	
Boletus aureus	18	7·5	
Yeast, of the consistence of paste	15	14·0	
Yeast, washed with distilled water	18	20·0	

According to these experiments (in which the volume of the organ respiring is taken, for comparison sake, as the unit), those portions of plants deprived of living azotized matter carry on no respiratory act, whilst those which, like very slender fibrils, alburnum, fungi, yeast, &c., are richly furnished with it, fulfil that function the more actively in direct proportion with the quantity secreted or deposited. It is worth remarking that seeds and fruits, although rich in proteine matters, produce only a minimum quantity of carbonic acid; but this at the same time is explicable on account of those substances being coated by dense envelopes, rendering them scarcely permeable by the oxygen, and of their relative volume as compared with their very small surface. These obstacles to their respiratory activity are, however, indispensable to their normal development; for otherwise neither starch, nor oil (so necessary to the germination of the young embryo), nor pectine, nor sugar, nor the ligneous deposits of fruits could be produced, if the carbon, the essential element in their formation, were consumed. A proof that this assertion is true is furnished by the analyses of M. Boussingault, which prove that fruits and seeds so placed as to facilitate the action of oxygen, and thereby to stimulate and promote the vital movements of the nitrogenous matter, carry on a respiratory function and are deprived of a great part of their carbon without any loss of their nitrogen.

The proteine material of plants exerts on the respiratory pabulum laid up a similar action to that which animal substance exercises on the same matter, and in such a manner that the more an organ is permeable to the air, and rich in nitrogenous material, the less will be the quantity of starchy, oleaginous, and saccharine products it accumulates. This circumstance may be illustrated in the case of fibrils, young leaves, petals, stamens, and the herbaceous stems of vegetables when forced to exuberant growth by manures. The contrary obtains in proportion as the contact with oxygen is lessened, as may be seen in fruits, seeds, and bulky roots, all which are structures in which we find those starchy and cognate alimentary matters in greater or smaller quantity, or artificially accumulated in still larger proportions by preserving some portions of the plants from contact with the air (e. g. potato and beetroot).

The action exercised by the proteine matter on the pabulum for respiration, though at first having a contrary purpose, has nevertheless, when of a certain intensity, the tendency to shorten the duration of the organ in which it proceeds, or at least to diminish its consistence. For example, young fibrils, petals, stamens, fungi, &c., rapidly wither; and the stems of flax and of our cereals, when their growth is too much forced by highly nitrogenous or too abundant manure, become overturned and laid on the ground from the insufficiency of those cellulose and encrusting deposits to which under ordinary conditions they are indebted for the powers of resistence to the influence of the rain and wind.

The conclusions deducible from the facts set forward in this memoir are, that the living azotized matter seen in motion within the cells of plants unites in itself the principal attributes of that which enters into the nature of animal life: it possesses the like excitability, contractility, and elementary composition; its respiration, in all that concerns its more appreciable results, differs in no way from that of animals. But whilst the proteine matter of plants possesses in itself the composition and some of the principal functions of that found in the superior animals, it likewise possesses an assimilating force not met with except among the lowest animals, whereby it brings inorganic matters into connexion with its own proper substance and with that of animals.

[*Observations.*—The foregoing essay evinces much diligent micro-chemical research, and furnishes a valuable contribution to our knowledge of the internal economy of plant-cells. But, whilst acknowledging thus much, we are not disposed to accept the writer's interpretation of much that he describes. The marvellous internal arrangement of vessels, carrying on a circulation of fluid, radiating from the nucleus and forming a network in the primordial tunic communicating with a similar vascular apparatus in surrounding cells, appears to us a creation of the imagination misled by microscopical appearances—a resurrection of hypotheses of complicated organization in the economy of the simplest organisms, such as modern research has demolished in the case of the Infusoria. In many respects, indeed, the descriptions of M. Garreau might pass for a *réchauffé* of Schultze's romantic hypothesis of an all-wide-pervading system of laticiferous vessels throughout vegetable tissue.

Yet, though dissenting from M. Garreau's interpretation of appearances he met with, we readily admit his general accuracy as an observer. We receive his account of cord-like processes extending from the nucleus to the primordial utricle of the cell, of their variability in dimensions and in their degree of tension, and of the centrifugal and less active centripetal currents of granules passing through them; but we discover in all this no evidence of vessels ministering to a circulation properly so-called. On the other hand, we find a precise analogy to it in the internal organization of the animals of the class Rhizopoda—the Amœbeæ, Foraminifera, &c. In the thin filiform processes of the Foraminifera we observe a streaming outwards of granules from the central mass of sarcode, followed by a backward current towards it, and at the same time a variability in the volume, tension, and direction of those processes. In these phenomena, however, naturalists do not recognize the existence of a vascular system, but see in them only the illustration of vital action, or the results of the nutritive force, operating as an attracting agent and establishing currents in the nutrient juices of the organism.

We would apply these views in the interpretation of the structural arrangements seen by M. Garreau. The nucleus doubtless represents the germinating and actively nutrient centre of the cell—the formative material,—whilst the surrounding cell-wall is the completed or formed matter, added to and advanced in growth so long as the nucleus retains its formative energy and power of assimilating new material from the inorganic matters reaching it through the osmotic action of the cell-wall. As such an active agent in nutrition, the nucleus operates as a central force, whilst the process of growth of the cell-wall, or chiefly of the primordial utricle, establishes nutritive currents which will be directed towards it. Space compels us to curtail our remarks on this physiological subject, which has been well worked out by Dr. Beale in his recently published lectures, originally delivered before the College of Physicians of London.

We will, however, venture an observation on the enveloping wall of the nucleus, which M. Garreau appears to have demonstrated, by asking, How far do those apparent membranes owe their origin to the mutual reaction of the simple organic material and the surrounding fluid? Chemistry demonstrates how very materially substances are affected by the chemical taking up of water; and there is good evidence to show that organized tissue may be very greatly modified in its chemico-vital endowments by contact with water and other fluids, and that the formation of a pellicle or film around it is no proof of the histogenetic independence of this film as a tunic. These inquiries are further suggested by Auerbach's researches, according to which a membrane encloses and limits the whole simple substance or sarcode of the Amœbeæ, although all the phenomena of variability, of adhesion, and of confluence of their processes proclaim the contrary. In reference to these researches we will finally ask, Do not the very means resorted to in order to detect the existence of a limiting membrane concur to produce a pellicle which may be mistaken for the independent structure sought for?—J. T. A.]

XIV.—*Notice of a second Species of* Paragorgia *discovered in Madeira by* Mr. James Yate Johnson. By Dr. J. E. Gray, F.R.S.

Mr. James Yate Johnson, along with a large and most interesting collection of fish from Madeira, has sent to the British Museum a very fine and large specimen of *Paragorgia*.

The species on which the genus is established is found on the coast of Norway, and is the subject of an elaborate memoir, illustrated by excellent figures, by Kölreuter, in the 'Novi Commentarii Acad. Petrop.' 1758 & 1759, p. 345, tab. 13, 14, 15 & 16.

It was first described and figured by Clusius (Exotic. p. 119), who gives a good figure of the stem, and who received it from Norway.

It is well described by Pontoppidan (Norges Natuurlige Historie, i. No. 12. fig. 5). He figures two varieties, one much more slender than the other.

It is also well described and figured by Esper, Pflanzenthiere, iii. 10, t. 1 *a*, with yellow, and t. 1 & 1 *b*, with redder bark.

All these works describe the polypes as congregated in short, roundish tuberculiform branches on the large, slightly branched main stem.

The specimen from Madeira resembles the Norwegian specimens in many characters, especially in the thickness and compressed form of the main stem; but it differs from that species in being studded with numerous slender, repeatedly-divided branches, which are covered on the upper surface with numerous close, rather prominent cells, which are more abundant on certain parts of the branches, and form roundish nodules.

This species may be named *Paragorgia Johnsoni,* after its discoverer.

Hab. Madeira.

XV.—*A Revision of the History, Synonymy, and Geographical Distribution of the recent* Craniæ *and* Orbiculæ. By Lovell Reeve, F.L.S., F.G.S.

1. Crania, Retzius.

The shell of this Brachiopod was first known in a fossil state. The calcifying functions of the animal are exercised chiefly by the under lobe of the mantle, for the secretion of a thickened adherent valve, unconnected by any hinge or ligament with the upper valve; and, before the time of Linnæus, it was named *Nummus,* and sometimes *Nummulus Brattenburgensis,* "Brattenburgh money." Linnæus and Chemnitz still confounded recent and fossil specimens together; and the separation of the valves led naturalists, among whom were Müller and Montagu, to describe them as Limpets. A curious character in the adherent valve of this genus, and which seems to have attracted the attention of Linnæus, is a similitude, in the configuration of the internal muscular scars and protuberances, to a human face. A little above the centre a raised callosity, termed the rostellum, forms the nose, and the scars of the two posterior adductor muscles of the animal give the resemblance of a pair of eyes, while the anterior thickened rim serves for the outline of the cheeks and chin. This fanciful representation suggested to Linnæus the name *Anomia craniolaris;* and *Crania* was soon afterwards proposed by Retzius to separately distinguish the group.

Defrance described several fossil species of *Crania.* The first special monograph of the genus which included the recent species was made, in 1828, by M. Höninghaus of Crefeld. Since that period, the *Craniæ* have been ably studied by Sowerby, Deshayes, Davidson, and Suess; and, although little has been added to our knowledge of the species, some interesting particulars have been collected of their geographical and bathymetrical distribution and their bearings on geological phenomena. The revision which I propose to make of the synonymy will be indicated in the following analysis of the species. Only four recent species have been collected. *C. anomala,* of our own coast, the best-known species of the genus, ranges from Spitzbergen, in the north of Europe, to Vigo Bay, in the south. Here it stops.

Prof. Suess has observed that *C. anomala* ranges over this area closely, both in locality and depth of habitat, with *Terebratulina caput-serpentis*. Wherever one species is found between Spitzbergen and Vigo, the other is found also; but *C. anomala* does not pass with *T. caput-serpentis* into the Mediterranean, nor to North America; and he deduces some interesting conclusions from this, in connexion with their fossil distribution, with the view of showing the relations of their existence in time as well as in space. Another species, which I refer to Poli's *Anomia turbinata*, appears in the Mediterranean, and it was dredged in the Ægean by Prof. Forbes from depths varying between 50 and 150 fathoms. A third species, *C. rostrata*, is recorded from West Africa; and a species, which I have the pleasure of naming *C. Suessii*, has been collected by Mr. Strange at Sydney, East Australia. No *Crania* has as yet been found in the New World. *C. radiosa*, described by Dr. Gould from Rio Janeiro, proves to be an *Orbicula*, which genus is not uncommon in the waters of South and Central America.

In *Terebratula* and *Rhynchonella*, it may be as well here to mention, the natural position of the mollusk is to repose upon its back; the lower valve of the shell is the dorsal valve, and the upper or ventral valve, from which anchorage is obtained, projects over one side, like a beak, for lowering the tendons. In *Crania* the position of the mollusk is reversed; the ventral valve is undermost, and, having no need, or even space, for a tendinous anchor, the valve becomes agglutinated at once to the place of attachment. It will be observed that in the genus *Orbicula* the shell is not so closely adherent, and there is a tendinous muscle of attachment passing through a fissure in a disk of the under valve; and it has been conjectured that the same thing obtains in a rudimentary form in *Crania*, in an early stage of its development. The arms or brachial appendages of *Crania* have no internal apophysary skeleton for their support. They are folded into a pair of spiral coils, which are directed towards the concavity of the upper valve, and supported there by a central prominence, termed the rostellum, rising up between them from the lower valve. This valve, as with other adherent shells, varies considerably in thickness in different individuals of the same species, according to the nature of its place of attachment.

Synopsis of Species.

1. *Crania anomala*, Müller, Zool. Dan. vol. i. p. 14, pl. 5. figs. 1 to 7.

Patella anomala, Müller.
Anomia craniolaris pars, Linnæus.
Patella distorta, Montagu.

Patella kermes, Humphreys.
Orbicula Norvegica, Lamarck.
Crania personata, Lamarck.
Crania Norvegica, Sowerby.
Criopus anomalus, Fleming.
Crania anomala, Lovén.

Hab. North Atlantic, from Spitzbergen to Vigo Bay.

The typical form of this species is orbicular, slightly truncately squared on the posterior side, with the vertex produced into a small and rather sharp hook, a little posterior to central. On a flat surface, undisturbed in growth by any surrounding obstacles, it is of the symmetrical form just described; but where numerous specimens encumber one another, they become distorted, and, if attached in a declivitous position, acquire an abrupt convexity. Professor Suess has observed that *Crania anomala* ranges along the Atlantic seaboard between Spitzbergen and Vigo Bay, in company always with *Terebratulina caput-serpentis,* but does not extend its range with that species to North America or to the Mediterranean.

2. *Crania turbinata,* Poli, Test. Sicil. vol. ii. p. 189, pl. 30.

Anomia turbinata, Poli.
Crania ringens, Höninghaus.

Hab. Mediterranean and Ægean Seas (attached to stones and coral, at depths of from 40 to 150 fathoms): E. Forbes.

Crania turbinata is a smaller and more conical species than *C. anomala,* and the internal rostellum is less prominently developed. It is the only species inhabiting the Mediterranean. In the Ægean Sea Professor E. Forbes collected living specimens at depths varying between 40 and 90 fathoms; and dead specimens were brought up with the dredge from the depth of 150 fathoms. Poli's Mediterranean *Anomia turbinata* has been quoted hitherto as a synonym of Müller's *Patella anomala* (*C. anomala,* Lovén). The researches of recent naturalists on the geographical distribution of the northern species show that it does not extend further south than Vigo Bay.

3. *Crania rostrata,* Höninghaus, Monog. p. 3, fig. 3 *a, b.*

Hab. West Africa.

No fresh observation has been made on this species since the publication, in 1846, of Mr. Sowerby's monograph of the genus. Its habitat, Mr. Cuming informs me, is not the Mediterranean, as given by Mr. Sowerby, but West Africa.

4. *Crania Suessii,* mihi, Conch. Icon. pl. 1. fig. 2.

Hab. Sydney: Strange.

Of this interesting Australian *Crania* Mr. Cuming possesses five specimens, collected by Mr. Strange at Sydney. It comes very near to the West-African species, which has been assigned to *C. rostrata* of Höninghaus; but it is of a more convex and roughly solid growth, and the difference of habitat leaves no room for doubt on the subject. The internal posterior scars of the lower valve are obliquely ovate and somewhat isolated, whilst those of the upper valve are narrow and callosely raised. The rostellum is large and prominent. Another character consists in the presence of a delicate tinge of orange-red colour on the outer surface, quite different from the red-stained colouring of the European species.

The name of Professor Suess being especially entitled to a place in the nomenclature of the Brachiopods, I dedicate this species to him, in testimony of my high sense of the originality and value of his researches.

2. Orbicula, Sowerby.

A genus with the name *Orbicula* was founded by Lamarck for the reception of a northern Brachiopod, *Patella anomala*, Müller, which proved to be *Anomia craniolaris* pars, Linnæus, and the type of Retzius's genus *Crania*. A Mediterranean *Crania*, *Anomia turbinata*, Poli, was considered synonymous, but it has just been shown to be distinct. On meeting with the first-discovered specimen of the group under consideration, Lamarck created a genus, *Discina*, for its reception; while Sowerby confounded it with the northern *Crania*, of which Lamarck had made an *Orbicula*. Sowerby, Broderip, and Deshayes, out of all this confusion, adopted *Orbicula* for the Brachiopods of which we are treating; and it appears to me unnecessary to set aside their decision.

The shell of *Orbicula* differs from that of *Crania* in the very important particular of having the under valve thin and horny, furnished with a disk, in which is a slit for the passage of a pedicle of attachment. The disk is subcentral, more or less inclined to be posterior, and corresponds in position with the vertex of the upper valve. In some species the vertex is posterior, and the disk is also posterior; in others the vertex is a little posterior to central, and the disk is also a little posterior to central. That is the natural symmetrical growth of the shell on a plane surface; but if the animal adheres to a declivitous surface, the disk and vertex, which, on a plane surface, would be subcentral, press more posteriorly; and if the surface be hollow, the under valve is more convex, and the vertex and disk more central.

Seven species of *Orbicula* are now known. We have none in the European seas. The original species, found among ballast on the roads (*O. ostreoides*), is supposed to be a native of the shores of North or West Africa; and there is a small species (*O. stella*) in the Eastern Seas. The rest are inhabitants of the New World, where *Crania* is unknown. *O. stella* has an analogue in the West Indies in *O. Antillarum*, and an allied representative, of more solid growth, in *O. Cumingii*, which ranges along the western coast of America, from Peru to Guatemala, and reaches to Mazatlan. The most striking type of the genus is that represented by three species on the coast of Peru, but not extending northward to Central America—*P. lamellosa, lævis,* and *tenuis,* of the last of which Mr. Cuming possesses specimens, strange to say, from South Australia.

Synopsis of Species.

1. *Orbicula ostreoides,* Lamarck, Anim. sans Vert. 1819, vol. vi. part 2. p. 237.

Discina ostreoides, Lamarck.
Orbicula Norvegica, Sowerby, in Linn. Trans. 1822 (not of Lamarck).
Orbicula striata, Sowerby, in Thes. Conch. 1846.
Crania radiosa, Gould.
Orbicula Evansii, Davidson.

Hab. North-west Africa? (in crevices of brown oxide of iron).

This species was originally named *Discina ostreoides* by Lamarck, from a specimen sent to him, in 1819, by Mr. James Sowerby, father of Mr. G. B. Sowerby, sen., who described it the following year, in a paper read before the Linnean Society (but not published until 1822), as *Orbicula Norvegica.* He had discovered it in abundance in the crevices of a quantity of ballast stone (brown oxide of iron) used in the neighbourhood of Lambeth for mending the roads. Mr. Sowerby makes no mention in his monograph, published twenty-four years later in his son's 'Thesaurus Conchyliorum,' of having described this species as *O. Norvegica,* but names it for the first time *O. striata,* although he bears testimony to its being the species on which Lamarck founded his genus *Discina.*

I am of opinion that Mr. Davidson's *O. Evansii* is a specimen of *O. ostreoides* in which the vertex of the upper valve and corresponding disk of the lower valve are more central than usual, owing to the shell's position of attachment in the hollow grooved crevice of the iron-stone; and the lower valve is more convex for the same reason. The type-specimen of *O. Evansii* is exactly like distorted specimens of *O. ostreoides* jammed within the crevices of the iron-stone. At first I fancied that the habitat Bodegas, California, given by Mr. Davidson for *O. Evansii,* on the authority of Mr. Cuming, might be a mistake; but it may be remembered by those who have studied the phenomena of geographical distribution that the fauna of the West-African sea north of Sierra Leone, whence *O. ostreoides* is supposed to have come, is in part identical with the fauna of the seas of California and the West Indies. Our British *Phasianella pulla*, which ranges southward to West Africa, appears also in the West Indies; and when preparing my monograph of *Terebra* in 'Conch. Iconica,' I had no hesitation in declaring that *T. variegata, Africana, Hupei, intertincta, marginata, albocincta, Hindsii,* and *subnodosa,* described by various authors from the mouth of the Gambia, Senegal, Mazatlan, and California, are all varieties, and but slightly varying varieties, of one and the same species.

2. *Orbicula stella,* Gould, Exped., Shells, Proc. Bost. Soc. 1846; Otia Conch. p. 120.

Discina stella, Gould.

Hab. China Seas; Wilkes. Singapore and Philippine Islands; Cuming.

This species has a wide distribution in the Eastern seas. On comparing authentic specimens received from Dr. Gould, collected in the China Seas by Wilke's Exploring Expedition, I find them identical with specimens, attached to fragments of *Pullastra, Pinna,* and *Malleus,* collected by Mr. Cuming at Singapore and at the Philippine Islands. The sculpture varies in strength. In young specimens, as stated by Dr. Gould, the radiating striæ are scarcely developed; in older specimens, that have had to contend with irregularities in their place of attachment, the sculpture has a minutely latticed character, like the grain of a thimble. The under valve is thinly membranaceous, or thicker, concave or convex, according to circumstances of habitation; and the position of the slit obviously varies with the position of the vertex in the opposite valve. On a flat place of attachment the shell is symmetrically orbicular, and the vertex and subcumbent slit are nearly central; but when attached to a sloping or declivitous substance, the vertex is pressed to one side, and the slit of the under valve follows the same direction.

3. *Orbicula Antillarum,* D'Orbigny, Moll. Hist. Cuba, 1853, p. 368, pl. 28. figs. 34–36.

Hab. Cuba, Martinique.

Mr. Cuming possesses specimens of *O. Antillarum,* both from Cuba and Martinique, in all of which the vertex is inclined posteriorly, while the shell is less cancellated than in the Eastern *O. stella*; but the shells are wonderfully alike in their general aspect.

4. *Orbicula Cumingii*, Broderip, Proc. Zool. Soc. 1833, p. 124.
Orbicula Cumingii and *strigata*, Broderip.

Hab. Central America, dredged at Payta, St. Elena, Panama, and Isle of Caña, Guatemala, attached to the lower side of stones in sandy mud at low water, and, in some instances, at depths of from 6 to 18 fathoms: Cuming. Ecuador: D'Orbigny. Mazatlan (attached to various shells): Carpenter, in Cat. Reigen Collection.

Mr. Broderip's *O. strigata*, which he did not describe along with *O. Cumingii* in the 'Proceedings of the Zoological Society,' but afterwards, when figuring the *Orbiculæ* in the 'Transactions,' is a less-worn state of the species, in which there are rays and bands of colour. The upper valve is calcareous and firm, of quite a different type from the horny *Orbiculæ* of Chili and Peru. The habitats Malacca and Philippine Islands, given with this species by Mr. Sowerby, are erroneous. He probably mistook specimens of *O. stella* for it.

5. *Orbicula lævis*, Sowerby, Trans. Linn. Soc. 1822, vol. xiii. part 2. p. 468, pl. 26. fig. 1 *a, b, c, d*.

Hab. Concepcion, Chili (found attached to *Mytili* at the depth of 6 fathoms): Cuming.

O. lævis was first described by Mr. Sowerby in a paper read before the Linnæan Society in 1820 (but not published till 1822) from a specimen attached to a grey flint pebble nearly coated by the root of an *Isis*, of which the habitat was not known. Twelve years later, the species was found attached to *Mytili* dredged by Mr. Cuming at Concepcion, Chili. It is a stout horny shell, with the surface smooth and faintly malleated. The vertex, which inclines much posteriorly, is conically raised, swollen, and rather obtuse.

6. *Orbicula tenuis*, Sowerby, Thes. Conch. vol. i. p. 366, pl. 73. fig. 4.

Hab. Chili: Cuming. South Australia.

Compared with the preceding species, *O. tenuis* is thinner, rounder, and more depressed. The original group of specimens was collected by Mr. Cuming on the coast of Chili; but he possesses specimens of an *Orbicula* of a lighter and more glossy substance, which is perfectly identical with this, from South Australia.

7. *Orbicula lamellosa*, Broderip, Proc. Zool. Soc. 1833, p. 124.

Hab. Iquiqui and Bay of Ancon, Peru: Cuming.

This very characteristic species, as related by Mr. Broderip, was found by Mr. Cuming in groups, the specimens being in many instances piled in layers one over the other, on a sandy bottom, at a depth ranging from 5 to 9 fathoms. At Ancon they were found attached to dead shells, and also clinging to the wreck of a Spanish vessel of about 300 tons, that went down in the bay about ten years before. The sunken timbers (for the sheathing was gone to decay) were covered with these shells, much in the same way that beams on land are sometimes infested with parasitic Fungi. At Iquiqui they were taken adhering to a living *Mytilus*.

Figures of the type-specimens and groups of *Crania* and *Orbicula* will appear in the forthcoming thirteenth volume of the 'Conchologia Iconica,' to be published in the course of a few days.

XVI.—*On* Ephedra.

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

[Continued from vol. ix. p. 437.]

It has been the opinion of many botanists that the existence of annularly dotted vessels in the wood of the *Gnetaceæ* affords evidence of their close affinity with the *Coniferæ*; but even if this had been true, it would have claimed, on its own merit, a very secondary importance, since we find such vessels also in the *Winteraceæ*, *Canellaceæ*, *Schizandraceæ*, &c. Dr. Lindley says of *Gnetum* that its wood "is composed of woody fibres and of annular and reticulated vessels lying scattered sparingly among tubes of woody fibre"*. He says also that its wood is zoneless. These circumstances led that eminent botanist to conclude that the *Gnetaceæ* are very distinct from the *Coniferæ*, forming a link between *Taxineæ* and *Piperaceæ*: this, at least, was his opinion in 1834, although other considerations induced him afterwards to modify his view of the place of this small family in the system. I have noticed, however, that the wood of *Ephedra* is regularly zoned, as in other exogenous plants; for a transverse section of a branch of *Ephedra Andina* which I possess shows five distinct concentric rings, the intervals between the medullary rays exhibiting numerous longitudinal hollow air-cells. The branches of *Gnetum*, on becoming dry, separate readily at the nodes by distinct articulations; but such separation rarely takes place in *Ephedra*. On the other hand, a longitudinal section of a new branch of the latter genus shows that the central pith of one internode is not continuous with the pith of the next internode, nor with that of their accessory branchlets;

* Bot. Reg. vol. . pl. 1086.

for the ligneous fibres of the several internodes which enclose the pith, and which constitute the wood, all converge to form a sort of plexus or solid diaphragm across each node, much after the manner of the stem of a *Bambusa*.

This pith is quite homogeneous, consisting of oblong, square, parallel cells (hexagonal in their transverse section), with very thin transparent walls, which are pitted with few, minute, opake dots. The wood is hard, formed of fine, simple, indurated fibrous tissue, closely compacted; these longitudinal fibres, under a powerful microscope, appear marked by dark glands lying across them at irregular distances, which are either transversely linear or oblong, thus giving them almost a scalariform appearance, the walls themselves being pitted with minute and almost invisible specks; these are crossed by very numerous transverse medullary rays of similar structure, which extend from the pith to the bark. In the first two or three rows of the longitudinal fibres or ducts next the pith, the markings are so very close that they have much the appearance of uncoilable tracheæ; but I have nowhere been able to find any true spiral vessels. Interspersed among the longitudinal woody fibres, are the many hollow air-tubes before mentioned, of three or four times their diameter, which appear uninterrupted throughout the entire length of the internode: their walls are extremely thin and translucent; and it is upon these only that we find the large circular spots (apparently fenestrations), which are well shown in Lindley's 'Introduction,' pl. 2. fig. 7. It will hence be seen that there is no analogy between this structure and that of the *Coniferæ*, where the annular disks, which so conspicuously mark the Gymnospermous families, are always found upon the ligneous fibres themselves, and not upon the air-passages, as in *Ephedra*. The structure is equally different from that of the young branchlets of *Casuarina*, where the pith crosses the nodes and is continuous throughout the branches.

There is a peculiarity in the bark of *Ephedra* that may be worth recording: it is filled with strong ligneous fibres, as in *Urticaceæ*, which, being always united in bundles, give rise to its finely striated surface; it is covered by a thick, tough epidermis, of the texture of parchment, and which follows the sinuosities of the striatures. Upon the ridges of the striæ a number of prominent horny excrescences occur, which occasion its scabridity; and in the hollows between the ridges are seen a number of black longitudinal specks, which appear almost like stomata that have become closed by a deposit.

Thus far it has been endeavoured to show that the order *Gnetaceæ* is not allied to any of the Gymnospermous families, with which it has been associated by most botanists. It will now be necessary to pass in review the points of analogy that exist between it and other exogenous orders, in order to judge of its true affinities.

Blume, when he founded the order, as before stated, suggested the relationship of the *Gnetaceæ* with *Casuarina*, to which genus it certainly offers many points of approximation. *Casuarina* resembles *Ephedra* in the following particulars:—in the vaginant sheaths that encircle the nodes of its branchlets, where they occupy the place of leaves; in its spicated inflorescence, with diclinous flowers; in the persistence of the involucral leaflets, which afterwards enclose the fruits; in its bifid perigonium, even more deciduous than that of *Ephedra*, for it is carried away by the stamen as it grows upward in the act of æstivation; in its solitary stamen, very analogous to that of *Gnetum*; in its one-celled ovary, with an ascending ovule; and in its indehiscent one-celled fruit, with a single erect seed, containing an embryo imbedded in albumen, with a superior radicle. *Casuarina*, however, differs from both *Gnetum* and *Ephedra* in its straight, lofty, solid, woody trunk; in its ovary with two lengthened styles (being probably formed normally of two combined carpels, one of which is always abortive, and which contains two ovules); in its fruit, with a samariform epicarp, a mesocarp replete with very numerous delicate spiral vessels, and a solid testaceous endocarp; and, finally, in the development of its seed, the anomalous circumstances attendant on which have been only imperfectly understood*.

* I have examined the seeds of *Casuarina equisetifolia* many times, always with the same result; and as my analysis shows a structure very different from what is recorded of it, I will state the details. The description given by Endlicher of this structure (Gen. Plant. p. 271) is altogether incorrect. It is well known that the fruits are contained in globular or oblong strobiliform heads, each separate fruit being enclosed in a cell formed of two coriaceous valves, which are the persistent involucels of the spicated flowers, which valves stand right and left in regard to the axis. Each fruit is fixed to the bottom of its enclosure by a small basal hilum: it is somewhat samariform, oblong and compressed; the upper moiety (being a portion of the extended epicarp) forms a thin membranaceous wing; the lower moiety is thickened and smooth, consisting of an intermediate mesocarp filled with copious, white, spiral threads, and a testaceous, brittle, obpyriform endocarp, completely 1-celled and indehiscent, and containing a single erect seed, which tapers to the apex. This seed consists of two very delicate translucent membranaceous tunics: upon the outer one (testa) is seen, imbedded in it, a thickened simple cord (raphe), by one extremity of which the seed is attached to the bottom of the cell; this cord rises to near the middle of the integument, when it becomes suddenly recurved downward for a short distance, where it terminates in a darkish areole (chalaza); before its recurvature it throws out a short lateral branch or free thread, which serves as the medium of attachment of an abortive ovule at a point a little above its base, where this also is recurved upon its basal chalaza. The abortive ovule, tapering upwards, is nearly half the length of the fertile seed to which it is thus attached; it is deli-

With the *Myricaceæ, Ephedra* agrees in many points of structure, the most prominent of which are, its diclinous flowers in amentiform spikelets; its bract-like involucels; its two-lobed perigonium; its monadelphous stamens; its simple ovary, with a single, erect, atropous ovule; its one-celled fruit, with a solitary erect seed; and its embryo with a superior radicle. *Myrica* differs, however, in its habit; its alternate leaves; its perigonium in the form of two hypogynous scales, which remain and become agglutinated to the fruit; in its more distinct stamens, with anthers bursting longitudinally; in its two stigmata; and in the want of albumen in the seed. Although these points show a considerable interval in the positions of these two families, it is still evident that a notable degree of approximation exists between the *Gnetaceæ* and *Myricaceæ.*

The *Gnetaceæ,* in their jointed stems and floral structure, offer many points of approach to the *Chloranthaceæ, Piperaceæ,* and *Saururaceæ;* but the absence or depauperation of floral envelopes in those families, and the presence of a vitellus or embryoniferous process which surmounts the albumen, of which we find no trace either in *Gnetum* or *Ephedra,* are features which well characterize the above families as a peculiar group, having little connexion with the *Gnetaceæ.*

Excepting their amentiform diclinous inflorescence, there is nothing in the structure of the *Betulaceæ, Cupuliferæ, Artocarpeæ,* and other consociate families, that offers any relation with the *Gnetaceæ.*

In its aphyllous habit, its geniculated nodes, and vaginant bracts in lieu of leaves, *Ephedra* presents some similitude to *Calligonum, Pterococcus,* and *Calliphysa,* with which it accords also in its tubular petaloid perigonium, seated in the axils of a general involucre—thus approaching the structure of the *Eriogoneæ,* and more particularly that of *Chorizanthus vaginatus,* which has its stems furnished with opposite bracteiform leaflets united into a membranaceous sheath, as in *Ephedra.* The *Poly-*

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cately membranaceous, darkish brown, without the trace of any embryo within it. Upon the outer integument of the fertile seed, the white cord continues to ascend from the point of its furcature, and terminates in the apical micropyle, which is much darkened. There is no trace of any albumen within the integuments; and the contained embryo, which is not half their length, floats loosely in the upper part of the vacant space, generally with the radicle pointing to the micropyle, or at other times lying obliquely across the vacant space. The cotyledons are oval, flattened, and foliaceous, with a superior terete radicle of about half their length.

It will be seen that there is very little analogy in the whole of this singular structure to *Ephedra*; and although the orthotropous embryo lies atropously in regard to the hilum, it is amphitropous in respect to the chalaza.

gonaceæ generally, indeed, agree with the *Gnetaceæ* in their often polygamo-monœcious or diœcious flowers, in their calycinoid involucres; their petaloid perigonium; their stamens often monadelphous at the base; their usually one-celled ovary, with a single erect ovule, which (as I have shown) becomes fertilized, in the same manner as in the *Gnetaceæ,* by the direct influence of the pollen through an aperture in the apex of the cell, without the intervention of a placenta; and, finally, in their indehiscent one-celled fruit, bearing a single erect albuminous seed, covered by two regular integuments, and enclosing an embryo with a superior radicle. However remarkable these analogies may be, which are in many respects shared with the *Nyctaginaceæ,* it is impossible to place the *Gnetaceæ* in a position near these families and their allies; for the *Oleraceæ* of Endlicher form a most distinct and natural group, well characterized by the peculiar feature of a curved embryo placed outside of a farinaceous albumen.

Although the relationship of the *Gnetaceæ* with the *Urticaceæ* may not at first sight be apparent, still in many very essential points an analogy exists, which is well deserving of attention. The flowers in *Urticaceæ* are often diclinous, and in bracteated spikelets. It has been shown (*ante,* vol. ix. 430) that their solitary carpel, sometimes wanting a style, with sessile stigmata, has a pervious opening in the apex of its cell, through which the solitary erect ovule is directly fecundated by the pollen, without the intervention of any placenta. This erect ovule is always atropous, with two distinct integuments; and its embryo, with a small superior radicle, is enclosed in fleshy albumen. In these remarkable particulars I know of no other order that so nearly approaches the *Gnetaceæ.* On the other hand, the *Urticaceæ* are very different in habit—in their usually (but not always) alternate leaves, in the form of their inflorescence, and in the structure of the male flowers; in the latter respect, however, a degree of analogy remains, for it generally happens in these, as in *Ephedra,* that the lobes of the perigonium are opposite to those of the involucels. We find also in the inner bark of *Ephedra,* strong fibres almost as abundantly as in the *Urticaceæ*: another similar development invariably occurs in that genus, in the vaginant stipulary leaves that surround each branchlet, at the point of its origin in the axils. There is some approach in the floral structure of the *Gnetaceæ* to that of the *Urticaceæ*; that is to say, it is in both cases diclinous, the male flower in both families presenting a gamophyllous perigonium seated generally in its own involucel, or occasionally several perigonia within involucels more or less confluent with each other. It is true that in *Urticaceæ* the perigonium is often 4- or 5-partite, but it is sometimes 2- or 3-fid, with equal segments; the insertion of the stamens is invariably at the base of the tubular portion of the perigonium, as in *Ephedra*, and often the filaments are monadelphously conjoined at their base. In the tribe *Forskohleæ* the involucels of the flowers are combined into an annular cup, as in *Gnetum*; sometimes two involucels, united at the base, contain one or two florets, and then the solitary stamen is fixed in the base of the perigonial tube, without any vestige of an ovary, as in *Gnetum*. I have stated these numerous points of coincidence in order to show that, when we take into consideration the sum of their characters respectively, a greater approximation will be found to exist between these two families than has been imagined: in the present imperfect state of our knowledge, their juxtaposition in the system cannot be safely established; for the *Gnetaceæ* require a more careful examination. Much additional information may be expected from the promised description, by Dr. Hooker, of the new and curious genus *Welwitschia*, which, I have no doubt, will tend greatly to elucidate the question of the true affinities of this family.

Meyer has classed the different species of *Ephedra* in two sections,—the one, *Plagiostoma*, where the summit of the tubillus is obliquely ligulated or unequally two-lobed; the other, *Discostoma*, where it is truncated or enlarged in the form of a disk, the latter section comprising only two species, which are of South-American origin, *E. Tweediana* and *E. americana*. On referring to his drawing of the former species (Mem. Acad. St. Petersb. tom. v. pl. 7. fig. 9), we find there a representation of this tubillus, marked H, which shows no approach whatever to a disciform shape; and in regard to the latter species, which Meyer does not appear to have seen, Kunth describes its tubillus as he conceived it to be, a "stylus subulatus exsertus, stigma simplex;" and Richard defines the same as "rectus, tubulosus, ostiolo oblique sub-4-lobo." In all the specimens of *E. Tweediana* that I have seen, especially in those collected by myself, the tubillus is straight, in no degree enlarged at the apex, and generally lacerated; but, when uninjured, I have found it shortly 2-fid, with two small erect rounded lobes, differing in no respect from what is observable in his section *Plagiostoma*. I therefore consider that such a division of the genus, founded upon the character assumed, is not maintainable.

I have expressed a doubt (*ante*, vol. ix. 426) of the truth of the general belief that in *Ephedra* the flowers are diœcious, that is to say, that the male and female flowers are always upon distinct plants. I have stated the impression entertained by me when in Chile, that both sexes exist on the same plant, if not in the same spikelets: in support of this, my drawing of *Ephedra bracteata*, made nearly forty years ago, showed fruits upon one of the lower branchlets, while all the upper ones exhibited male flowers only; but I was unwilling to place much reliance on that circumstance at this distance of time, as all my specimens were lost. I have, however, lately noticed a confirmation of this fact in a specimen, now existing in the Hookerian herbarium, of the same species, where most of the ramifications have their floral branchlets terminated by ripe fruits, while in a lower part is another branchlet charged with a spikelet of male flowers. Kunth also corroborates a similar occurrence in *Ephedra americana*: in that species, he states that each axil produces a cluster of four spikelets, three of which consist of male florets, while the other contains two female flowers; for he adopted the view of Richard in considering the pericarp of each achenium as the indurated perigonium, and the enclosed seed with its tubillus as the ovary surmounted by its style. It is still a matter of doubt whether the two achenia generally associated in the apex of a spikelet are produced from one or two florets. I am inclined to think the latter, because it is more in analogy with the position of the male florets. Meyer describes four species from Southern Europe and Mauritania, where the fruit is constantly solitary in each spikelet: this, perhaps, is merely the result of the abortion of one of the florets.

Careful observations on the progressive growth of the plants, made in their living state, are required to clear up these several doubts, and to complete the history of *Ephedra*. The following diagnosis of the genus is based wholly upon my own observations of the South-American species here described.

Ephedra, Tournef.—*Flores* unisexuales; sed dubitandum est, si sexus singuli in diversis plantis, vel in diversis ramis, vel in eadem spica orti sint: certissime ♂ in axillis spicarum enati, mox decidui, ♀ semper terminales et forsan in eadem spica tardius oriundi.—*Flores* ♂ in spica amentiformi imbricato-involucrata plurimi; *involucellum* singulum bracteiforme imo cum opposito in vaginam brevem coalitum, ovatum, erectum; involucella hoc modo per paria nexa, decussatim imbricata et 4-faria, singula 1-flora. *Perigonium* intra quodque involucellum unicum, e basi ortum, petaloideum, coloratum, turbinato-tubulosum, compressum, limbo 2-labiato, labiis (antico et postico) rotundatis, æstivatione imbricatis, posteriore exteriore, mox deciduum. *Stamina* monadelpha, cum perigonio decadentia; *filamenta* in columnam fistulosam compressam apice dentatam aut breviter fissam perigonio æquilongam vel longiorem connata; *antheræ* 3 ad 12, tubi dentibus vel filis brevissimis crebriter basifixæ, ovatæ vel oblongæ, erectæ, 2-lobæ, 2-locellatæ (lobis sine connectivo collateraliter adnatis), poris

2 apicalibus rarissime transversim connexis dehiscentes. *Pollen* globosum, vel ellipticum, 8-sulcatum. *Ovarii* vestigium nullum.—*Florum* ♀ partes ignotæ. *Achenia* 2 distincta, rarius solitaria, summo spicæ amentiformis (ei ♂ similis) affixa, involucellis omnino vel semi-inclusa, oblonga, subcompressa, plano-convexa, collateralia, erecta. *Pericarpium* siccum, coriaceum, glaberrimum (*mesocarpio* fibrillifero), indehiscens, apice glandulæforme pro tubilli transitu pervium, uniloculare. *Semen* unicum, basi affixum, loculo paulo brevius, apice acutum; *integumenta* 2, simplicia, ab imo usque ad medium coalita et membranacea, dehinc superne libera et distincta *testa* tegmine valde brevior, ore lato aperta; *tegmen* superne opacius, crassius, sæpe corrugatum, apice glandula carnosa majuscula clausum; *tubillus* e centro glandulæ productus, erectus, elongatus, per foramen pericarpii prolatus, et sæpe longe exsertus, filiformis, teres, fistuloso-membranaceus, persistens, apice irregulariter laceratus aut breviter 2-labiatus, labiis aut brevibus concavis et subæqualibus, aut inconstanter inæqualibus; *hilum* cum *chalaza* basali confusum, substipitatum; *raphe* nulla; *albumen* oblongum, compressum, obpyriforme, carnosulum, apice ad glandulam adhærens, embryone paulo longius; *cotyledones* oblongæ, compressæ, subfoliaceæ; *radicula* teres, supera, hilo contraria, cotyledonibus æquilonga vel dimidio brevior et earum sexta parte latitudinis.

Suffrutices *cosmopolitani, e basi ramosissimi, erecti, humifusi vel alte scandentes*; ramulis *teneribus, sæpius virgatis, oppositis, ternis, aut fasciculatis, in axillis nodosis*; folia rudimentaria 2, *opposita, vel plura, primum in vaginam brevem amplexicaulem apice 2–3–4-fissam coalita, demum sæpe disjuncta;* flores *parvi, spicati;* spicæ *parvulæ, in axillis sessiles, solitariæ, binæ aut plures glomeratæ,* vel in ramulum *brevem terminantes,* involucellis *viridibus,* perigonio *sæpius aurantiaco,* columna staminali *viridescente,* antheris *læte flavis.*

[To be continued.]

BIBLIOGRAPHICAL NOTICES.

The British Ferns. By Sir W. J. Hooker; *with Drawings by* W. Fitch. 8vo. London: Reeve, 1861.

A work on the British Ferns from the pen of our great botanical chief, and illustrated by the pencil of one of our best floral draughtsmen, must attract general attention. We feel sure that a reference to it will always supply some information, accurate in its facts and correct in its delineation. Of course we must not expect too much: the pen of the author cannot go beyond the knowledge which he possesses, nor the pencil of the artist convey information not afforded by the specimen before him. Here, at any rate, what we do get is perfectly trustworthy.

The term Ferns is intended to be understood in the Linnæan sense, as including *Filices, Equisetaceæ, Marsileaceæ,* and *Lycopodiaceæ.*

The plates are 66 in number, and to each of them a single leaf of letter-press is devoted. This latter contains a specific character for the species, a tolerably complete collection of references and synonyms, and some account of the plant, especially of its range in foreign countries; but no description. It does seem to us that a little less detail in the geographical part of these remarks (seeing that the author has given or is about to give them even more fully in his valuable 'Species Filicum'), and a tolerably complete description from his experienced pen, would have rendered the book more acceptable to the class for which it is intended. The majority of the collectors and cultivators of British Ferns would have been satisfied with a general statement on the former of these subjects, but do want the latter, and will be disappointed at not finding it. Also, an occasional discussion of the specific distinctions, real or supposed, between the allied plants would have added greatly to the value of the work. Almost all persons except professed botanists will probably now use the book for its plates alone; and concerning these it is not easy to use too strong terms of praise. They are incomparably the best representations of our ferns that have appeared. In some few cases, where a frond was too large for complete representation on the page, we should have liked to see a reduced drawing of it appended, so as to convey to the inexperienced an idea of its general aspect. For instance, *Polypodium alpestre* does not furnish to us a clear idea of the appearance of that elegant plant; also, a plate of the remarkable form or species called *P. flexile* by some authors might well have been given. It is true that a little scrap of *P. flexile* is drawn on the plate, but that is far from conveying the information required.

The two *Woodsias* are beautifully represented; and these plates fully confirm the now prevalent belief that there are really two species in Britain. They represent finer specimens than we have ever seen in this country—a fact that should be borne in mind by students, who have to learn to appreciate their differences when gathered in the very diminutive states in which we usually find them. It is then often far from easy to distinguish them; and we much wish that our eminent author had stated the best mode of doing so with tolerable certainty. Even the plates given by Sowerby in 'English Botany' and 'The Ferns' represent fronds which are larger than the usual wild state of the plants.

We cannot help suspecting that the venation is incorrectly drawn in the case of *Nephrodium cristatum.* Both Newman and Sowerby give a much more complicated structure to it; and, indeed, some authors have laid considerable weight upon its being greatly branched, as a character to distinguish this plant from its near allies. The *Lastræa spinulosa, L. dilatata,* and *L. æmula* of authors are considered as one species, under the name of *Nephrodium spinulosum.* It certainly seems to us that they form three well-marked species, of which good plates are here given. A plate of *L. dumetorum* seems unnecessarily introduced; for it is surely nothing more than a young state of *L. spinulosa*: it here figures as a variety, on an equality in rank with the three above-named plants. Some remarks upon *L. uliginosa* would have been acceptable; for it is one of the most obscure of our plants, and the mature opinion of Sir W. Hooker concerning it would have been highly valuable; but it is passed over almost without notice. Whilst combining these three well-marked plants, as we think them, our author doubtfully separates, as a species, the *L. remota.* If it is true that hybrids occur in Ferns, we should be inclined to consider *L. remota* as one, having for its parents *L. spinulosa* and *L. Filix-mas.* If our information is correct, very few plants of it have been found.

Cystopteris alpina is another plant which might well have been omitted; for certainly it has no claim to be considered as a native of this country.

Hymenophyllum Wilsoni is very properly kept separate from *H. Tunbridgense,* and also from *H. unilaterale.* We are unable to understand the difficulty which some persons seem to find in distinguishing the *H. Tunbridgense* from *H. Wilsoni.* As our author most justly remarks, "It is hardly possible to see the two kinds . . . . . . growing frequently on the same rock, in separate patches, yet maintaining their respective characters, without being satisfied of their being really different."

The figure of *Isoëtes lacustris* is by far the best that we have seen. It represents the larger spores in a highly satisfactory manner, and so as to show the remarkable difference between them and the spores of the *I. echinospora,* which latter plant we find recorded as a native of Wales and Scotland in the new edition of Babington's 'Manual.' In all probability, Sir W. Hooker knew nothing of the existence of *I. echinospora* in Britain; for we believe that it was first announced by M. J. Gay in the 'Bulletin de la Société Botanique de France,' either late in 1861 or at even a more recent date.

There is a beautiful plate of the Guernsey form of *Isoëtes Hystrix,* under the name of *I. Duriæi.* We have the authority of M. Durieu for stating that the Guernsey plant is *I. Hystrix.* It has fewer of the singular persistent woody leaf-bases (phyllopodes) than are found on specimens from Algeria; but such is also the case with the *I. Hystrix* of France. It is at once known by its comparatively smooth (very slightly tubercled, "très-finement réticulés") macrospores—the oophoridia of Hooker. These are well figured by Fitch, but are erroneously described as "strongly granulated." We possess authentic specimens of these plants, and are quite convinced that *I. Hystrix* is the correct name of that which grows in the Channel Islands: but our opinion is of no consequence; for M. Durieu is the very highest authority in this curious genus, and his determination, even if it had not agreed with our own, would be conclusive.

And now we conclude our notice of this valuable addition to our botanical literature, merely adding that, if any of the plates can be selected as especially admirable, they are those of the *Equiseta*, which it seems to us that it would be impossible to surpass.

We need scarcely add that we strongly recommend the book to our readers.

Catalogue of a Collection of American Birds belonging to PHILIP LUTLEY SCLATER, M.A., Ph.D., F.R.S., Sec. Z.S., Editor of 'The Ibis.' Illustrated by 20 Plates. 8vo, pp. 338. London: Trübner & Co. 1862.

Of late we have heard so much respecting the number of acres which model museums of natural history are said to require for their proper exhibition, that it may astonish some of our readers to learn that one of the most extensive collections in existence, illustrating the ornithology of the New World, is "arranged with the greatest ease in *ten* small cabinets measuring about 2 feet 1 inch by 1 foot 6 inches, and 3 feet in height." Such, however, is the case with that of Dr. Sclater, who has just published, under the title above quoted, an admirable list of his treasures, which will be found indispensable to those who are interested in that branch of study. This collection contains, we are told, about 4100 specimens, representing 2170 species, and is consequently among the largest ever brought together by any private person. The readers of these pages need not be told that the energetic proprietor of this comprehensive half-score of cabinets is one of the first ornithologists living; and the publication which we now briefly notice is well calculated to increase his reputation.

A work of this character, if reviewed at all, ought to be taken (as Napoleon defeated his antagonists) in detail; we therefore abstain from further comment, only observing that the synonymy of the species, and what is of no less importance, their geographical distribution, appears, as far as we are able to judge, to have been elaborated with great care. We will, however, take this opportunity of enforcing the growing conviction among naturalists, that the practical use of a zoological museum is commensurate with its adaptation for *real work*, and, consequently, that its true value, from that point of view, consists in its capability for being readily consulted. This condition is only to be obtained by a series of *unmounted* skins, such as that which forms the collection of the talented Secretary of the Zoological Society of London, and the abundant wealth of which this Catalogue is intended to reveal to the ornithological public.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

June 19, 1862.—Major-General Sabine, President, in the Chair.

"Anatomy and Physiology of the Spongiadæ." Part III. By J. Scott Bowerbank, LL.D., F.R.S.

This paper is the third part of the Anatomy and Physiology of the Spongiadæ. The author, after pointing out the inefficiency, or rather the non-existence of a definite arrangement of species of sponges, proposes to establish a series of orders, suborders, and genera, the distinguishing characters of which are to be founded on the structural peculiarities of the various organs of the animals which have been described in detail and named in the first and second parts of the paper. The term Amorphozoa, proposed by De Blainville as a designation of the class, is rejected, as all sponges cannot be considered as shapeless, many genera and species exhibiting much constancy in their forms, while that of Porifera, proposed by Dr. Grant, is adopted, as the porous mode of imbibition of nutriment is universal in this class of animals. The author also agrees with Dr. Grant in dividing the class into three great orders, dependent on the nature of the substances of which the skeletons are constructed. These three great divisions are designated by Dr. Grant in the following order:—1st, Keratosa, having skeletons of horny structure, with few or no siliceous spicula; 2nd, Leuconida, the skeletons composed of calcareous spicula; and 3rd, Chalinida, the skeletons constructed of siliceous spicula. The author, for reasons stated in detail in the paper, proposes to change the order of this arrangement, placing the calcareous sponges first, under the designation of Calcarea. The siliceous sponges are placed second, and designated Silicea, while the first order of Dr. Grant, Keratosa, is placed last. With these exceptions of arrangement and designation, the orders are essentially those established by Prof. Grant in his "Tabular View of the primary divisions of the Animal Kingdom."

The first of these orders (Calcarida) has hitherto been represented by the genus *Grantia* only; but as the genus as established by Fleming contains sponges having very differently constructed skeletons, the author has divided the whole of the species of calcareous sponges that have been named and described into the four following genera, *Grantia, Leucolenia, Leuconia,* and *Leucogypsia,* in accordance with four distinct types of skeleton-structure which are found to exist among the sponges originally arranged under the genus *Grantia* of Fleming.

The second order, Silicea, is very much more extensive than that of Calcarea, and, from the striking varieties it affords in the construction of the skeletons, it allows of a subdivision into seven suborders. The first of these consists of sponges having spiculo-radiate skeletons, and contains thirteen genera, as follows:—*Geodia, Pachy-*

matisma, *Ecionemia*, *Alcyoncellum*, *Polymastia*, *Halyphysema*, *Tethea*, *Halicnemia*, *Dictyocylindrus*, *Phakellia*, *Microciona*, *Hymeraphia*, and *Hymedesmia*.

The second suborder consists of spiculo-membranous sponges; it consists of one genus, *Hymeniacidon*. The third has spiculo-reticulate skeletons; it contains four genera, *Halichondria*, *Hyalonema*, *Isodictya*, and *Spongilla*. The fourth suborder has spiculo-fibrous skeletons; it contains two genera, *Desmacidon* and *Raphyrus*. The fifth suborder has compound reticulate skeletons; it has but one genus, *Diplodemia*. The sixth suborder has solid siliceo-fibrous skeletons; it contains one genus, *Dactylocalyx*. The seventh suborder has canaliculated siliceo-fibrous skeletons, and contains one genus, *Farrea*.

The third order, Keratosa, is also divided into seven suborders. The first, consisting of solid non-spiculate kerato-fibrous skeletons, is represented by one genus, *Spongia*; the legitimate type of the genus being the cup-shaped and finest Turkey sponges of commerce. The second suborder has solid semi-spiculate kerato-fibrous skeletons; it contains at present but one genus, *Halispongia*; the types of which are the coarse massive sponges of commerce from the West Indian Islands. The third suborder has solid, entirely spiculated kerato-fibrous skeletons; it has one genus, *Chalina*: the type of this genus is one of the commonest of the British sponges, *Halichondria oculata* of Johnston. The fourth suborder is characterized by having simple fistulo-fibrous skeletons; it contains one genus, *Verongia*. The fifth suborder contains sponges which have compound fistulo-fibrous skeletons, and is represented by the genus *Auleskia*. The sixth suborder consists of sponges having regular semi-areno-fibrous skeletons, and is represented by the genus *Stematumenia*. The seventh suborder has irregular and entirely areno-fibrous skeletons; it is represented by the genus *Dysidea*. The whole of these genera (those previously established as well as the new ones proposed by the author) have been characterized in accordance with their anatomical structures.

The author concludes his paper with a dissertation on the discrimination of species, and a general review of those portions of the organization that may be applied with advantage to their scientific description,—the principal sources for this purpose being:—1st. The spicula. 2nd. The oscula. 3rd. The pores. 4th. The dermal membrane. 5th. The skeleton. 6th. The interstitial membranes. 7th. The intermarginal cavities. 8th. The interstitial canals and cavities. 9th. The cloacal cavities. 10th. The sarcode; and 11th. The ovaria and gemmules. And, finally, directions for the examination and preservation are given, with a few examples of the mode of specific description proposed by the author.

ZOOLOGICAL SOCIETY.

February 11, 1862.—Dr. J. E. Gray, V.P., in the Chair.

Note on the Gigantic Earth-worm (Megascolex cæruleus) from Ceylon. By Sir James Emerson Tennent, K.C.B., V.P.Z.S., etc.

[In 1853 the British Museum received, through Mr. Hugh Cuming, two specimens of a large Earth-worm from Ceylon, which is evidently the *Megascolex cæruleus* described by Dr. Templeton in the 'Proceedings of the Zoological Society' for 1844, p. 89.

A few days ago Sir James Emerson Tennent kindly procured from Ceylon, and sent to the British Museum, a specimen of the same worm, and, in reply to my inquiries respecting the habits and vernacular name of the animal, sent to me the following letter, which, with his permission, I lay before the Society.—John Edward Gray. *British Museum,* Feb. 11, 1862.]

"Board of Trade, Feb. 10th, 1862.

"My dear Sir,—The large Annelid which I sent to the Museum a few days ago was recently forwarded to me by the Principal Civil Officer in charge of the North-eastern Province of Ceylon; it was obtained by him from the vicinity of Trincomalie.

"My attention had frequently been attracted, during my rides through the forests in the north of Ceylon, by the heaps of earth in the shape of 'castings' thrown up and piled on the surface, often to the height of 12 or 18 inches. These occurred in low and moist ground, and chiefly in the beds of dried-up tanks shortly after they had been deserted by the subsidence of the waters. The natives assured me they were the products of huge earth-worms, which I was told often grew to the length of 2 or 3 feet, with a proportionate thickness.

"I made some efforts to obtain specimens, but, owing to the apathy of the Singhalese and their indifference to anything illustrative of animated nature, I could not succeed. One reason why I was myself less likely to come on these creatures during my rides was that the traces I saw were fresh only at the early dawn, showing that the worm worked chiefly during the night.

"Some months ago I wrote to Mr. Morris, the gentleman I allude to, at Trincomalie, and by him I have been supplied with the specimen which I have sent to the Museum. It is cut into two parts, together about 22 inches long.

"The vernacular name for them I do not know; nor is it probable that the Singhalese have given them any specific designation, other than the general term equivalent to *vermin,* which they apply to the whole tribe of minor reptiles and Annelids.

"The existence of these very large earth-worms appears to have been known to some of the French naturalists; for in D'Orbigny's 'Dictionnaire d'Histoire Naturelle' I find he has noticed the Ceylon species in the following terms, under the designation of *Megascolex*:—'On sait qu'il en existe d'assez grandes, et l'on en a rapporté des parties chaudes de l'Amérique qui n'ont pas moins d'un mètre de longueur*. Il en existe de semblables dans l'Inde; et il a été trouvé dans l'île de Ceylan une grande espèce de *Ver de terre* dont on a proposé de faire un genre sous le nom de *Megascolex*.'—*D'Orbigny, Dict. Univ. d'Hist. Nat.* vol. vii. p. 431.

"Faithfully yours,

"*Dr. J. E. Gray, F.R.S., &c.* "J. Emerson Tennent.

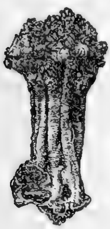
"I expect another and, I hope, a larger specimen from another district of Ceylon, which I shall be happy to submit to you on its arrival."

Description of Two New Genera of Zoophytes (Solenocaulon and Bellonella) discovered on the North Coast of Australia by Mr. Rayner. By Dr. John Edward Gray, F.R.S., V.P.Z.S., F.L.S., etc.

Among the numerous interesting animals collected by Mr. Rayner during the voyage of H. M. S. 'Herald' is a new form of coral, nearly allied to *Gorgonia*, and especially to the coral called *Cœlogorgia* by M. Milne-Edwards, but very distinct from it. I therefore send a description of it to the Society for publication in the 'Proceedings.'

Solenocaulon.

The coral coriaceous, tubular, circular, and simple below, compressed, subquadrangular, tortuous, and more or less branched above,



the branches being similar in size and form to the main stem. The main stem and branches furnished with more or less elongate, subsolid, slender branchlets, which are placed on the edge of the large holes in the main stem and branches which communicate with the main tube. These branchlets (and sometimes the branches at the base of them) are furnished with large cells for the polypes, which are placed in one (more frequently in two) series on each side of the branchlets, and sometimes the series are continued on the main stem or branches at the bottom of the branchlets. The polype-cells are rather large, circular, nearly superficial, and furnished with a cup divided into eight conical connivent lobes, each lobe being formed of some transverse spicules at the base and some obliquely-placed spicules diverging from each lateral edge towards the top above.

1. Solenocaulon tortuosum.

Hab. North Australia.

This genus seems to form a particular group of the *Alcyonaires*, which may be called after this genus *Solenocaulonidæ*, characterized by the tubular form of the axis, the tubes being formed of a thin coriaceous substance. The smaller branches are subsolid and cellular within, but they soon become hollow. It has been said that the tubular form arises from the abortion of the epithelial tissue of the centre of the axis. This may be true if we can regard the large

* A metre is $39\frac{37}{100}$ inches.

lax cells in the interior of the young branchlet as epithelial tissue; but the inner surface of the tube of the axis is quite smooth and simple, and the branchlets never become large like the main stem.

This coral cannot be considered as a solid stem becoming hollow, as the last-formed (younger) parts at the end of the branches are in the form of a foliaceous expansion, which gradually folds up together on itself, coalesces, and forms a tube nearly of the same diameter as the main stem. The large apertures which occur in the stem and base of the branches, and communicate with the central cavity, are the parts of the expanded lamina which have not been closed in when the other portions of the tube were formed.

The specimen described evidently grew in a nearly horizontal position; for one side of the main stem and branches is entirely without any cells, and the branchlets on the same side are fewer than on the other, showing that this part was beneath, and not exposed to the light. I do not give this as the generic or specific character, as it may be only incidental to the specimen—a fact that can only be determined by the examination of a larger number of examples. Mr. Holdsworth has suggested that it may be the same as or allied to *Gorgonia trichostemma* of Dana (Zoophytes, 665, t. 59. f. 3); but Dana does not describe the main stem as tubular. But the coral is, like many others in his work, so badly figured and described that it is impossible to determine with any certainty what it is intended to represent. Milne-Edwards seems to have been equally doubtful (see Coralliaires, i. 154) as to its affinities.

The genus *Cœlogorgia* of Milne-Edwards (Coralliaires, vol. i. p. 191) should be placed in the same family. It is described as arborescent, very branching, and with slender cylindrical branches with scattered, subcylindrical, elongate polype-cells. Only one species is known, viz. *C. palmosa*, from Zanzibar.

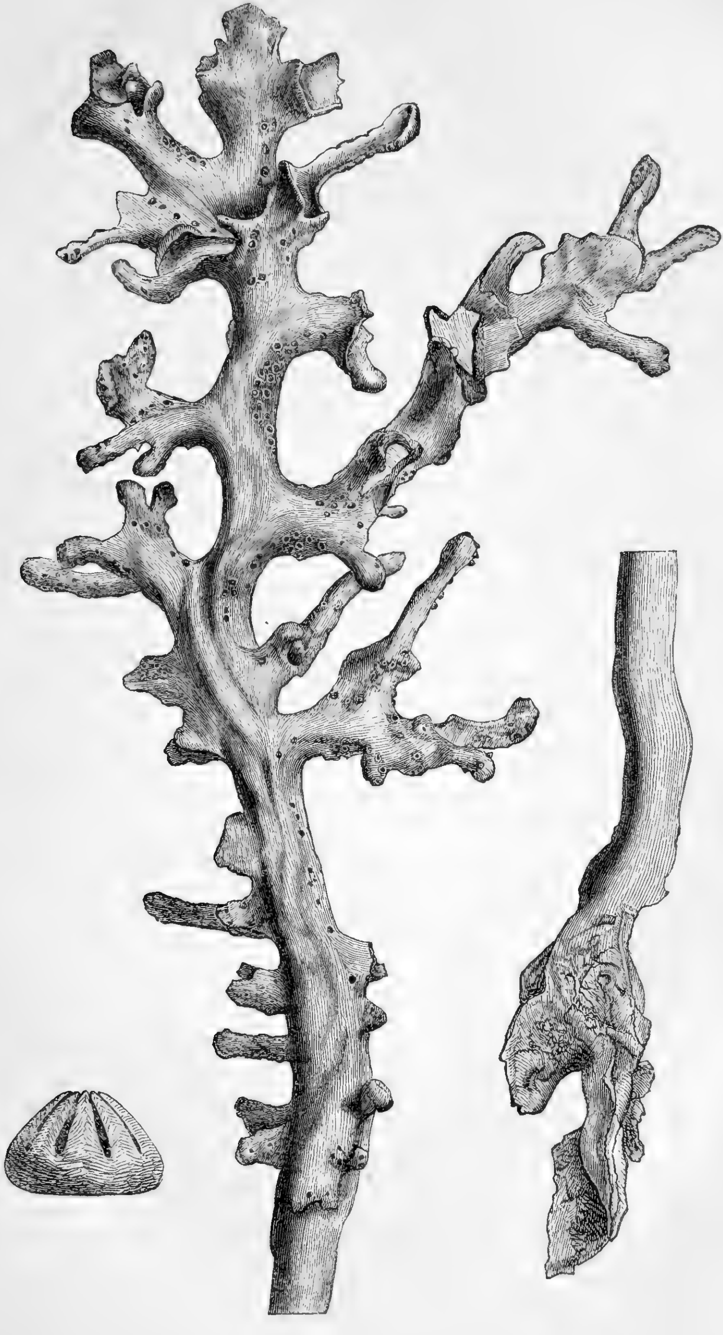
Among the specimens preserved in spirits in the same collection there is also a new form of *Alcyon*, which seems to me to be a type of a new genus allied to *Xenia*, but quite distinct from it both in the form of the cells and in the polypes being completely retractile. It has some characters in common with my genus *Nidalia*, described in the 'Proceedings of the Zoological Society,' 1835, p. 6, and figured, Radiata, Pl. III. fig. 2, but differs from it in the surface of the coral being minutely granular, and not spiculose.

Bellonella.

Coral cylindrical, formed of a number of subcylindrical tubes agglutinated together and forming at the top a hemispherical head of subcylindrical prominent cells, which are angular at the tip. The outer surface of the coral is minutely granular. The polypes are completely retractile; the base of their tubes is strengthened with very minute spicula, placed in a longitudinal series parallel to each other.

1. Bellonella granulata. (Woodcut, opposite page.)

Hab. Bellona Reefs, 17 fathoms (*T. M. Rayner, Esq.*).



March 11, 1862.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

Mr. W. H. Flower, F.R.C.S., F.L.S., Conservator of the Museum of the Royal College of Surgeons, read a memoir on the Brain of the Javan Loris (*Stenops javanicus*).

The subject of this communication was an adult female, which died in the Zoological Society's Gardens in January, 1862. In the examination of the brain every care had been taken to preserve the natural configuration of the different portions of the organ; the drawing of the upper surface had been made before its removal from the cranial cavity, and the other drawings, descriptions, and measurements were checked by comparison with a cast of the interior of the skull. The value of the descriptions and figures of the brain of *Stenops* already published had been much diminished by inattention to such precautions; and they had also had the disadvantage of being made before the researches of Gratiolet had thrown light upon the arrangement of the convolutions on the cerebral hemispheres of the higher Quadrumana. A new description, which may serve as a standard of comparison in studying the cerebral anatomy of allied forms, seemed therefore to be called for.

The following is an abstract of Mr. Flower's remarks :—

"When seen *in situ*, the two hemispheres present together an oval figure, 1·3 inch in length, and 1·05 inch across the broadest part, which is situated at the junction of the middle and posterior third of the long axis. From this point the oval gradually narrows to rather a sharp apex in front. There is no appearance of that want of symmetry, both of size and form, in the two hemispheres, described and figured by Vrolik. Projecting anteriorly to the extent of $\frac{1}{5}$ inch beyond the cerebral hemispheres are the olfactory lobes, of considerable vertical depth, but compressed laterally, and pointed in front. Projecting posteriorly is a very narrow edge of the cerebellum, most visible in the middle line, both on account of its own greater prominence at this part, and because the widening out of the termination of the great longitudinal fissure of the cerebrum allows more of its upper surface to be seen. When seen from one side, the upper contour of the brain forms a low, flattened arch, the greatest point of elevation being a little way behind the centre. The anterior or frontal lobe is much depressed, and excavated below to make room for the orbital plates of the frontal bone. The temporal lobes, distinctly marked off from the last by the Sylvian fissure, are full, and make a considerable projection downwards and forwards. The occipital lobes are short and of little vertical depth, being hollowed below for the cerebellum, the greater part of which body they cover. The sulci of the cerebral hemispheres, though few, are well marked and tolerably symmetrical. A particular description of their arrangement is given in the paper. The principal sulci correspond with those which in the higher Quadrumana have been named Sylvian, antero-temporal, calloso-marginal, calcarine, and dentate.

"On the inferior surface of the brain, the olfactory lobes in their anterior half are seen to be compressed, and of equal width almost to their termination; posteriorly they become flat, and widen out to their attachment to the under surface of the anterior lobe. The fissure of Sylvius divides them from the temporal lobe. The orbital surface of the hemisphere, as seen on each side of the olfactory lobes, is hollowed out, and presents a simple longitudinal sulcus. The optic nerves are small for the size of the brain; behind them is a prominent, round, whitish mass filling up the greater part of the interpeduncular space, in which the corpora albicantia are not clearly distinguished from the tuber cinereum. The crura cerebri are of moderate size. The pons Varolii is not much elevated; it is distinctly marked off in front, but very indefinitely separated from the medulla behind. The last-named body is broad and flat anteriorly, the median groove distinct, its other divisions but faintly indicated. The nerves appear all to rise in the situations usual in this group of animals.

"The corpus callosum is 0·65 inch long, and covers half of the anterior pair of the corpora quadrigemina. Of these bodies the anterior are the largest, they are flat and rounded in outline; the posterior are small, but very prominent. The posterior part of the fornix is very broad, covering the optic thalami, and forming a wide lamina (corpus fimbriatum) descending into the middle corner of the ventricle. The hippocampus major is of moderate size. With all the care taken, it was not possible to ascertain satisfactorily the extent to which the ventricular cavity passed into the posterior lobe; but this is a circumstance of very little importance, and varies greatly even in the same species of Quadrumana. On the other hand, it is of considerable anatomical and physiological consequence that the portion of grey matter homologous to that forming the so-termed 'hippocampus minor' of the human subject, only of proportions corresponding to the greater relative depth of the calcarine sulcus, exists in this brain, as in that of *Lemur* and *Galago* and all the true Apes.

"The brain of *Stenops* conforms closely with that of *Lemur*, both in its general form and the disposition of its surface-markings. The principal differences that were observed between them are described in the paper; and then follows a comparison of the brains of these two animals with those of the higher Quadrumana. As has been so well shown by M. Gratiolet, in his beautifully illustrated memoir upon this subject, a certain type both of general configuration and of surface-markings pervades the brain of all the *Primates*, from Man to the Marmoset. From this type M. Gratiolet excludes the Strepsirrhine Quadrumana, placing them, with the Insectivora, in a group of Mammalia whose cerebral organization he considers to be quite distinct from that of the two first families of Quadrumana. The author of the present paper finds reason to dissent from this proposition, and upon cerebral characters alone would retain the *Lemurs* in the position assigned to them by the majority of systematic zoologists—admitting, however, that, while possessing certain very important points of structure peculiar to the *Primates*, they are in many respects, especially in the shortness of the posterior lobes, an aberrant group, forming a transition towards the Cheiroptera, Carnivora, and other inferior Mammalia."

This paper will be published at full length in the Society's 'Transactions,' and appropriately illustrated.

March 25, 1862.—Dr. J. E. Gray, V.P., in the Chair.

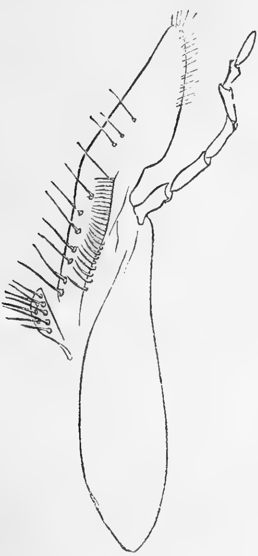
Notes on the Form of the Comb (Pecten) in different Andrenidæ and Apidæ, and on the alar hooks of the Species of Sphecodes and Halictus. By Miss E. F. Staveley*.

I have made a few notes in the hope of saving your time and eyes; but I fear they are of very little value; and, as you are aware, I know so little of what has been already written on the subject, that my notes, even if correct, may not be new. Besides this, my examination of the parts of the mouth has as yet been confined to about twenty-six Bees of various species and the three sexes.

There are some peculiarities in the maxillæ of the Bees which I think might serve as generic or specific characters, and which I believe have not yet been used for that purpose.

One is the presence of a row of strong, flat hairs or teeth, forming a sort of comb, varying much in form and situation.

In all the *Andrenidæ* where I have found it, it forms a wavy line, commencing near the base of the upper joint of the maxilla about midway between the two margins, as in *Andrena cingulata*, ♀ (figs. 1, 2).



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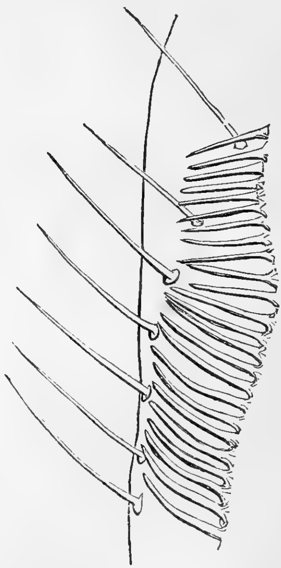

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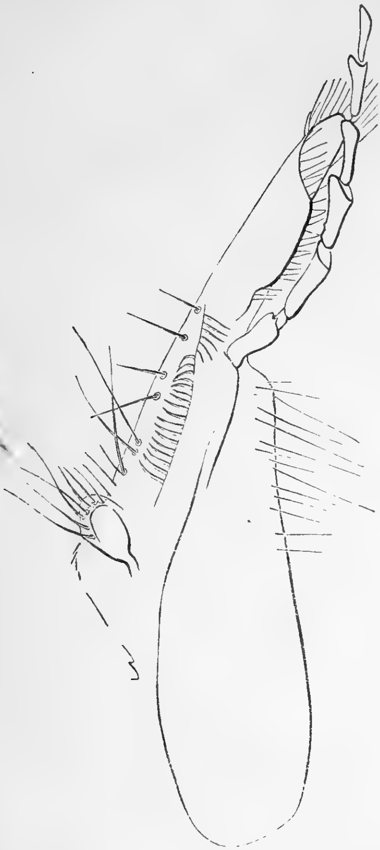
* Communicated by Dr. J. E. Gray with the following letter:—

"I beg of you to lay the following observations, which Miss Staveley has sent to me, before the Society. They indicate some characters which appear to have hitherto been overlooked.

"*Dr. Sclater, F.R.S., &c.*" "J. E. Gray."

In some, as *Andrena nitida*, ♀ (figs. 3, 4), the direction of the teeth is reversed in the course of the row. The row of hairs is



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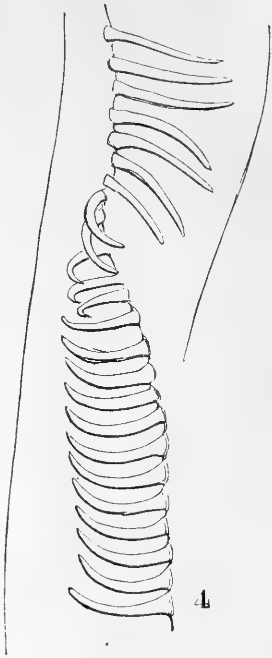

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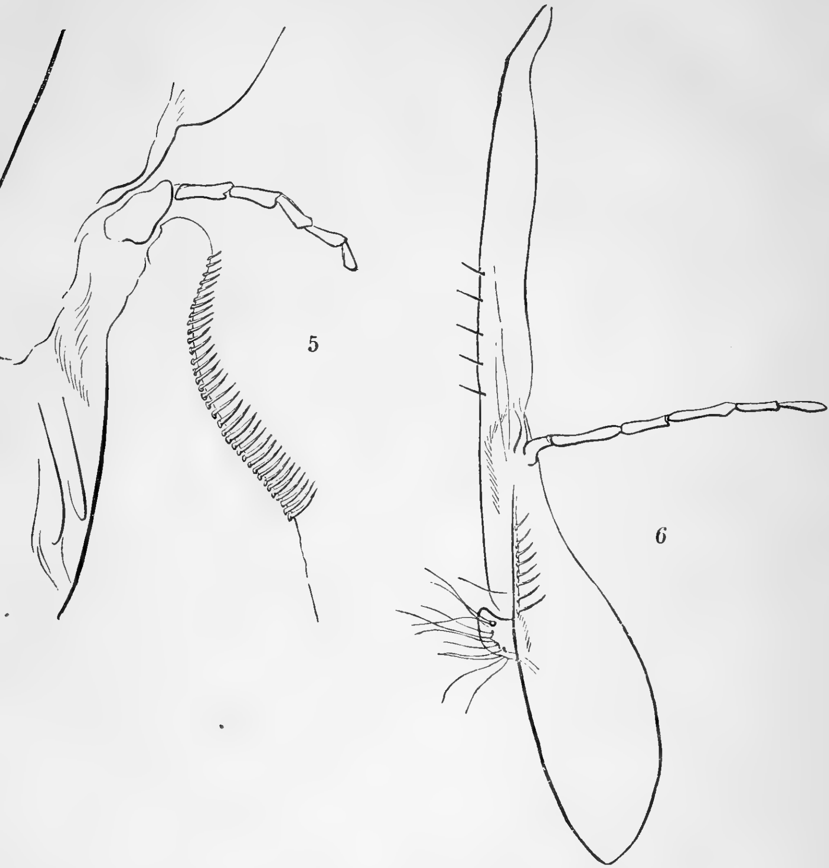
figured by Kirby in his work on 'British Bees,' at t. 1. f. 4 *e*, and called by him, in the explanation of the plates at page 226, "*setæ rigidiusculæ*;" but I do not find any mention of them in any other part of the work.

In the *Apidæ* it is invariably at the upper part of the lower joint of the maxilla (fig. 5), and, with one exception, is marginal. In *Panurgus* (fig. 6, *P. Banksianus*, ♀), the first genus of the *Apidæ*



(and of which Mr. Smith remarks that in habit it is precisely similar to *Andrena*), the comb resembles that of the *Andrenidæ* in not being marginal, while it agrees with that of the other *Apidæ* in being near the top of the second joint. This series of spines is also figured in Kirby, at t. 10. f. 1 *c*, t. 11. f. 2, t. 12. f. 6 *c*, and t. 13. f. 3 *a* ; and in the chapter headed 'Termini,' at p. 94, is called the "*pecten* ;" but, though several forms of it are figured as above, I do not find it mentioned in the description of the species.

I subjoin a list of the insects in which I have looked for it :—

ANDRENIDÆ.

Colletes Daviesana, ♂ (teeth much the longest at the lower end).
Andrena cingulata, ♀, figs. 1, 2.
—— nitida, ♀, figs. 3, 4 (comb reversed near the top).
—— Clarkella, ♀ (comb reversed near the base).
—— ——, ♂ (comb reversed).
Cilissa leporina, ♀ (comb of four teeth).
—— ——, ♂ (comb of three teeth).
} Comb not marginal, commencing near the base of upper joint of maxilla.

Sphecodes subquadratus, ♀.
Halictus leucozonius, ♂.
—— morio, ♀.
Dasypoda hirtipes.
} Comb not present.

APIDÆ.

Panurgus Banksianus, ♀, fig. 6. Comb not marginal.
Eucera longicornis, ♀ (fig. 5).
—— ——, ♂.
Bombus terrestris, ♀.
—— lucorum, ♀.
—— ——, ♂.
—— ——, ☿.
—— Latreilliellus, ☿.
Apathus campestris, ♀.
Apis mellifica, ♂.
Euglossa cordata.
} Comb marginal.
} Comb on upper part of second joint of maxilla.

Nomada furva, ♀ *.
Epeolus variegatus, ♂ *.
Cœlioxys vectis, ♀ *.
Osmia rufa, ♀.
Chelostoma florisomne, ♂.
} Comb not present.

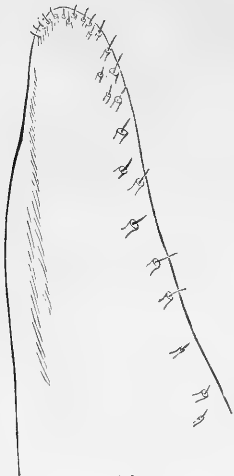
There is also an appendage to most of the maxillæ (and when absent it may possibly have been torn off in dissection), which seems too delicate to assist in the mechanical work for which the combs are probably used. It is a small membranous lobe, covered more or less thickly with long hairs, and situated on the lower joint of the maxilla, on the opposite side to that of the palpus (see figs. 1, 3, 6).

In many of the maxillæ there are several projections or small *tubes* (as I shall for convenience call them, having little doubt of their tubular construction) generally tipped by a hair, and in appearance strongly resembling the small tubes which exude the material of the web from the spinneret of a spider. They are in various situations: sometimes at the apex of the maxilla; forming sometimes an irregular line nearly the whole length of the upper joint; sometimes in a cluster close above or below the maxillary palpus; sometimes in two clusters, one above and one below the palpus. I would call your attention particularly to the straight tubes near the apex of the maxilla of *Epeolus variegatus* ♂ (fig. 7), and the flask-shaped tubes near the palpus in *Osmia rufa* ♀ (fig. 8) †.

* Parasites. I have as yet found no parasitic Bee with the comb.

† After writing the above paragraph, it occurred to me that Dr. J. Braxton Hicks, in a paper read before the Linnean Society (and printed in their Trans. vol. xxiii. part 1, p. 139), had preceded me in the observation of these organs, and I hesitated to send the notes for printing; but, on examination of his paper, I am inclined to think that the tubes which I have described in the maxillæ of the Bees are not necessarily of the same nature as the organs observed by him in

Is it possible that these tubes, which, as I have observed, are remarkably similar in appearance to those in the spider's spinneret,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may be of the nature of salivary glands? It is easy to imagine the use of such a provision in the management of the materials of the nests and the storing of food, even if not also in the assistance of digestion; while it appears to me that there is analogy in favour of such a supposition, the House-fly exuding from its mouth a drop of moisture when feeding on sugar or other hard substance, while the Gnat, with still another form of mouth, is supposed to inject a poison into the wound inflicted by its proboscis.

I believe that somewhat similar tubes exist in the mandibles of some of the Bees and Wasps.

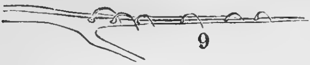
The mandibles of some of the *Apidæ* have a transverse ridge of strong hooked hairs (besides other hairs in various parts). In the mandible of *Apis mellifica* ☿, they are very visible.

With the above objects I send specimens of the hind wings of various Hymenopterous Insects, the observation of which has confirmed me in my former opinion as to their usefulness as distinctions; but as I have arrived at no new results, not having had the means as yet of representing more than a very limited number of genera, I will only remark on one variation from the usual arrangement of the distal hooks, which occurs in the genera *Sphecodes* and *Halictus*.

The distal hooks of the Bees are usually at regular or at regularly diminishing intervals; but in these two genera, one or two of those

various parts of insects, with the exception of those which he figures Tab. 18. R. *a*, and which I have mentioned above as tubes "in a cluster close above the maxillary palpus."

in the middle of the row are separated from the rest by a space double the size of that which is between the other hooks (figs. 9,



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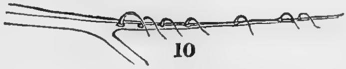

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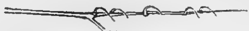

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10, 11); and if this is found to be the case in all the species, it is a distinction easy to observe.

MISCELLANEOUS.

Notice of a new Species of Cyclemys *from the Lao Mountains, in Siam.* By Dr. J. E. Gray.

Cyclemys Mouhotii.

Shell oblong, pale yellow; back flattened above, with a dark-edged keel on each side; the vertebral plates continuously keeled, and rather tubercular in front; the margin strongly dentated; nuchal shield distinct. Lao Mountains.

This species is most like *Cyclemys platynota* from Singapore, but the back is much more decidedly flattened, the flattened part is strongly keeled on each side, and the edge of the shell is strongly toothed both before and behind. This is not merely an individual variety; for M. Mouhot has sent a considerable series, of different ages, and they all agree in this respect, the younger animals being more decidedly dentated on the margin and more acutely keeled on the back.

I have named this species after the late M. Mouhot, who has discovered and sent to England many new and most interesting animals of different orders.

On the Transformation of Entozoa. By P. J. Van Beneden.

The remarks of MM. Pouchet and Verrier, of which a short abstract appeared in our last Number, have called forth from Professor Van Beneden a letter, the chief points of which are as follow:—

He first states that MM. Pouchet and Verrier are in error in supposing that he regarded *Cœnurus cerebralis* as the scolex of *Tænia serrata*; he has described the Tape-worm produced by *Cœnurus* as a distinct species, under the name of *T. cœnurus*, and that produced by the *Cysticercus pisiformis* of the Rabbit as *Tænia serrata*. He ascribes the doubts of MM. Pouchet and Verrier to their having failed to distinguish these two species of Tape-worms. He does not, however, attempt to explain the main point dwelt upon by the French authors, namely, the presence in the intestines of the dogs of a much larger number of Tape-worms than that of the heads of *Cœnurus*, but expresses a hope that, by the continuation of their experiments, those gentlemen themselves will be able to clear up the mystery.

Referring to the failure of MM. Pouchet and Verrier in producing staggers in sheep by the administration of mature ova of *Tænia serrata*, he shows that in experiments made simultaneously at Louvain, Giessen, and Copenhagen, with ova obtained from a single dog which had been fed with *Cœnuri*, precisely the same phenomena were produced nearly after the same lapse of time. In all these cases the young sheep were attacked by staggers about the fifteenth day,—the only difference being that, at Copenhagen, only two out of three sheep were affected. The failure of the French experimentalists is ascribed by M. Van Beneden to their having administered ova of *Tænia serrata* instead of those of *T. cœnurus*.

M. Van Beneden also communicates to the Academy the results of an experiment just completed by M. Leuckart.

For some years a second species of *Tænia*, the *T. mediocanellata*, has been indicated in the human subject, but its mode of introduction and the characters of its *Cysticercus* were unknown. M. Leuckart has administered ova of *Tænia mediocanellata* to calves, and in a short time found a development of *Cysticerci*, especially in the muscles, so abundant as to cause a sort of leprosy. The *Cysticercus*, while still in the cysts of the calf, presents all the distinctive characters of the adult *Tænia*. Thus Tape-worm is developed by the use of veal and beef; but it is a distinct species, which has always been confounded with *Tænia solium*. In the present state of science, it may be asserted that *Tænia solium* is introduced into the human body by pork; *T. mediocanellata* by veal and beef; and the *Bothriocephalus*, or Broad Tape-worm of the older writers (in Switzerland, Poland, and Russia), by water*.

At the Meeting of the Academy of Sciences on the 16th of June, MM. Pouchet and Verrier replied to Prof. Van Beneden's remarks, asserting that they have not committed the error ascribed to them by him, as, if his *Tænia cœnurus* be really a distinct species, of which they express great doubts, it was this that they administered to their young sheep. They add that in a recent experiment, in which each of two dogs received a hundred heads of *Cœnurus cerebralis*, the examination of the intestines two months after the administration showed in one dog two specimens of *Tænia cucumerina*, 50 centimetres in length, and filled with ova, and in the other, two of *T. serrata*, one 12 millimetres and the other 20 centimetres in length.—*Comptes Rendus*, June 2 and 16, pp. 1157 and 1207.

* Dr. Koch, of St. Petersburg, has lately stated that the embryos of *Bothriocephalus latus* are covered with vibratile cilia, and that, in the form of Infusoria, they live free in the water. He adds this interesting remark, that at Moscow, where spring-water is drunk, the *Bothriocephalus* is rare; whilst at St. Petersburg, Riga, and Dorpat, where river-water is used, it is very common.

Description of a new Genus of Tree-frogs, from Ecuador. By W. Peters.

PLECTROMANTIS, nov. gen.

Tongue elongated, posteriorly slightly emarginated and free. Palatal teeth. Tympanum distinct. Orifices of the Eustachian tubes nearly twice as large as the choanæ. A large elongated gland between the angle of the mouth and the shoulder, and over the latter a larger triangular one, less distinctly bounded above and behind. Fingers free, rounded at the tip, without adhesive disks; the metacarpus of the thumb and of the first finger armed each with a conical, pointed, hard spine. Toes free, thin, with narrow membranous borders, and with distinct, but small, broad adhesive disks at the apex; a flattened elongated knob at the base of the metatarsus of the first toe, and a smaller roundish one at that of the fifth. Transverse processes of the sacral vertebra narrow.

This genus is therefore very nearly allied to *Hylodes*, and is distinguished therefrom by the presence of parotids and the two remarkable spines on the inner side of the hand.

Plectromantis Wagneri, nov. spec.

The present species has at the first glance exactly the form of a *Rana temporaria* with rather thin toes. The head is as broad as long, with a somewhat prominent rounded snout. The nostrils are transversely oval, and are rather more distant from each other than from the apex of the snout, whilst their distance from the eyes is distinctly greater. The diameter of the very distinct tympanum is equal to the distance of the nostrils from each other, and amounts only to four-sevenths of the largest diameter of the eyes. The eyes are very prominent, and the inner transparent fold of the lower eyelid (the so-called nictitating membrane) is greatly developed. The intermaxillary and maxillary teeth are closely approximated, and have their points directed a little inwards and backwards. The palatal teeth stand at some distance behind the widely separated choanæ, upon two curved processes the convexity of which is anterior; they occupy about half the width of the palate. The skin of the body appears smooth, with the exception of the somewhat wrinkled sides. The anterior extremity exceeds the muzzle by the entire hand. The first finger extends beyond the second, which is a little shorter than the last, but considerably shorter than the last but one. The spines on the inside of the metacarpus are $1\frac{1}{3}$ millim. in length, and have the appearance of pointed warts; they are very hard, and appear to consist of a bony process, covered with a horny coat. The toes increase very considerably in length from the first to the fourth. The fourth toe is nearly twice as long as the third (19 : 11); whilst the fifth is intermediate between the second and third. The colour of the upper surface of the body and extremities is dark brown, and exhibits a few indistinct darker spots. The lower part of the sides of the body, the belly, the inner and outer surfaces of the thighs, and also the inside of the leg, appear of a dingy white, with a more or less extended black marbling.

Total length 0·058 m.; length of the head 0·023; length of the anterior extremity to the tip of the last finger but one 0·033; length of the hinder extremity to the tip of the fourth toe 0·095.

The single specimen of this species was discovered by Dr. Moritz Wagner on the west side of the Andes in Ecuador, and is now in the Zoological Museum of Munich.—*Monatsber. der Akad. der Wiss. zu Berlin,* April 1862, p. 232.

Discovery of Microscopic Organisms in the Siliceous Nodules of the Palæozoic Rocks of New York.

At Prof. Dana's suggestion, Dr. M. C. White, well known for his devotion to the microscope, has examined various specimens of the hornstone nodules found in the Devonian and Silurian rocks of this country, with a view to determine the presence of organisms analogous to those well known to exist in the flints of the chalk. This research has been rewarded by the discovery of abundant organisms referable to the Desmidieæ, besides a few Diatomaceæ, numerous spicula of sponges, and also fragments of the dental apparatus of Gasteropods. Among the Desmids, there is a large variety of forms of *Xanthidia* supposed to be the sporangia of Desmids, besides an occasional duplicated Desmid; also, lines of cells, some of which appear to be sparingly branched. The researches have been mostly confined to the hornstone of the corniferous limestone; though extended also to the hornstone from the Black-River limestone and that of the sub-carboniferous limestone of Illinois, both of which contain some organisms.

The hornstone-nodules from the Black-River limestone (as well as the corniferous) have been since examined also by Mr. F. H. Bradley with similar results.

These observations will be regarded with much interest by geologists as well as by microscopists. They carry back to a very early epoch forms of life which have hitherto been looked upon as belonging only to a much more recent era in the life of our planet.

The analogy of these hornstone-nodules to the flints of the Chalk is obvious; and the discoveries here announced may be regarded as establishing their similarity in origin. The organisms figured so closely resemble those of the flint that they might be taken for them; it is difficult in all cases to make out a difference of species.

The extreme abundance of the hornstone-nodules in our palæozoic limestones will render it easy to multiply observations in this new field of research, which presents an interesting addition to the labours of the microscopist. It will be remembered by those who undertake such examinations that the use of turpentine renders the chips of chert almost as transparent as glass.—*Silliman's Journal,* May 1862, p. 385.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 57. SEPTEMBER 1862.

XVII.—*Notes on rare and little-known Fishes taken at Madeira.* By James Yate Johnson, Cor. Mem. Z. S.

No. I.

Order PHARYNGOGNATHI, Müll.

Fam. Cyclolabridæ.

Centrolabrus trutta, Lowe, sp.

The genus *Centrolabrus* was proposed by Dr. A. Günther, in his "Synopsis of the Labroid Genera," which appeared in the 'Ann. and Mag. Nat. Hist.' for November 1861, for the reception of those species of the genus *Acantholabrus*, C. & V., which have their teeth in a single series instead of in a band. The species shortly described by Mr. Lowe, in the Proc. Zool. Soc. for 1833 (p. 143), under the name of *Crenilabrus trutta*, will fall into the genus *Centrolabrus*; and it appears to me that the three species described by M. Valenciennes in his 'Ichthyologie Canarienne' (p. 64), under the names of *Acantholabrus viridis*, *A. romeritus*, and *A. romerus*, not only belong to the present genus, but are in reality merely varieties of the very species now under consideration.

First, with respect to *A. viridis*: this fish was considered by Valenciennes to be near the fish which Mr. Lowe originally called *Crenilabrus luscus*, but which was afterwards shortly described by him under the name of *Acantholabrus imbricatus* (Trans. Zool. Soc. vol. iii. p. 11), a fish now ascertained by Dr. Günther to be identical with *A. Palloni*. With the latter species I am well acquainted, having procured several specimens; and it is quite distinct from the fish described and figured by Valenciennes (pl. 17. fig. 4) under the name of *A. viridis*, in colouring, shape, and fin-formula, and by the possession of rows of imbricated scales on the vertical fins. Now, certain fishes which I have obtained agree so nearly both with Valenciennes's description and figure of *A. viridis,* and with Mr. Lowe's description of *Crenilabrus trutta,* that there can be no doubt that both these naturalists referred to the same species, and that the fishes now before me also belong to that species. Mr. Lowe's specific name, being the older, must be retained. I may remark, however, that the vertical bands on the sides, spoken of by Mr. Lowe, are not to be clearly made out on my specimens, although there possibly are some slight indications of them; neither did I see more than one spot on the anal fin, whereas he speaks of two or three; whilst I perceive *five* fuscous blotches on the dorsal fin, whereas he found only *four*. But these differences are of little consequence, since he met with a variety "unicolor viridis subimmaculata;" and hence it is evident that the colouring is subject to considerable variation. The fin-formula of *A. viridis* agrees (with the trifling exception of 13 being substituted for 14 in the number of the pectoral rays) both with Mr. Lowe's account of *Crenilabrus trutta* and with the rays observed on my specimens. It also agrees with that observed in another Canarian fish, of which Valenciennes made a new species under the name of *Acantholabrus romerus,* saving that he assigns 15 rays to the pectoral fin. The only ground, apparently, for separating the fish from *Crenilabrus trutta* was that the four spots on the dorsal fin and the two or three spots on the anal fin were not seen on his fish—a difference of very little importance, if this were so in the living fish. Since the French naturalist only saw stuffed skins, the spots might have easily disappeared, if there originally. It may therefore be concluded, I think, that these two Canarian fishes and Mr. Lowe's Madeiran fish really belong to the same species.

On referring to the description given by Valenciennes of a supposed third Canarian species (*Acantholabrus romeritus*), it will be seen that the only differences pointed out between it and the other two are in the tint, the number of the teeth, and in the numbers of the spinous and soft rays of the dorsal and anal fins (viz. 16 spinous and 9 soft rays in the former, in place of 17 and 8, and in the latter 4 spinous and 9 soft rays, in place of 5 and 8). The differences in the colouring and the dentition are too trivial to deserve consideration; and it may be strongly suspected, considering the general close resemblance, that, in regard to the fin-rays of the single specimen observed, one of the dorsal and one of the anal spines had been abnormally converted into soft rays.

A description of the species, drawn up from the three specicimens that have been obtained by me (in January, February, and March), shall now be given. The synonymy, if my conclusions are correct, will be—

Centrolabrus trutta (Lowe), Günther.

Crenilabrus trutta, Lowe.
Acantholabrus viridis, Val.
Acantholabrus romeritus, Val.
Acantholabrus romerus, Val.

D. 16–17+8–9. A. 4–5+8–9. V. 1+5. P. 13–15.
C. IV.+13+IV. M.B. 5.

Back and head blackish brown; sides of the same colour, dappled with bluish green, the middle portion of the scales being brown with greenish margins, the green dapplings sometimes so arranged as to form a reticulated pattern; belly whitish, with a greenish tinge, the middle of each scale being pale brown; a dark spot at each side of the tail near the base of the caudal fin; the dorsal and anal fins bluish green, with red or orange spots, and occasionally with some obscure fuscous blotches; pectoral fins yellow, immaculate; caudal fin yellow, with red or orange spots or streaks; a blue line under the eye; sometimes blue lines across the opercular pieces, and occasionally small patches of pale red in front of the eyes and on the under jaw.

Body oblong, compressed, clothed with rather small scales having even margins. The height between the ventral fins and the vent is about equal to the length of the head, and, compared with the total length, as 1 to $3\frac{1}{2}$.

The *lateral line* on the anterior part of the body follows the curve of the back; but there is a rapid descent under the end of the dorsal fin, and it is then straight along the tail. The scales of the lateral line are 35, and in the height of the body about 14 (4+10) may be counted.

The *head* between and in front of the eyes is scaleless, whilst the opercle and preopercle are scaly, the former having its membranous border emarginate above the base of the pectoral fin, and the latter having its vertical edge set with fine teeth and its horizontal edge serrate. The longer axis of the slightly oval *eye* is contained about $5\frac{2}{3}$ times in the head. The iris is bright green, surrounded by a ring of gold. The *mouth* is small, furnished with fleshy lips and a protractile upper jaw. Each jaw is set with a single row of small canine *teeth*, which are larger in front than at the sides. In the upper jaw the number varies from 7 to 10, and in the lower jaw from 12 to 19. The palatines and vomer are unarmed.

The long *dorsal* fin rises out of a groove, and commences a little in front of the pectoral fins. It is low in front, the spinous portion being not so high as the soft-rayed portion. The comparative lengths of the bases of the two divisions of the fin are as 19 to 9. Each spine carries a short filament, and the last spine is rather longer than its neighbours. The fin is truncate behind, with the angle rounded off.

The *pectoral* fins are inserted close to the edge of the opercle; they are rounded, and their length to the total length of the fish is as 1 to $5\frac{1}{2}$. The *ventral* fins are in length rather more than one-seventh of the total length of the fish, and are inserted considerably behind the pectoral fins. The spine is rather more than half as long as the first soft ray. There is a long scale-like appendage between their roots. The *vent* is in front of the middle of the fish by about one-thirteenth of the whole length. The *anal* fin rises from a groove; it is about half as long as the dorsal fin, and their terminations are opposite each other. The spinous portion is lower than the rest; and the spines gradually increase in length backwards. The fin is truncate behind. The tail is high and compressed; its fin is truncate, with the angles somewhat rounded off.

The following measurements are taken from a specimen which had a total length of $6\frac{3}{4}$ inches, and a height of 2 inches.

	inches.
Head	$1\frac{7}{8}$
Eye, longer axis	$\frac{7}{20}$
Mouth, width	$\frac{4}{10}$
Dorsal fin, length of base	$2\frac{4}{5}$
,, distance from snout	$1\frac{9}{10}$
,, height of soft-rayed part	$\frac{9}{10}$
Pectoral fins, distance from snout	$1\frac{4}{5}$
,, ,, length	$1\frac{1}{5}$
,, ,, width of base	$\frac{4}{10}$
Ventral fins, distance from snout	$2\frac{4}{10}$
,, ,, length	1
Vent, distance of its vertical from snout	$3\frac{1}{10}$
Anal fin, length of base	$1\frac{4}{10}$
,, ,, height of soft-rayed portion	$\frac{4}{5}$
Tail, height	$\frac{4}{5}$

Order ANACANTHINI, Müll.

Suborder THORACICI.

Fam. **Gadidæ.**

URALEPTUS, Costa, Fauna Neapol.

Body scaly, elongated subelliptical, and attenuated behind, with two dorsal fins, one anal fin, and jugular fins of seven rays. Caudal fin distinct. No barbel. Teeth of upper jaw in two rows, of lower jaw in one row. Seven branchiostegal rays.

Uraleptus Maraldi, Risso, sp.

1st D. 11. 2nd D. 60. A. 65. P. 24. V. 7. C. II. 20. II.

The body is subelliptical, compressed, elongated, much attenuated behind, and covered with small cycloid scales. The height compared with the total length is as 1 to $5\frac{1}{2}$. The unarmed head is thick, broad, and flattened above, with a short, obtuse, rounded snout; its length, compared with the total length, is as 1 to $4\frac{1}{2}$. The large eye reaches to the profile of the head, and is contained therein four times; it is distant rather more than a diameter from the tip of the snout, and the space between the eyes is equal to about one diameter and a third. The opercular pieces are covered with scales. The upper jaw is protractile, and the upper border of the mouth is formed entirely of the premaxillary, which is armed with a row (12–16) of small pointed teeth, distant from each other and curving inwards, behind which is an inner row of minute, sharp, closely-set teeth. In front the inner row becomes double. The maxillary is covered with colourless skin, and lies, when the mouth is closed, under the integument behind. The mandible, which is rather shorter than the upper jaw, carries a single row of (9–14) conical, pointed, curving teeth, with minute sharp teeth intercalated between them. The palatine bones, the vomer, and the tongue are unarmed. The mouth is white inside; the rictus of moderate size.

There is no nuchal groove. The first *dorsal* fin is short, but rather higher than the second, and commences a little behind the root of the pectoral fins at the distance of about one-third of the total length of the fish from the snout; it extends to the second, which is long, is rather higher in front than behind, and reaches almost to the caudal fin. The long *anal* fin commences almost as far forward as the second dorsal, which it resembles in shape, and ends opposite to its termination, both being angular behind. The pectoral fins are long and pointed; they are not fleshy, and their rays are slender. The slender *ventral* fins are inserted in front of the pectoral fins; their second ray is elongate, and the first and third are also long. The *caudal* fin, composed of delicate rays, is lanceolate, and is equal to about one-ninth of the total length. The vent is far forward, being situate in the first third of the total length.

The *lateral line* commences a little above the opercle, and follows the curve of the back for its anterior half; it then descends rather rapidly, but is horizontal on the posterior third of the body. There is no barbel on the chin.

The *colour* is a dark brownish grey, with a black throat and pale-red pectoral fins; the other fins are of a dark indigo hue.

Two examples of this fish have occurred, and these were taken in the months of February and March. The smaller one was $7\frac{1}{4}$ inches in length, the larger 9 inches, and this had a height at the first dorsal fin of $1\frac{5}{8}$ inch, its head measuring 2 inches in length. The fishermen style the fish "Rato," *i. e.* Rat, from its slender tail-like hinder part.

It may be suspected that this fish is the *Gadella gracilis* of Mr. Lowe (Ann. & Mag. Nat. Hist. ser. 1. vol. xiii. p. 399), although in his short description he speaks of a single dorsal fin and subscobinate teeth. I am indebted to Dr. Günther for referring me to the descriptions of *Gadus Maraldi* in Risso's 'Ichth. de Nice,' 125, and *Merlucius Maraldi* in his 'Hist. Nat. de l'Eur. Mér.' iii. 220. The following figures represent in inches the dimensions of the principal parts of the larger specimen :—

Mouth, depth = width at angle of jaws	$\frac{9}{10}$
Eye, diameter	$\frac{1}{2}$
First dorsal, distance from snout	3
,, ,, length of base	$\frac{6}{10}$
,, ,, height	$\frac{3}{4}$
Second dorsal, height in front	$\frac{7}{10}$
Pectorals, length	$1\frac{4}{10}$
,, distance from snout	$2\frac{4}{10}$
Ventrals, length	$1\frac{1}{5}$
Anal, distance behind vent	$\frac{1}{4}$
,, height in front	$\frac{7}{10}$
Caudal, length	1
Vent, distance from tip of mandible	$2\frac{4}{10}$

Haloporphyrus, Günther, MS.

Body scaly; two dorsal, one anal, and seven-rayed ventral fins; a barbel; scobinate bands of teeth in the jaws and on the pharyngeal bones; scobinate teeth on the vomer; no teeth on the palatine bones or on the tongue. Branchiostegal membrane with seven rays.

The only species yet discovered of this genus was imperfectly described and badly figured by Risso, in his 'Hist. Nat. de l'Eur. Mérid.' (vol. iii. p. 218, pl. 11. fig. 40), under the name of *Lota lepidion*. From the true *Lotæ*, however, it may be distinguished by the possession of ventral fins with seven rays, and by the larger scales. Three specimens having been lately procured at Madeira, the following description of the species has been drawn up from them.

Haloporphyrus lepidion, Günther.

The fin-rays of the three examples were as follows :—

	1st D.	2nd D.	P.	V.	A.	C.
A.	4	55	21	7	49	vii. or viii. + 16 + vii. or viii.
B.	4	56	21	7	52	,, ,,
C.	4	52	20	7	48	,, ,,

The fish is of a uniform dark brownish-grey colour, with fins of a bluish black. The body is oblong, attenuated, and compressed behind, the thickest part being under the second dorsal fin, and the tail behind the dorsal fin low and thin. In general appearance it closely resembles *Mora mediterranea*, Risso (which has been of late years abundant in the market of Funchal, where it bears the name of *Abrotea do alto*), but is at once distinguished by the single anal fin. The *head* is scaly, thick, unarmed, rounded in the neighbourhood of the eyes, and flat between them; the mucous pores are numerous; the cheeks convex. The snout is short and rounded. The nostrils are close together, and the posterior is the smaller; the anterior has an elevated semitubular border on its hinder side. The eye is round and of moderate size; it is contained about six times in the head, is distant about $1\frac{1}{2}$ of its diameter from the snout; it is high up, and the distance between the two is about $1\frac{1}{4}$ of the diameter.

The seven-rayed *branchiostegal* membrane is much exposed, being left in great part unprotected by the gill-cover.

The *rictus* is wide and moderately deep. The lower portions of the upper jaw, which is scaleless, are very protrusile; and when the mouth is open, the orifice is nearly circular. The lower jaw is furnished with a thick cartilaginous lip, and shuts inside the upper jaw. There is a barbel at the chin. The premaxillary forms the upper border of the mouth; the maxillary is broad below, and reaches back nearly to the vertical from the middle of the eye. The *teeth* are small, and form scobinate bands in the premaxillary and mandibles, that in the former being broader in front and narrowing backwards on each side, whilst the band in the lower jaw is nearly of the same width throughout. There is a small patch of similar teeth on the vomer, but none on the palatines or tongue, which is broad, thick, and pointed in front. The pharyngeals are armed with scobinate teeth.

The first *dorsal* fin is short, having only four rays, of which the first is much elongated, and is equal to one-third of the total length of the fish. It commences over the pectoral fins, at a distance from the snout nearly equal to one-fourth of the total length of the fish. The long second dorsal fin is separated by only a short interval from the first. Its rays project beyond the membrane, and it falls in slightly between the two extremities, the largest rays being in the anterior third. The posterior extremity of the fin is angular, and the last three rays very short. The highest part of the fin is about two-sevenths of the greatest height of the fish.

The pointed *pectoral* fins are inserted in the upper half of the height under the first dorsal. The first ray is not quite equal to the total length of the fin, which is equal to about one-eighth of the total length of the fish, and reaches back to the fifth ray of the second dorsal. The fifth, sixth, and seventh rays are longer than the rest, the last being by a trifle the longest.

The thoracic *ventral* fins are separated by a wide interval, and have their first and second rays very long, the latter being to the total length of the fish as 1 to $4\frac{3}{4}$ nearly.

The vent is a little in advance of the *anal* fin, which is about two-thirds of the length of the second dorsal fin, and has its highest part in front. The middle is depressed, the posterior extremity angular, and it terminates a little in front of the end of the second dorsal. Like that fin, it has the lower two-thirds fleshy, and covered with small scales between the rays.

The *caudal* fin is truncate, and at the middle its length is about one twenty-third of the total length of the fish.

The deciduous *scales* are small, and have the free border simple. The *lateral line* commences in advance of the first dorsal fin, rising slightly with a gentle curve, to fall rapidly just behind the vent, whence it is straight to the middle of the tail. The scales of the lateral line are about 200; and there are about 85 rows of scales in the height, of which 15 are above the lateral line.

On opening specimen A., the liver was found to be excessively large, forming three lobes, two of which were 7 inches long and between 2 and 3 inches across. The pyloric cæca were in two bundles, eight on each side, and $3\frac{1}{2}$ inches in length. An air-sac with a very thick coat, 4 inches long, lay under the back. The cæcal stomach had also a thick coat, and was 4 inches in length. The intestine had two convolutions, and was 17 inches long.

One of the three specimens was taken in the month of January, the other two in March. Their dimensions in inches are given in the following table:—

	A.	B.	C.
Total length	25	35	$21\frac{1}{2}$
Height under commencement of 2nd dorsal	$5\frac{3}{4}$	8	$4\frac{3}{4}$
Thickness, same place	$3\frac{1}{4}$	$4\frac{1}{2}$	
Length of head	$5\frac{3}{4}$	$8\frac{1}{4}$	$5\frac{1}{4}$
Eyes, diameter	1	$1\frac{3}{8}$	
„ distance from one to the other	$1\frac{1}{4}$	$1\frac{8}{10}$	
Mouth, upper jaw, length	$2\frac{1}{2}$		
„ width from side to side when open	$2\frac{3}{4}$		
Barbel	$1\frac{1}{8}$	$1\frac{3}{8}$	
1st dorsal fin, distance from snout	6	$8\frac{1}{2}$	
„ length of 1st ray	$8\frac{1}{4}$	$10\frac{3}{8}$	$7\frac{1}{4}$
„ „ 2nd ray		$1\frac{1}{2}$	

	A.	B.	C.
Interval between the two dorsals	$\frac{1}{3}$	$\frac{3}{8}$	
2nd dorsal fin, length of base	$13\frac{3}{4}$	21	
,, height in front	$1\frac{3}{4}$	$2\frac{3}{10}$	
Pectorals, distance from snout	6	8	
,, length	$3\frac{1}{4}$	$4\frac{3}{8}$	$2\frac{7}{8}$
,, width of base	$\frac{9}{10}$	$1\frac{1}{8}$	
Ventrals, length of 1st ray	$4\frac{1}{4}$	$6\frac{1}{4}$	
,, length of 2nd (longest) ray	$5\frac{1}{2}$	$7\frac{1}{4}$	5
,, distance apart	$1\frac{3}{8}$	$1\frac{3}{4}$	
,, width of base	$\frac{3}{10}$		
Vent, distance from snout	11		
Anal, distance from snout	$11\frac{1}{2}$	$15\frac{3}{4}$	
,, length of base	9	$13\frac{1}{2}$	
,, height	$1\frac{3}{8}$	2	
Caudal, length at middle		$1\frac{1}{2}$	
Tail, height behind 2nd dorsal	$\frac{8}{10}$	1	

Fam. **Macrouridæ**.

MACROURUS, Bloch.

Of this curious genus Mr. Lowe has given short diagnoses of three species taken at Madeira, viz. *M. atlanticus*, *M. lævis*, and *M. serratus*. Specimens of only the first two have fallen in my way; and I will now describe them from my notes. Both are of rare occurrence, but the first is taken more frequently than the second. It appears to be the fish which is figured in the 'Fauna Italica' under the name of *M. Mysticetus*, and described in the text under the name of *M. cœlorynchus*, although there are considerable differences between the numbers of the rays in the dorsal and anal fins as stated by Bonaparte (1st D. 9; 2nd D. 68; A. 83) and those given below.

Macrourus cœlorynchus, Risso, Ichth. Nice, p. 200; Hist. Nat. iii. 244.

M. atlanticus, Lowe, Trans. Zool. Soc. iii. p. 15.

1st D. 10. 2nd D. 98. A. 110. P. 15–20. V. 7. M.B. 6*.

The head is thick and subcubical, the body compressed and much attenuated behind, so that the tail with its fin terminates in a point. The body is dark grey above, the belly paler grey; the anal, pectoral, and ventral fins black. It is clothed with small scales that have a tessellated arrangement, and are rough with numerous minute spines, but are without a keel. The head compared with the total length is as 1 to 4; the height of the

* Risso assigns seven, Bonaparte five branchiostegal rays to *M. cœlorynchus*.

body to the length as 1 to $7\frac{1}{2}$. The head, between the eyes, is concave; two crests with numerous small spines commence over the middle of the eyes, and run backwards. The postero-superior orbit of the eye is spinous, and a spinous crest runs backwards from it. The rest of the head is covered with minute villiform spines, except the space around each pair of nostrils, which is naked. The large *eye* is contained about three times its longer diameter in the head, about twelve times in the total length, and is distant about one diameter from the tip of the snout. The eyes are separated from each other by a space about equal to their own shorter diameter. The projecting snout is subcarinate both above and below, and it is subtrilobate at the tip. There runs backwards from it between the eye and the mouth, almost to the posterior angle of the subopercle, a keel or broad crest (bearing a band of small spines), that gives a remarkable appearance to the head. The mouth is on the under side of the head, as in the case of the Shark tribe. The upper border of the mouth is formed partly by the premaxillary and partly by the maxillary; but only the former is set with teeth. There is a villiform band of teeth in each jaw, but none on the palate, vomer, or tongue. The upper jaw is very protractile. The pharynx and the inside of the gill-covers are black. The chin carries a short barbel.

The *first dorsal* fin has ten rays, and is a little posterior to the vertical passing through the roots of the pectoral and ventral fins. Its longest rays, when pressed to the back, reach to the commencement of the second dorsal. It begins at a distance from the snout equal to about one-fourth of the total length of the fish, and its height is rather less than the height of the body under it, but much greater than that of the second dorsal. The first ray is not serrated; it is slightly longer, but not stronger, than the next three rays. The last ray is about one-third of the length of the first.

The *second dorsal* fin commences behind the commencement of the anal fin, and is much lower than that fin. Both of them unite with the caudal without a break. The space separating the two dorsal fins is about one-third the length of the head.

The pointed *pectoral* fins are inserted near the border of the opercle, and their length is about equal to half the length of the head; they reach backwards to the commencement of the anal fin, but not quite so far as the commencement of the second dorsal fin.

The *ventral* fins are placed under the roots of the pectoral fins. The first ray is produced, and reaches back as far as the vent, which is situated at a distance from the tip of the snout equal to one-third of the total length of the fish. Between the ventral fins there is a depression, the middle part of which is scaleless.

The *anal* fin commences under the space separating the two dorsal fins, and is higher and more distinct than the second dorsal; it is highest at the middle. There are about 82 rays in it, counting all to the tip of the tail.

The *lateral line*, in the anterior part of its course, is nearly parallel with the outline of the back; it descends a little under the anterior part of the second dorsal, and is then straight along the middle of the tail.

The following are the dimensions in inches of the two longest specimens that have occurred:—

Total length	10	$13\frac{1}{5}$
Height under first dorsal	$1\frac{3}{10}$	$1\frac{7}{8}$
Thickness at pectorals	$\frac{8}{10}$	$1\frac{1}{4}$
Head, length	$2\frac{4}{10}$	$3\frac{3}{10}$
,, thickness behind eyes	$1\frac{1}{10}$	$1\frac{5}{8}$
Eye, longer diameter	$\frac{8}{10}$	$1\frac{1}{8}$
,, shorter diameter	...	$\frac{6}{8}$
First dorsal, height	$1\frac{4}{10}$	$1\frac{9}{10}$
,, distance from snout	$2\frac{1}{2}$	
Second dorsal, distance from snout	$3\frac{1}{2}$	$5\frac{5}{8}$
Pectorals, length	$1\frac{1}{10}$	$1\frac{7}{10}$
,, distance from snout	$2\frac{4}{10}$	$3\frac{3}{10}$
Ventrals, length of first ray	$1\frac{1}{10}$	$1\frac{4}{10}$
Vent, distance from tip of mandible	$1\frac{8}{10}$	$3\frac{1}{2}$
Anal, distance from vent	$\frac{6}{10}$	
,, height at middle	...	$1\frac{1}{10}$
Barbel, length	...	$\frac{1}{2}$

Macrourus lævis, Lowe, Ann. & Mag. Nat. Hist. ser. i. vol. xiii. p. 400.

1st D. 9. 2nd D. A. & C. 00. P. 15. V. 8. M.B. 7.

The body is coloured a light grey, and has a sleek appearance, from the smallness of the scales; those on the head and cheeks are rougher. The head is rather less than one-sixth of the total length of the body, the height of which (under the first dorsal) is contained rather more than seven times in the length. The body attenuates rapidly behind the first dorsal fin. The *head* is subcubical, the snout short and blunt. On the vertex is a ridge rising from depressions between the eyes, which are oval. The cheeks are flat; the mouth is on the under side of the snout, which projects one-fifth the length of the head beyond the mouth. The upper border of the mouth is formed entirely of the premaxillary. The *teeth* are small and acute, forming two rows in the upper jaw, those of the outer row being conical, curved, and larger, but fewer and more irregularly disposed than those of the inner row. In the lower jaw there is but a single row of teeth, and these are similar in form to the teeth in the outer row above. The palatines, vomer, and tongue are unarmed. The mouth is white within, and the tongue is only free near the tip. The chin carries a small barbel.

The *first dorsal* fin is much higher than the second; it commences at a distance from the snout equal to a little more than the length of the head. It is highest in front, where its height is about three-fourths of that of the body under it; but its longest rays, when pressed to the body, do not nearly reach back to the commencement of the second dorsal. The first spine is not serrated.

The *second dorsal* fin unites, like the anal, with the caudal.

The pointed *pectoral* fins are inserted under the first dorsal fin, and are about half as long as the head.

The short *ventral* fins have their roots under the roots of the pectoral fins.

The *vent* is distant from the snout about one-fifth of the total length, and the *anal* fin commences shortly behind it under the root of the pectorals.

The *lateral line* in the anterior part of the body follows the curve of the back; it descends rather rapidly behind the tip of the pectoral fin, and is straight along the middle of the body and tail.

Differences in the dentition, the scales, the configuration of the sides of the head, the position of the vent, and the structure of the ventral fins, distinguish this species from the preceding one; whilst both may be discriminated from *M. serratus* by the simple, not serrated, first spine of the first dorsal fin.

The following measurements were taken from the single specimen that has occurred, now in the British Museum:—

Total length	$14\frac{1}{2}$
Height under first dorsal	2
Thickness of body near pectoral	$\frac{9}{10}$
Head, length	$2\frac{1}{2}$
„ thickness behind eyes	$1\frac{3}{10}$
Snout, distance from tip to mouth	$\frac{1}{2}$
Eye, longer axis	$\frac{8}{10}$
Upper jaw, length	$1\frac{2}{10}$
First dorsal, distance from snout	$2\frac{8}{10}$
„ height	$1\frac{4}{10}$
Second dorsal, distance from snout	$4\frac{8}{10}$
Pectorals, length	$1\frac{2}{10}$
Vent, distance from tip of under jaw	$2\frac{6}{10}$
Ventrals, distance from vent	$\frac{1}{5}$
Barbel	$\frac{6}{10}$

XVIII.—*On the Mexican Species of* Hydropori. By the Rev. Hamlet Clark, M.A., F.L.S.

A very interesting and valuable collection of Coleoptera, made by M. Truqui during his residence of several years in Mexico, has recently passed into the hands of my friend Mr. Alexander Fry. The Dytiscidæ of this collection I have, by Mr. Fry's kindness, carefully examined. Some of the species of the group are well known; but many others (and these especially the smaller species) appear to be new to science. The genus *Hydroporus* especially (represented by sixteen species) presents no form that I am able to recognize as already described by Say, Melsheimer, or Leconte. Say's descriptions are somewhat imperfect, and, in the absence of typical specimens, often insufficient; and I have been unable to examine the fifth volume of the 'Annals of the Lyceum of Natural History of New York,' in which many of Leconte's species are described. With the aid, however, of the admirable analysis of the *Hydropori* of the States, drawn up by Dr. Leconte, and published in the 'Proceedings of the Academy of Natural Sciences,' April 1855, and especially (in some cases) of type-specimens of interesting species described by him, which that gentleman has added to my cabinet, I have been able to satisfy myself of this, at least, that, whatever may be the characterized species of Mexican *Hydropori*, none of them are to be found among the species which I have been recently examining. I propose therefore in this paper briefly to describe the new species from Mr. Fry's cabinet and my own, having first enumerated those Mexican species of this genus that (so far as I know) are already determined. With the aid of Dr. Leconte (by his interesting set of types from his cabinet, and also copies of valuable papers by him on North-American Coleoptera), and by the kindness of M. Bonvouloir of Paris (who has entrusted to me for comparison type-specimens of North-American species named by M. Aubé), I believe that the list is tolerably accurate. The prefix to each species of a letter and figure indicates the subsection of the genus, as adopted in the following paper, to which the species may be referred.

Species already described by authors :—

(A. 1.) *H. punctatus*, Say, Long's Second Exped. Philad. 1824, ii. 271.

——, Aubé, Species Général, 1838, 471.

(A. 1.) *H. cuspidatus*, Germ. Faun. Ins. Eur. v. t. 4.

Hyphydrus notatus, Say (?).

(B. 2.) *H. lacustris*, Melsh.; Say, Trans. Amer. Philos. Soc. 1823, ii. 103.

H. pulicarius, Aubé, Species Général, 1838, 495.

(A. 3.) *H. striatellus,* Lec. Proc. Ac. N. Sc. 1855, 295.
(A. 3 *a.*) *H. mixtus,* Lec. Proc. Ac. N. Sc. vii. 296.
(A. 3 *a.*) *H. semirufus,* Lec. Proc. Ac. N. Sc. vii. 296.
(A. 3 *a.*) *H. vittatus,* Lec. Proc. Ac. N. Sc. vii. 296.
(A. 3 *a.*) *H. catascopium,* Say, Trans. Am. Phil. Soc. ii. 103.
H. interruptus, Say, Trans. Am. Phil. Soc. iv. 445.
H. parallelus, Say, Acad. Nat. Scien. Phil. iii. 153.
(A. 3 *a.*) *H. vilis,* Lec. An. Lyc. N. Hist. v.
(A. 3.) *H. concinnus,* Lec. Proc. Acad. N. Sc. vii. 297.
(A. 3 *b.*) *H. patruelis,* Lec. *ibid.* vii. 298.
(A. 3 *b.*) *H. nubilus,* Lec. *ibid.* vii. 298.
(A. 3 *b.*) *H. discoideus,* Lec. *ibid.* vii. 298.
(A. 3 ?) *H. bifidus,* Say, Trans. Am. Philos. Soc. iv. 444.
(A. 3.) *H. nudatus,* Say, *ib.* iv. 444.
(A. 3.) *H. sericatus,* Say, *ib.* iv. 445.

Hydroporus, *Clairv.*

A. Thorace haud striolato.

1. Rotundati.

1. *H. Portmanni,* n. sp.

H. subcircularis, latus, depressus, leviter punctatus; thorace pene triangulari, flavo-ferrugineo; elytris flavis, ad suturam nigris; antennis pedibusque flavis.

Long. corp. $1\frac{1}{4}$ lin., lat. $\frac{4}{5}$–1 lin.

Broad and depressed, glabrous, under a high power very finely punctate, in colour ferruginous or flavo-ferruginous: *head* broad, impunctate, black: *thorax* broadly transverse, much narrower laterally than medially, the sides being very short; the surface is anteriorly finely punctate, more distinctly so towards the base; in colour flavo-ferruginous, the anterior margin being more pale than the base; the form of the thorax is remarkable—it is subtriangular, by reason of its deep scutellary angle and its narrow sides: *elytra* broad, depressed, finely punctate, more distinctly so than in *H. Bryanstonii*; in colour flavous, faintly clouded with fusco-flavous, the sutural line being distinctly black: *abdomen* and underside black: *legs* and *antennæ* pale flavous.

Nearly related to *H. Bryanstonii*; in several distinct particulars, however, it differs from it: it is larger in size; it is less brightly glabrous, the coloration is more distinctly pale, and the punctations on the elytra are more distinct. Allied to *H. pustulatus,* Melsh., which is found in North America; it is a trifle broader, not so convex, and more glabrous.

Mexico. In the cabinets of Mr. Fry and the Rev. Hamlet Clark.

2. *H. Leconteii*, n. sp.

H. subovatus, rotundatus, punctatus, nigro-ferrugineus; capite nigro; thorace rufo-ferrugineo, antice et postice nigro marginato; elytris rufo-ferrugineis, obscure nigro-fuscatis; antennis pedibusque rufo-flavis.

Long. corp. $1\frac{1}{5}$ lin., lat. $\frac{3}{5}$–$\frac{4}{5}$ lin.

Perceptibly narrower than *H. Portmanni*, and somewhat more convex; in the single ♂ example before me the surface is very dull and opake: it is a question whether this is sexual, as in many other species. The surface of the elytra, when viewed under a high power, is sparingly and distinctly punctate; other very minute and frequent punctures give to the surface the appearance of delicate granulation.

H. Leconteii closely resembles a species (I believe undescribed) which I have received from Florida, and which must apparently be placed near *H. farctus*, Lec.

I name this species after Dr. Leconte of Philadelphia, who has carefully studied the Hydrocantharidæ of North America, and to whose excellent papers in the 'Proc. Acad. Nat. Sciences' and in the 'Annals of the Lyceum of Nat. Hist. of New York' we are indebted for nearly all that is known of the many interesting species of this vast continent.

Mexico; the exact locality unrecorded. A single specimen, taken by the late M. Truqui.

3. *H. Bryanstonii*, n. sp.

H. latus, subcircularis, depressus, subtiliter punctatus, glaber, rufo-ferrugineus; thorace rufo-fusco; elytris utrinque ad suturam breviter et tenuiter striatis.

Long. corp. 1 lin., lat. $\frac{4}{5}$ lin.

Broad, subcircular, depressed, glabrous, finely punctate, rufo-ferruginous: *head* broadly transverse: *thorax* broad, the sides somewhat rounded and much constricted in front; the surface is very finely punctate, in colour rufo-fuscous, the medial disk being always darker than the sides: *elytra* broad, subdepressed, *finely* punctate, glabrous; near the suture is, on either side, a short and indistinctly punctured stria; the surface is ferruginous or rufo-ferruginous in colour: *abdomen* and *underside* black, the mesothorax being rufous: *legs* rufous: *antennæ* pale rufous.

This species varies but little in coloration, and apparently is not rare. I have specimens before me, from Mr. Fry's cabinet, received from M. Truqui, and also from my own, which I obtained through Mr. Stevens: all the examples manifest the same ferruginous colour. It may be distinguished by its almost circular depressed form, its *glabrous* surface, and the short and almost obsolete stria at the base of the elytra. At first sight the species might be taken for large and dark specimens of *H. convexus,* Aubé (found in the States); it is, however, an entirely separate species.

In the collections of the British Museum, Mr. Fry, and the Rev. H. Clark.

2. Breviter ovati.

4. *H. Roffii,* n. sp.

H. latus, robustus, impubescens, punctato-striatus, niger; elytris ad basin rufo notatis, ad apicem juxta marginem rufo maculatis, pedibus fuscis.

Long. corp. 2 lin., lat. 1 lin.

Ovate, broad, robust, impubescent, punctate-striate, black, the base and apex of the elytra being frequently rufo-maculate: *head* broadly transverse; when seen from the front, two distinct depressions are apparent on either side near the inner surface of the eyes; under a high power the surface is finely punctate, the apex and line of the base being more or less distinctly marked with rufous: *thorax* broadly transverse, the sides slightly rounded and much constricted towards the front; the surface is subglobose; parallel to the anterior and also the posterior margin is a depressed line of punctures, those at the base being more distinctly apparent: *elytra* broad, attenuate towards the apex, subglobose, with three distinctly impressed rows of striæ, and a few single deep punctures near the line of the base between the first and second striæ; the surface (when seen under a high power) is very finely granulated, in colour black, the line of the base being marked with rufous (in some examples this basal marking is almost obsolete); towards the apex, near the margins, are two or three well-defined red spots; the apex itself also is distinctly marked with red: *abdomen* and *underside* black: *legs* fuscous: *antennæ* rufous, the apical joints being rufo-fuscous.

Var. A. The elytra in colour entirely black; in all examples, however, there is an *indication,* however faint, of rufous colouring at the apex.

Several examples before me of this species from M. Truqui's collection exhibit every shade of coloration, from the typical pattern to the almost black variety.

In the cabinets of the British Museum, Mr. Fry, and the Rev. Hamlet Clark.

5. *H. decemsignatus,* n. sp.

H. ovatus, ad apicem attenuatus, punctato-striatus, niger; elytris flavo decemnotatis; antennis testaceis; pedibus fuscis.

Long. corp. 2 lin., lat. 1 lin.

Broadly ovate, compressed and attenuated towards the apex, punctate-striate, of a dull black colour: *head* broad, impunctate, with two insulated depressions, one on either side of the inner margin of the eyes, in colour black, the basal line and also the apex being obscurely tinged with rufous: *thorax* broad, the lateral margin being much constricted towards the front, and in a continuous line with the lateral margin of the head; the surface (under a high power) is obsoletely rugose; parallel with the anterior margin is a line of faintly impressed punctures; in colour black, with a medial circular spot of suffused rufous (in a second example there is a distinct trace of a similar suffused rufous marking *near the margin*): *elytra* broad, attenuated towards the apex, with three lines of faintly impressed punctures—one near the suture, another medial, and a third at some distance from the lateral margin; the surface is of a dull black colour, with five markings of flavous on each elytron—one at the base, transverse and parallel to the margin (sometimes continued at the shoulders in a line parallel to the lateral margin); the four others are smaller, of equal size, in form either subcircular or somewhat quadrate; of these, two are near the lateral margin, one is situate at the apex, and a fourth medially near the suture: *abdomen* and *underside* fusco-rufous, sometimes almost black: *antennæ* testaceous: *legs*, the anterior rufo-testaceous, the posterior fusco-rufous.

This species may be separated at once from all others by the very distinct flavous markings on its elytra.

I know of only two examples of the species, both taken by M. Truqui in Mexico: one in the collection of Mr. Fry; the other, by that gentleman's kindness, in my own.

3. Oblongi.

6. *H. Wardii*, n. sp.

H. ovatus, elongatus, subdepressus, punctulatus; thorace flavo, ad medium fusco; elytris leviter striatis, rufo-ferrugineis, ad basin et suturam flavis; pedibus rufo-flavis; antennis flavis.

Long. corp. 2 lin., lat. 1 lin.

Ovate, depressed, subelongate, finely punctate, rufo-fuscous: *head* broad; when viewed from above, a slight depression may be traced near the inner margins of the eyes; the surface is glabrous, finely punctate, and flavous, the line of the base and of the inner margins of the eyes being black: *thorax* broadly transverse, narrow, the anterior margin straight; the sides are somewhat constricted in front; the basal margin (medially) broadly punctate; the surface, obsoletely punctate and with a distinct line of deeper punctures parallel to the anterior margin, is in colour flavous, with a medial suffused spot of fuscous, the basal line being also medially and broadly black: *elytra* attenuate towards the apex, finely and thickly punctate, throughout glabrous; near the anterior margin, traces may be discerned of three obsolete striæ, which become evanescent before the middle; in colour rufo-ferruginous, the line of suture, the anterior margin, and the lateral margins being more or less flavous; this flavous coloration is most apparent near the shoulders, but varies somewhat in degree: *abdomen* and *underside* black: *legs* rufo-flavous: *antennæ* flavous, the apical joints being medially suffused with fuscous.

H. Wardii resembles in general appearance *H. nubilus*, Leconte, a species found in Kansas: it is more glabrous, less deeply punctate; and in *H. nubilus*, Lec., there is no trace of punctate striæ on the elytra.

Mexico. In the collection of the Rev. Hamlet Clark.

7. *H. Kingii*, n. sp.

H. ovatus, subdepressus, punctulatus; thorace nigro, marginibus flavis; elytris rufo-fuscis; pedibus antennisque rufo-testaceis. Long. corp. $1\frac{1}{2}$ lin., lat. $\frac{3}{4}$ lin.

Ovate, broad, subdepressed; when seen under a high power, finely and sparingly punctate; glabrous, darkly castaneous: *head* broadly transverse, impunctate, black: *thorax* broadly transverse, the sides rounded in form, the marginal line being continuous with that of the sides of the elytra and also of the head; the anterior margin is straight, the anterior angles being subprominent; parallel to the anterior margin is a row of minute punctures; the surface generally is impunctate and glabrous, with faint traces near the base of obsolete punctures; in colour black, the sides being suffused more or less broadly with flavous: *elytra* sufficiently robust, towards the apex subacuminated (but not so distinctly as in *H. Wardii*); the surface is finely and somewhat sparingly punctate throughout, with a single medial stria of closely-arranged minute punctures on each elytron: *abdomen* and *underside* black: *legs* and *antennæ* rufo-testaceous.

A much smaller insect than *H. Wardii*, though similar to it in form; not unlike *H. suturalis*, Leconte, but more parallel and a trifle narrower.

Taken by M. Truqui in Mexico.

8. *H. æquinoctialis*, n. sp.

H. oblongo-ovatus, subdepressus, confertissime subpunctatus, fusco-niger; capite lævi, ad basin obsolete punctato, nigro, ad medium suffuse rufo; thorace sat lato, subtiliter rugoso, lateribus haud marginatis, cum elytrorum humeris angulum valde obtusum formantibus, rufis, ad medium baseos nigro binotatis; elytris 4-striatis, confertissime punctatis, nigris vel fusco-nigris, ad humeros et marginem testaceo notatis; pedibus rufo-fuscis.

Long. corp. 2 lin., lat. 1 lin.

Oblong-oval, subattenuated towards the apex, subdepressed; when viewed under a high power, the surface is very thickly and minutely punctate; elytra punctate-striate, in colour black or fuscous black marked with rufous: *head* finely and thickly punctate, black, the medial anterior disk being suffused with rufous: *thorax* broadly transverse, in front distinctly excavated; the sides are subconstricted and very narrowly marginate; the basal line is broadly and distinctly angulated in the place of the scutellum; when viewed obliquely, a row of fine punctures is discernible parallel to the anterior and also to the basal margins (these lines of punctures in different examples vary somewhat in breadth); in colour rufo-flavous, the anterior margin and also two medial basal circular markings being black; the margination is also narrowly black: *elytra* sufficiently robust, subdepressed, and slightly acuminate; the shoulders are somewhat rounded, thus forming a distinct angle with the line of the margination of the thorax; towards the apex the surface is very finely and thickly punctate, with four rows of deeper and more distinctly punctate striæ (that near the line of margination being sometimes more obsolete); the colour is dark fuscous, with an irregular, short, longitudinal rufous marking at the base between each stria, and other irregular longitudinal markings distributed throughout the surface, more distinctly near the line of margination; in different examples these markings vary considerably in number and degree of coloration: *abdomen* and *underside* black: *legs* flavo-rufous; *antennæ* rufous, the apex being more or less fuscous.

The three examples before me of this species present some variation in the form and extent of the markings on the elytra. It is a very distinct and handsome species.

San Angel and Cuernavaca, Mexico. In the collections of Mr. Fry and the Rev. Hamlet Clark.

9. *H. infaustus*, n. sp.

H. oblongo-ovalis, subparallelus, antice sat obtusus, confertissime et obsolete punctatus, punctato-striatus, niger; capite brevi, inter oculos undique late et obsolete depresso, punctatissimo, nigro, ad medium prope basin transverse rufo notato; thorace transverso, lato, ad latera tenuiter marginato, prope basin irregulariter transverse depresso, punctatissimo, nigro, ad medium rufo notato; elytris sat productis, ad apicem subacuminatis, subtiliter punctatissimis, punctato-striatis, nigris, ad latera obsolete rufo vel fusco

notatis; pedibus rufo-testaceis, femoribus posticis nigro suffusis; abdomine nigro.
Long. corp. 2 lin., lat. 1 lin.

Oval, somewhat produced, punctate-striate, black: *head* broad, on either side in front is an obsolete depression; the surface (under a high power) is very finely and thickly punctate, in colour black; near the line of the base a narrow transverse band of flavous is well defined: *thorax* broadly transverse, the anterior margin excavated; the sides subparallel and rounded in front, very narrowly and evenly marginate; the line of the base is broadly angulated at the region of the scutellum; the surface is finely and thickly punctate and medially somewhat rugose, with a row of minute punctures parallel to the anterior margin; near the base it is medially transversely depressed, in colour fuscous black, with a post-medial marking (sometimes almost obsolete, sometimes subcircular and suffused) of flavous: *elytra* somewhat acuminated at the apex; the shoulders are sufficiently prominent, thus forming an angle with the line of the margination of the thorax; the surface is very finely punctate, with six deep punctate striæ (more obsolete near the margins and apex) of a dull black colour, three or four obsolete markings of flavous being more or less distinct near the line of margination: *abdomen* and *underside* black: *legs* flavous, the apical joints being fuscous.

More deeply striated, narrower, and darker than *H. æquinoctialis*, and unmarked on the elytra by longitudinal flavous lines.

A single specimen, taken between Nopaluca and Vera Cruz by M. Truqui.

10. *H. infacetus*, n. sp.

H. parallelus, punctatus, rufo-ferrugineus; capite flavo, ad medium rufo-fusco; thorace rufo-flavo; elytris rufo-ferrugineis, ad basin flavo lineatis, sutura fusca; pedibus antennisque rufo-flavis.
Long. corp. $1\frac{4}{5}$ lin., lat. $\frac{4}{5}$ lin.

Parallel, subovate, thickly punctate, rufo-ferruginous: *head* finely punctate, flavo-testaceous; near the inner margin of the eyes is a longitudinal suffused marking of rufo-fuscous: *thorax* transverse, finely punctate, rufo-flavous: *elytra* subparallel, sufficiently robust, the sides near the anterior angles forming an obtuse angle with the sides of the thorax; the surface is thickly punctate and rufo-ferruginous, the anterior margin and also the longitudinal medial lines being flavous; these lines, three or four in number, are more or less obsolete; the extreme apex is also flavous, and the sutural line narrowly fuscous: *abdomen* and *underside* black: *legs* and *antennæ* rufo-flavous.

H. infacetus approaches in *general* appearance and colour *H. Wardii*: it differs, however, materially in form; it is broader and more parallel, the punctures also are coarser, and its elytra are marked with distinct flavous medial longitudinal lines. It is smaller than *H. Kingii*. From other species it differs by its parallel form and distinct punctures on the surface of the elytra.

A single specimen, taken by M. Truqui in Mexico, has no distinct locality affixed to it. In the collection of Mr. Fry.

B. Thorax striola utrinque basali.

a. *In elytris continuata.*

1. Breviter ovatus, sat convexus.

11. *H. Fryii*, n. sp.

H. breviter ovatus, ad apicem subattenuatus, punctatus, niger vel ferrugineo-niger; thorace fortiter punctato, undique ad latera antice transverse flavo notato, linea basali attenuata, constricta, elongata; elytris maculis quatuor magnis, his ad humeros subcircularibus, illis apicem versus elongatulis.

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

A very pretty species, quite distinct in pattern from any described as North-American species: it would probably range under Section C. of Leconte's Analytical Table of Hydropori of the States (Proceedings of Academy of Natural Sciences, April 1855); in general pattern it resembles at first sight *H. decoratus*, Gyll., and *H. cuspidatus*, Kunz., Aubé; in form, size, and also in pattern, it approaches *H. pumilio*, Dj., Aubé, but is much less coarsely punctate; it is remarkable for the fine *thread*-like character of its thoracic longitudinal striæ, which are not short and broadly defined, but elongated and narrow, as if formed by the scratch of a pin; there are no traces of striæ on its elytra, except in the scutellary region, where there is an abbreviated row of indistinct punctures near the suture: the surface of the elytra is sparingly covered with *minute* punctures: *legs* and *antennæ* fuscous.

My friend Mr. Alexander Fry has kindly placed at my disposal the whole of the collection of Hydrocantharidæ made by M. Truqui, for the purpose of examination and description. I have pleasure in dedicating to him this very distinct and pretty species.

Taken by M. Truqui in Mexico (locality unrecorded). In the cabinets of Mr. Fry and the Rev. H. Clark.

2. Oblongi.

12. *H. Magensis*, n. sp.

H. sat robustus, subpubescens; thorace ad basin transverse depresso, nigro, antice flavo; elytris punctato-striatis.
Long. corp. $1\frac{1}{5}$ lin., lat. $\frac{1}{3}$ lin.

Ovate, broad, sufficiently robust, very finely and sparingly pubescent: *head* transverse, impunctate, glabrous; below the inner margin of the eyes on either side is a minute fovea, and parallel to the line of the base is a minute longitudinal depression; in colour black: *thorax* somewhat narrow, transverse; on either side is a distinct, longitudinal, somewhat oblique fovea, extending from the middle to the line of the base; the surface is thickly punctate; when viewed obliquely, a transverse shallow depression may be discerned near the middle, and also a minute punctured fovea near to the anterior margin; in colour black, the anterior margin and sides being distinctly suffused with flavous: *elytra* broad, robust, very finely pubescent; beneath this pubescence are distinct punctures, and also a faintly punctate stria; at the anterior margin, halfway between the suture and the lateral angles, is a short depressed fovea, corresponding in position with the fovea on the thorax; in colour a deep brown black: *abdomen* and *underside* black: *legs* rufous: *antennæ* rufo-fuscous.

A single example of this species is in my collection, received some years ago through Mr. S. Stevens. Locality "Mexico."

13. *H. Charlottii*, n. sp.

H. ovatus, subelongatus, punctatus, flavo-ferrugineus; elytris rufo-flavis, lineis obscuris tribus aut quatuor fuscis; antennis rufo-testaceis.
Long. corp. 1 lin., lat. $\frac{1}{2}$ lin.

Ovate, subparallel, punctate, glabrous, of a flavo-ferruginous colour: *head* broad, in colour rufo-flavous: *thorax* broad; the sides are somewhat rounded in form and constricted towards the front; the anterior margin is straight; the surface is thickly and obsoletely punctate; on either side of the middle, near the line of the base, are two short and distinct foveæ extending halfway to the anterior margin; the surface is glabrous, and in colour flavo-ferruginous: *elytra* sufficiently broad, slightly constricted in front, the margins near the base forming an oblique angle with the line of the thorax; the surface is thickly and obsoletely punctate; near the basal line, immediately opposite the thoracic fovea, is a short longitudinal depression, broader and less distinctly defined than the fovea of the thorax; in colour rufo-flavous, with three or four obscure fuscous lines extending from the base nearly to the apex: *abdomen* and *underside* rufo-flavous: *legs* and *antennæ* rufo-testaceous.

H. Charlottii approaches in character to *H. Magensis*; it is broader, the apex of the elytra is somewhat less attenuated, and its coloration is entirely different. The species *very closely* resembles a pale variety of *H. nanus*, Aubé (= *H. affinis* of Say), examples of which I have received from Dr. Leconte. The species before us is larger, a trifle more parallel in form, the longitudinal markings on the elytra are less distinctly defined, and the punctures on the elytra are less distinct.

Taken by M. Truqui in Mexico.

14. *H. Emilianus*, n. sp.

H. ovatus, impubescens, punctatus, rufo-ferrugineus; capite flavo, ad medium fusco suffuso; thoracis lateribus flavo suffusis; elytris punctatis; antennis rufo-flavis.

Long. corp. $\frac{4}{5}$ lin., lat. $\frac{2}{5}$ lin.

Ovate, impubescent, thickly and finely punctate, rufo-ferruginous: *head* transverse, impunctate, glabrous, in colour flavous, the inner margins of the eyes near the base being suffused with fuscous: *thorax* transverse, the sides subparallel and constricted in front; the surface is glabrous and finely punctate, more distinctly near the base; on either side of the middle, connected with the line of the base, is a short, well-defined, longitudinal fovea: *elytra* parallel, subattenuate near the apex, thickly but obsoletely punctate; at the anterior margin (halfway between the humeral angles and the suture) is a short longitudinal fovea, corresponding in position to the thoracic fovea; the surface in colour is rufo-ferruginous or fuscous, the sides being more or less distinctly suffused with flavous: *abdomen* and *underside* dark fuscous; *legs* flavous; *antennæ* rufo-flavous.

Closely allied to *H. Magensis*, from which, however, it may be separated by its smaller size and its glabrous and impubescent elytra, as well as by its coloration: it is somewhat smaller, more ovate, and less parallel than *H. nanus*, Aubé, more nearly related still to *H. erythrostomus*, Man., a northern species, found in Russian America.

I have three examples of *H. Emilianus* before me, from Mr. Fry's and my own collections, all from Mexico, though doubtless taken in different localities. I can trace no tendency to variation in the species.

15. *H. adumbratus*, n. sp.

H. oblongo-ovalis, punctatus, pubescens; capite fusco, interdum antice rufo-fusco; thorace flavo, ad basin plus minus fusco; elytris subtiliter punctatis, subpubescentibus, fuscis; antennis pedibusque rufo-flavis.

Long. corp. $\frac{4}{5}$ lin., lat. $\frac{2}{5}$ lin.

This minute species varies somewhat in size and also in colour: one example before me is of a deep-black colour, the thorax being somewhat fuscous; this same example is perceptibly smaller in size. In the absence of any series of specimens, I can detect no necessarily permanent difference which would constitute it a distinct species. *H. adumbratus* is less distinctly punctured than *H. Emilianus*; it is, moreover, easily recognized by its manifest pubescence.

Three examples were taken by M. Truqui in Mexico. In the cabinets of Mr. Fry and the Rev. Hamlet Clark.

b. *Thoracis striola in elytris haud continuata.*

16. *H. apicatus*, n. sp.

H. breviter ovatus, apice attenuatus, subrotundatus, modice depressus, glaber, punctatus; capite flavo; thorace ad basin subtilissime punctato, rufo-flavo aut flavo; elytris crebre punctatis, rufo-ferrugineis; pedibus antennisque flavis.

Long. $\frac{3}{5}$–$\frac{4}{5}$ lin., lat. $\frac{2}{5}$ lin.

This pretty minute species resembles in size and coloration *H. convexus*, Aubé (= *Desmopachria nitida*, Bab., Trans. Ent. Soc. Lond. iii. p. 16), of Brazil: it is, however, an entirely different species; the basal striæ of the thorax place it in a different section of the genus; it is more acuminated at the apex, and not so globose; the punctation of the elytra is much more distinct than in *H. convexus*. In form it approaches *H. granarius* of Aubé.

A single example has been kindly communicated to me by M. Deyrolle of Paris, received by him from "Teapa," Mexico.

XIX.—*Descriptions of Indian and Burmese Species of the Genus* Unio, *Retz.* By W. H. Benson, Esq.

Having collected specimens of the genus *Unio* in Bengal, Bahar, the Doab, Oude, Rohilkhund, Bundelkhund, and other parts of the Gangetic region, from Calcutta to Delhi and the base of the Himalayan range, and having received others from correspondents who have kindly transmitted the productions of tracts which I had no opportunity of visiting during the years of my residence in India, I have procured a series of the species, inhabiting the waters of that country, which no other collector is likely to have had opportunities for obtaining.

Considering the mode in which the species of this difficult genus approach each other in their variations, I undertake the task of describing the following shells with diffidence, although confident that my observations will help to increase our knowledge of the genus, even if one or two forms should eventually be decided to be varieties. I have not quite exhausted my store of novelties, and am, moreover, inclined to believe that some of the shells which I still regard as varieties would be pronounced to be distinct species by some writers who have studied the genus more extensively.

The remarks published by Lamarck on the subject are worthy of note. He says : "Ce qui se montre dans tous les genres où nos collections se sont bien enrichies, savoir, que les espèces se nuancent et se fondent les unes dans les autres, dans le cours de leurs variations, se fait ici encore plus fortement remarquer qu'ailleurs, et confirme ce que j'ai dit de l'*espèce* dans ma 'Philosophie Zoologique' et autres ouvrages; aussi la détermination des espèces du genre *Mulette* est-elle très-difficile."

I add some notes on species already published, and which have fallen under my observation.

1. *Unio Jenkinsianus*, B., n. sp.

U. testa transverse elongata, subacuminato-ovata, valde inæquilaterali, tumida, crassa, antice brevi rotundata, postice elongata, minime alata, superne sensim descendente, demum angusta, obtusa; margine basali antice convexiusculo, postice subrecto; ligamento brevi; disco valde tumido, transverse plicato; epidermide picea, versus marginem ventralem olivacea; umbonibus leviter convexis, decorticatis, apicibus obtusis; dentibus arcuatim sitis, crassiusculis, erosis, cardinalibus elongatiusculis, valvæ sinistræ subsimplicibus, dextræ duplicibus laminatis, lateralibus remotis subelongatis, valvæ sinistræ duplicibus, lamina interna demum incrassata: margarita violaceo-albida, iridescente.

Long. 52, lat. 94, diam. 38 mill.

Habitat in fluvio Assamensi Berhampooter dicto.

The anterior cicatrices are widely separated, the posterior confluent, and in the right valve a distinct cicatrix is placed in the angle formed by the confluent portions. The dorsal cicatrices are situated between the shallow cavity of the beaks and the cardinal tooth. The subapical lobe of the cardinal tooth in the right valve is obsolete, the other somewhat thickened, oblique, and erect. In the left valve the cardinal tooth is double and oblique, the internal portion being thickened. The lateral teeth are oblique, erose, and rather short, especially the double one in the left valve, in which the lower lamina is very thick, especially towards the extremity. The ligamental slope is flattened, not alate as in *U. marginalis*, and the ligament is very short when compared with that of the different varieties of the latter species.

The very tumid form, the sloping posterior end, the absence of a wing, the short ligament, and the nature and position of the teeth, all concur in warranting the separation of this shell from *U. marginalis,* a small variety of which was sent to me from the Berhampooter River by Major Rowlatt.

I am indebted to Colonel Jenkins for the species here described, as well as for the types of the Assamese forms *U. involutus, U. Corbis, U. Radula,* and *U. Scobina,* figured in Sylvanus Hanley's Supplement to Wood's Index. *U. Scobina* was subsequently published by Lea as *U. fluctiger,* without knowledge of its habitat.

2. *Unio pachysoma,* B., n. sp.

U. testa transverse ovato-elongata, inæquilaterali, tenuiuscula, valde tumida, antice brevi rotundata, postice breviter alata, demum modice acuminata, margine ventrali subrecto, postice ascendente; disco læviusculo, polito, transverse striatulo, postice dense striato; epidermide viridi, fasciis nonnullis luteis radiisque obscuris ornata, postice cærulescenti-viridi; umbonibus prominentibus versus apices contiguos minute radiato-costatis, carina umbonali prominente obtusa, linea secunda radiata interjacente; dentibus cardinalibus duplicibus, laminatis, lateralibus modice elongatis, valvæ sinistræ solum duplicibus: margarita pallide purpurea, interdum salmonis colore tincta.

Long. 23, lat. 44, diam. 21 mill.

Habitat in fluvio Berhampooter Assamensi.

Anterior cicatrices distinct, posterior confluent, dorsal ones under the cardinal teeth. The inner lamina of the latter in the left valve sometimes obsolete.

This is an inflated form of the *cæruleus* type, quite devoid of radiate rugæ on the slopes, and with an excavated posterior slope. The colour of the nacre is peculiar. I am indebted for the type to Colonel Jenkins.

A shell taken at Calcutta by Mr. W. Theobald, with a more elongate-cylindrical form, an olive-green epidermis, and a salmon-coloured nacre, and which I was at first disposed to consider to be a variety of *U. cæruleus,* seems to be a distorted variety of this species. A shallow shell, allied to the ordinary type of *U. cæruleus,* was sent to me from Assam by Major Rowlatt in abundance.

3. *Unio Theca,* B., n. sp.

U. testa transverse oblongo-ovata, valde inæquilaterali, tenui, compressa, antice et postice rotundata, superne subtusque convexiuscula, margine ventrali medio recto; disco subplanato, læviusculo, lineis transversalibus subrugosis versus margines notato; epidermide pallide stramineo-lutea; umbonibus planatis, decorticatis, versus apices tenues prominulos concentrice sulcatis, postice lineis duabus radiantibus tenuibus subelevatis munitis; ligamento lon-

giorie; dentibus cardinalibus laminatis, tenuibus, brevibus, utriusque valvæ duplicibus, valvæ dextræ prope marginem anteriorem sitis, obliquis; sinistræ lobo subapicali transverso, anteriore obliquo, lateralibus elongatis, vix curvatis, valvæ dextræ simplicibus, sinistræ duplicibus: margarita lutea, versus marginem ventralem albida.
Long. 20, lat. 40, diam. 10 mill.
Habitat in fluvio Cane, prope Banda, Bundelkhund.

Interior of shell transversely subplicate; cavity of beaks shallow. Anterior cicatrices separate, posterior confluent, apical ones in the cavity of the beaks. Some slight rugæ are visible on the posterior slope at right angles to the striæ of growth.

This shell, of which I found a single specimen, belongs to the *Corrianus* type of *Unio marginalis,* and is remarkable for its elongate-ovate non-rhomboidal form. *Unio marginalis,* although so abundant in other parts of the north-west, and occurring also in the upper part of the river Jumna, near Delhi, never was captured by me, in the branch of that river where I discovered this species, before 1830, and it has not appeared in any other collection made in the Gangetic region. The shell is somewhat wider posteriorly than anteriorly. The pale opake straw-colour of the unpolished epidermis is also a peculiar feature, not observable in any other Northern Indian species.

As in *U. bilineatus,* Lea, which occurs everywhere with *U. marginalis,* and which appears to me to be the young of that species, varying according to its varieties, the double umbonal line, apparent occasionally in adult specimens of *U. marginalis,* is conspicuous.

4. *Unio macilentus,* B., n. sp.

U. testa transverse rhomboideo-subovata, valde inæquilaterali, tenuiuscula, compressiuscula, antice rotundata, postice alata, recta, tum descendente, demum obtusa, margine ventrali convexiusculo; disco striato, medio radiato-rugoso, versus marginem transverse plicato; epidermide fuscata, versus marginem ventralem viridescente; umbonibus convexiusculis undato-sulcatis, decorticatis, ferrugineis, apice prominulo; ligamento elongato; linea umbonali convexiuscula; ala planiuscula, radiato-sulcata; dentibus cardinalibus brevibus, subverticalibus, duplicibus, erosis, lateralibus longiusculis rectis, valvæ sinistræ duplicibus: margarita versus marginem iridescente, versus apicem colore salmonis tincta.
Long. 24, lat. 42, diam. 15 mill.
Habitat in rivulo Choia Nuddy dicto, non procul a Bijnore, provinciæ Rohilkhund.

Anterior cicatrices separate, posterior confluent, apical in a row in the angle at the base of the cardinal tooth, the inner lobe of which in the right and the outer in the left valve are erect.

I took a single specimen of this shell in a hurried search at the locality indicated. Although belonging to the *favidens* type with reference to its teeth, it approaches that of *cæruleus* in other respects. A delicate specimen which I got in the Gungun River, near Moradabad, appears to be a younger variety. Its next nearest Indian relation is a similarly radiate-sulcate compressed shell, taken by Dr. Bacon in Purneah and the Mahanuddy River, far to the eastward; but that form is narrower, has a shorter wing, is truncate posteriorly, and has the cardinal teeth (when not obsolete) more oblique, and the lateral teeth curved, approaching the Borneo species *Unio plicatulus*, Lea.

5. *Unio favidens*, B.

U. testa transverse ovata, inæquilaterali, crassa, subtumida, antice rotundata, postice subalata, declivi, angulata, demum obtusa, margine ventrali convexiusculo; disco inæqualiter sulcato; epidermide olivaceo-fusca, versus marginem ventralem luteo-olivacea, postice viridi parce fasciata; umbonibus tumidis, prominentibus, decorticatis, sulcis radiatis angulato-flexuosis indutis; lunula impressa, elliptica, decorticata; ligamento elongato; carina umbonali læviuscula, linea unica vix elevata notata; dentibus cardinalibus crassis, fortiter radiato-rugosis, lateralibus obliquis, elongatiusculis, valvæ dextræ duplicibus, sinistræ subtriplicibus: margarita pallide lutea, iridescente.

Long. 45, lat. 66, diam. 30 mill.
Habitat in fluvio Gange superiore.

The anterior and posterior cicatrices are distinct, the apical ones disposed on the under side of the cardinal tooth.

This fine shell, the type of the species, was taken by me in the Ganges at Bhitoura, between Cawnpore and Allahabad, in 1824, and the outline of it was figured in plate 7. fig. 1 of the 1st volume of 'Gleanings in Science' for 1829, from a private lithographic copy made in 1826, by Mr. Wood, from my rough sketch. The Bhitoura specimens were the largest which I captured during many years' residence in the country.

The following are the chief varieties of *U. favidens*. Some of them may possibly be regarded as separate species.

1. var. *marcens*. Banded with olive and green; nacre salmon-coloured; beaks nearly smooth, eroded; sulci obsolete, lunule narrow.

   Long. 44, lat. 66, diam. 27 mill.
   From the Berhampooter River, Assam. Colonel Jenkins.

2. var. *trigona*. Shell with a piceous epidermis, more oblique; beaks and nacre as in type; lunule broad. It shows an inclination to verge towards *U. triembolus*.

   Long. 44, lat. 67, diam. 27 mill.
   From Nujeebabad, in the north-west of Rohilkhund.

3. var. *Deltæ.* Epidermis olive-green and yellow, rayed; nacre salmon-coloured; rugæ on umbones very distinct, some also on the upper part of the umbonal hinder slope; lunule somewhat broader than in the type; cardinal teeth narrower.
Long. 34, lat. 47, diam. 24 mill.

I took a single specimen in the River Jellinghy, in 1831, in the upper part of the Gangetic Delta, Bengal.

4. var. *Chrysis.* Longer and less broad in proportion; epidermis a beautiful green, banded more or less with yellow; umbonal rugæ very strong and extended; cardinal teeth mostly narrower than in the type; nacre salmon-tinted.
Long. 27, lat. 35, diam. 16 mill.

River Dojora at Kareily Ghát, near Bareilly. Single valves are long. 33, lat. 43 mill.

5. var. *viridula.* Form of type, but more compressed; colour as in the last; cardinal teeth broad; nacre bluish white; umbonal rugæ as in 4.
Long. 27, lat. 40, diam. 17 mill.

Standing water, or "jheel," between Humeerpore and Someerpore, Bundelkhund.

6. var. *densa.* More solid and tumid; epidermis yellow-brown, eroded; lunule as in type; shell more oblique.
Long. 33, lat. 47, diam. 24 mill.

Ganges River, above Chunár, between Allahabad and Benares.

Great confusion appears to exist with reference to the true *Unio corrugatus.* Lamarck describes it, including *U. rugosa*, Gm., as "ovato-rhombea, tenui," and the full-grown shell as "rounded rhomboid." Lea, in the third edition of his Synopsis, includes *U. corrugata, rugosa,* and *spuria,* Lk., as synonyms, and *nodosa,* with a mark of doubt. He also adds the solid *U. favidens,* Bens., with the very distinct and thick Tenasserim species *U. Tavoyensis,* Gould; but in vol. vii., in his remarks on *U. Nagporensis,* he alludes to *U. favidens* as a distinct species. A form allied to my var. *Deltæ* was supposed by Mr. Hanley to be the real type; and a Ceylon shell is also referred to it in Sir E. Tennent's List.

The winged young of *U. favidens,* 17 mill. in breadth, is thin and ovate-rhomboid; and the very young shell, which is more transverse, is angularly corrugate over the whole surface. The former approaches the figure of *Mya spuria* as copied by Wood.

A thin, compressed, rhomboid-ovate *Unio,* with radiate-sulcate beaks, found by Dr. Day on the Malabar coast, comes near Lamarck's description of his var. *rugosa.* It may possibly be the

Malabar *Mya radiata*, Ch. (not the American shell described by Lamarck and others), as there are traces of obsolete radiate striæ over the whole disk. It is 21 mill. long, 30 broad, and 12 mill. in diameter, and in form approaches the figure of *Mya radiata* in Wood's Index.

6. *Unio Smaragdites*, B., n. sp.

U. testa transverse ovato-rhomboidea, inæquilaterali, crassiuscula, tumida, antice rotundata, postice alata, recta, tum valde declivi, demum subangulata, margine ventrali convexo; disco lævigato, polito, vix striatulo, sub epidermide pulchre viridi tenuissima obscure radiata albo, margine lutescente; umbonibus prominentibus, apicibus approximatis, subdecorticatis, margaritaceis, breviter et minute radiato-sulcatis; lunula angusta, elongata, transverse rugata; ligamento subelongato; carina umbonali prominente obtusiuscula, areola versus apicem depressiuscula, viridi obscure radiata; dentibus cardinalibus duplicibus, subangustis, rugosis, lateralibus curvatis elongatiusculis, valvæ dextræ simplicibus, sinistræ duplicibus, nonnunquam subtriplicibus: margarita albida, nonnunquam luteo tincta.

Long 31, lat. 42, diam. 20 mill.

Habitat in fluvio Berhampooter, regionis Assamensis.

Remarkable for the smoothness of the beautiful green epidermis, which is very thin, and, when rubbed off, exhibits a plain white colour, not nacreous, underneath. The anterior cicatrices are confluent, the posterior nearly distinct, the apical ones situated under the cardinal teeth. Cavity of beaks very deep; a few rugæ cross the striæ on the posterior slope. In general characters it approaches most nearly to the Jellinghy variety (*Deltæ*) of *U. favidens*, which has a more tumid ovate form, a regular, sulcate, olivaceous surface, longer and distinctly angulate-flexuous umbonal furrows, and a broad lunule.

I received this shell from Colonel Jenkins.

7. *Unio triembolus*, B., n. sp.

U. testa oblique rhomboidali, subtrigona, transversa, inæquilaterali, crassa, antice brevi rotundata, postice subalata, descendente, demum angulata, obtusa, margine ventrali convexo; disco transverse plicato et striato, piceo-nigrescente; umbone tumido, gibboso, versus apices remotos obtusos decorticatos iridescentes radiato-sulcato, carina umbonali obtusa; dentibus cardinalibus crassissimis, corrugatis, lateralibus obliquis, valva dextræ duplicibus, sinistræ triplicibus: margarita albida vel colore salmonis tincta.

Long. 47, lat. 57, diam. 27 mill.
„ 45, „ 62, „ 27 „
„ 44, „ 63, „ 30 „

Habitat in flumine Ramgunga, prope Moradabad.

Smaller varieties of the more trigonal as well as of the oblique elongated form were taken by me in the River Goomty. I got a handsome variety of the first, with a green and olive epidermis, in the River Dojora, near Bareilly; and from the Gungut River, near Monghyr, in Bahar, a shell which may possibly be a gibbous variety of the second.

The anterior and posterior cicatrices are distinct, the latter particularly so; the apical cicatrices are indistinct on the inner side of the cardinal tooth; cavity of the beaks very deep and angular. In affinity the species appears to be connected on one side with the variety *trigona* of *U. favidens*, and, on the other, with *U. Rajahensis*, Lea.

The green Dojora variety is remarkable for the great development of the teeth. The lateral ones are disposed to be treble in the right as well as in the left valve; and several parallel plicæ intervene between them and the exaggerated cardinal teeth in a perfect specimen with the following dimensions:—

Lat. 50, long. 37, diam. 23 mill.

8. *Unio plagiosoma*, B., n. sp.

U. testa transverse trigono-ovata, inæquilaterali, crassiuscula, tumidiuscula, antice rotundata, postice subconvexe declivi, demum obtusa, margine ventrali convexiusculo; disco obsolete plicato, epidermide luteo-olivacea vel olivaceo-fusca; umbonibus convexis, prominentibus, decorticatis, angulatim flexuoso-sulcatis, apicibus prominentibus subremotis; ligamento brevi; carina umbonali obtusa; lunula elliptica; dentibus cardinalibus crassiusculis, radiatim eroso-sulcatis, lateralibus subelevatis, modice elongatis, obliquis, valvæ sinistræ duplicibus, dextræ simplicibus: margarita colore salmonis tincta.

Long. 26, lat. 39, diam. 18 mill.
„ 22, „ 32, „ 15 „

Habitat in flumine Cane, prope Banda, Bundelkhund.

The anterior cicatrices, as well as the posterior, are subconfluent, the apical ones situated on the under side of the cardinal teeth. The nacre is very iridescent posteriorly. A dark raised line borders the inner side of the umbonal slope, which exhibits a few rugæ at the upper part.

9. *Unio lævirostris*, B., n. sp.

U. testa transverse oblonga, subovata, valde inæquilaterali, crassiuscula, medio subtumida, antice superne breviter angulata, deinde rotundata, postice superne sensim convexe descendente, demum rotundata, margine ventrali convexiusculo; disco læviusculo, concentrice leviter striato; epidermide olivaceo-viridi, fusco fasciata; umbonibus convexis, decorticatis, obsolete radiato-sulcatis, apicibus prominentibus, approximatis; lunula impressa, elliptica; ligamento elongato; dentibus cardinalibus brevibus, crassiusculis, eroso-sulcatis, lateralibus subobliquis, elongatiusculis, rectis, utriusque valvæ duplicibus: margarita colore salmonis vix tincta.

Long. 28, lat. 50, diam. 20 mill.

Habitat in rivulis et stagnis prope Chunár.

This species was found by Capt. T. Hutton in tanks and streams near the Fort of Chunár, above Benares, and was noted as *Unio* No. 19, without name or description, in a paper contained in the fourth volume of the 'Journal of the Asiatic Society of Calcutta.'

It has two indistinctly raised dark rays on the posterior slope. The gradually compressed form of the hinder edge of the shell contrasts strongly with the inflated form of the central portion. Anterior and posterior cicatrices confluent, apical ones under the cardinal tooth. It belongs to the *favidens* type of Indian species, and is connected with the more oblique forms by the following species, *U. Pinax*, which is its representative in the more northerly and westerly tracts of the Gangetic region.

10. *Unio Pinax*, B., n. sp.

U. testa transverse oblonga, suboblique ovata, valde inæquilaterali, crassa, subinflata, antice rotundata, postice superne sensim descendente, demum obtusa, margine ventrali convexiusculo, postice vix emarginato; disco læviusculo, concentrice leviter striatulo, antice obsolete radiato-striato, versus marginem ventralem et posteriorem plicato; epidermide olivaceo-fusca; umbonibus convexis, decorticatis, obsolete radiato-sulcatis, apicibus prominentibus obtusis, remotiusculis; lunula elongato-elliptica; ligamento brevi; dentibus cardinalibus crassioribus, radiatim eroso-sulcatis, lateralibus obliquis, utriusque valvæ duplicibus, subflexuosis: margarita albida, iridescente.

Long. 30, lat. 48, diam. 21 mill.

Habitat in rivulo Gungun, prope Moradabad, Rohilkhund.

Anterior cicatrices subconfluent, posterior entirely so, apical ones under the cardinal tooth; cavity of the beaks very deep.

11. *Unio Leioma*, B., n. sp.

U. testa transverse oblonga, valde inæquilaterali, tenuiuscula, tumidiuscula, antice angustiore, rotundata, postice superne elevatiore convexiuscula, demum subverticaliter truncata, margine ventrali recto; disco transverse multisulcato; epidermide cinerascenti-olivacea; umbonibus convexiusculis, decorticatis, erosis, apicibus remotis; dentibus cardinalibus brevibus, laminatis, duplicibus, lateralibus rectis breviusculis, valvæ sinistræ solum duplicibus: margarita lactea, vix aurantiaco tincta.

Long. 23, lat. 50, diam. 17 mill.

Habitat in regione Dekhan? prope Bombay.

The subapical tooth of the left valve is lengthened and inclined to be obsolete, the outer one is short, thin, and prominent; those of the right valve are divaricate, the outer one thin, and the inner thicker, erose, and prominent at the end. The anterior cicatrices are distinct, the posterior confluent, the apical ones run under the inner cardinal tooth. The cavity of the beaks is shallow. There are slight indications of rugæ on the posterior slope. The valves are open posteriorly. The elevated portion of the posterior slope is broad and flattened. It has considerable resemblance in form to *U. navigioliformis,* Lea, but is more perpendicularly truncate posteriorly, has very different teeth, and the lateral ones are shorter in comparison. It differs altogether from *U. Shurtleffianus,* Lea, from the Dekhan, in its very transverse form, the position of the beaks, and the colour of the epidermis.

This pod-shaped species is very distinct from all the shells of the *cæruleus* type, both in form and surface. I mislaid my note of its habitat; but, from various circumstances, I have reason to believe that it was sent to me by Dr. Jerdon from the Dekhan.

12. *Unio crispisulcatus,* B., n. sp.

U. testa transverse subovata, subinæquilaterali, antice rotundata, postice superne descendente, leviter angulata, demum obtuse angulata, crassiuscula, compressiuscula; disco convexiusculo, minutissime radiatim rugoso-costulato, costulis nonnullis acute divaricatis, posterioribus latioribus; umbonibus prominentibus, contiguis, apicibus acutiusculis; epidermide luteo-olivacea, postice fuscata, hic illic nonnunquam viridescente; dentibus cardinalibus utriusque valvæ duplicibus, lamellatis, lateralibus obliquis, modice elongatis, valvæ sinistræ duplicibus: margarita cæruleo-albida, iridescente.

Long. 28, lat. 45, diam. 16 mill.

Habitat in rivulo Bangong, prope Thyet-Myo, regionis Burmanicæ. Collegit W. Theobald.

The anterior cicatrices are distinct, the posterior confluent, the apical ones above the moderate angular cavity, and running under the cardinal tooth.

The delicate sculpture over the whole disk of this shell is peculiar. In form it does not approach any Gangetic type.

13. *Unio Pugio,* B., n. sp.

U. testa transverse elongato-triangulari, linguæformi, valde inæquilaterali, compressiuscula, crassa, antice brevissima, subito descendente rotundata, postice sensim angustiore, cuneiformi, demum acuminata, margine dorsali recto, ventrali convexiusculo, postice ascendente; umbonibus late planatis, lævibus, prominentibus, carina umbonali subito obtuse angulata, area interjacente versus cardinem descendente; disco subplanulato, læviusculo, substriato;

dente cardinali (valvæ dextræ) brevi, crassa, prominente, radiato-sulcata, laterali elongata, subduplicata, intus crenulata: margarita albida, iridescente.

Long. 21, lat. 42, diam. 16 mill.

Habitat in regione Ava.

The anterior cicatrices are distinct, the larger deeply excavated under the cardinal tooth, the smaller punctiform, posterior ones confluent. Cavity of the beaks very shallow. Dorsal cicatrix under the cardinal tooth. The cardinal ligament is lengthened. The single right valve sent for examination by Mr. Theobald is decorticate and worn.

The Chinese lengthened lanceolate *Unio Grayanus*, Lea, and the Siamese *U. sagittarius*, Lea, are allies of this shell in regard to form; but the thick prominent cardinal tooth, and the exceedingly short anterior portion of the shell suddenly deflected from the beak, are sufficient characters for the recognition of the species, independently of other differences. It is also more narrow at the posterior end than *U. sagittarius*. The angle of the umbonal slope, with the area intermediate between the slope and the hinge, and descending to the latter, are also peculiar features.

The only allied species which exhibits a similarly short anterior portion of the shell is *U. truncatus*, Swains., in which, however, it forms an intermediate sinus, instead of descending suddenly and directly as in *U. Pugio*. There is also something in the general form connecting the two shells; but Swainson's species is tumid, not flattened, has a more prominent umbo, and is not so narrow posteriorly, while the peculiar angle and cardinal descent of the umbonal slope afford additional characters for separating *U. Pugio* from the rare shell, of unknown locality, in Mrs. Mawe's cabinet.

The habitat of *Unio Nuttallianus*, Lea, is merely announced as Indian by the author. I received specimens from Major Rowlatt from Assam, where, with the thin, tumid, and peculiarly formed *U. involutus*, nobis, it represents the thin and compressed Gangetic species, *U. olivarius*, Lea, some specimens of which, from the rivers Jumna and Dojora, approach it in the more angular form of the posterior end. The epidermis varies from a fine green to olive, and the salmon-colour of the nacre is occasionally very rich. The beaks exhibit slight nodules in rayed lines; and coloured rays are also visible on the epidermis. It attains the following dimensions:—long. 25, lat. 40, diam. 18 mill.

My largest specimens of a variety of *Unio olivarius*, Lea, taken in the River Ramgunga, above Moradabad, are 50 mill. in breadth by 28 in length, and 16 in diameter. It is widely distributed in the Gangetic region, and is most abundant in the

Rohilkhund streams,—the Ramgunga, Dojora, and Gurrah. It prefers sand-banks to mud, and is frequent in pools left by the falling waters. I have taken it also in the Jumna, Ganges, Bhaghiratty, and Goomty. It varies in colour from pale green to bluish green and olive.

The Assam species *Unio Corbis,* nobis, attains the size here recorded. With the exception of one small specimen, my examples are odd valves.

Long. 21, lat. 32, diam. 18 mill.

Another distinct species, of which I have a single valve, received from Major Rowlatt, inhabits Assam.

Unio bilineatus, Lea, I consider, as stated above, to be the very young of *U. marginalis,* Lk. Wherever the numerous varieties of the latter shell are found, from Delhi and Rohilkhund to Calcutta, the *bilineatus* form accompanies it, gradually altering, as the shell increases in size, into the regular type. The most beautiful variety of *Unio marginalis,* with a thicker shell and teeth, and with a fine salmon-coloured nacre, occurs in the Ramgunga, near Moradabad. At Calcutta, the species varies considerably in form, even in the same water. A salmon-nacred shell, sent by Dr. Day from Cochin, on the Malabar coast, apparently identical with the Chinese *U. consobrinus,* Lea, has the same form of young. In fact, the young of several species of *Unio,* of the *favidens* and *cæruleus* types, are disposed to be straight-hinged, as well as that of Gould's *U. Tavoyensis,* which closely approaches the young Siamese shell described by Lea as *U. Nucleus.*

P.S. *U. crispisulcatus.*—The sculpture is very like that of *Mya rugosa,* as figured by Chemnitz, t. 170. f. 1649; but the form of the posterior portion of the shell differs from that of the Coromandel species. The cardinal teeth are altogether different from those of the figure of "*rugosa*" in the 'Encyclopédie,' pl. 248. f. 6.

Cheltenham, Aug. 7, 1862.

XX.—*Notes on some Chinese Condiments obtained from the* Xanthoxylaceæ. By W. F. Daniell, M.D., F.L.S., Staff-Surgeon, Army Medical Staff, &c.

[Plate V.]

I. *Chinese or Japanese Pepper* (Xanthoxylum piperitum, *DC.*).

Among other articles of food vended in the grocers' shops of the various provinces of the Chinese empire, may be enumerated collections of small dried fruits, consisting of dehiscent capsules or carpels of a plant belonging to the natural order Xanthoxylaceæ. These fruits are employed as a condiment not only by the inhabitants of the Japan islands, but also by those of China. In consequence of their exportation from the sea-ports of the former, they have received the designation of Japan pepper; but, so far as their predominant use extends, they may with equal propriety merit the corresponding term of Chinese pepper. The name by which it is known throughout the latter country is that of *Hwa-Tseaou*. With reference to the source of this product, we have hitherto possessed but scanty information. Mr. D. Hanbury has recently stated that the supply of the Chinese shops was exclusively derived from the *Xanthoxylum alatum*, Roxb.* This statement, however, does not appear to be correct; on the contrary, so far as my researches reach, it is the produce of quite a different species, viz. *X. piperitum*, DC. (*Fagara piperita*, Linn.). During the recent war in Northern China, this plant was frequently observed under cultivation along the line of march from the mouth of the Peiho to Hang-chow. Isolated trees might be noticed growing on the native farms or clearances on the banks of the river, from Taku to Tien-tsin. It was also found under culture in several of the gardens in the villages of Sinho, Taku, &c., in the vicinity and in the courtyards of a few of the yamuns in Tien-tsin, and in one or two of those in the town of Peitang. The general habit of this species is that of a bushy tree of moderate growth, about 15–20 feet in height, with compact, flexuose, prickly branches, flowering in June and July, and densely covered, when the fruit ripens in October, with numerous corymbose expansions of deep-red berries. In this latter condition it presents a very ornate aspect, and can readily be distinguished in this respect from the circumjacent shrubs, bearing in the distance a close resemblance to the *Cratægus oxyacantha*, or Hawthorn-tree of Europe. In October and November, the people in the suburbs of Tien-tsin were engaged in gathering the ripe capsules for winter use; and with the view, therefore, of ascertaining whether they were identical with the dried article exhibited for sale in the local markets, I was induced to take the fruit-bearing branches to different shopkeepers of the towns, who without hesitation pronounced them to be the same. Upon comparison, no difference could be detected either in quality or flavour. That this species is known in other parts of China may be inferred from the circumstance of several of the Coolie corps from the southern provinces, attached to the expeditionary force, collecting the fruit for their daily meals, whenever an opportunity offered. From its wide distribution, it is probable that several varieties of this product

* Pharmaceutical Journal, ser. 2. vol. ii. p. 553.

may exist, one of which (marked by broader leaflets, a panicled inflorescence, and few, if any, spines) was sometimes brought for sale to the markets of the southern Taku Fort. I was informed that the inhabitants in the maritime and other districts of Petchili often plucked the immature fruit both for use and commerce.

Although the Xanthoxylaceæ are to be met with more or less abundant throughout the tract of country that embraced the seat of war, I nevertheless failed to discover the *X. alatum*, which, if it had constituted the ordinary source of the condiment of the population of Northern China, would have been placed under cultivation: such, apparently, is not the fact. This pepper, independently of its consumption as a spice, has been supposed to possess certain medicinal properties, and to act as an antidote against poisons. It is, however, never retailed in the drug-shops as a medicine, but only in those depôts where various kinds of food are submitted for purchase. Taking into consideration the preceding data, I can only arrive at the conclusion that the mercantile article denominated Chinese pepper, exported from various provincial sea-ports, is in a great proportion procured from the *X. piperitum*, DC.

II. *Anise Pepper* (Xanthoxylum Mantchuricum, *Benn.*).

Scattered among the oak (*Quercus Mongolica*, Fisch.; *Q. obovata*, Bge.), mulberry (*Broussonetia papyrifera*), and other trees that fringed the outskirts of the Tuns, or native hamlets, in the neighbourhood of Taku-shan (a small village on the eastern side of Talie-whan, in Mantchuria) were a number of arborescent shrubs or young trees, whose corymbose inflorescence, imparipinnate foliage, and widely-spreading branches rendered them somewhat conspicuous objects in the botanical features of the locality. They afforded the usual characteristics of the Xanthoxylaceæ, and, from dried specimens of the plants submitted to the consideration of Mr. Bennett, have been determined by him to be a new species, which will be subsequently described in this paper under the name of *X. Mantchuricum*. This production may be distinguished from the preceding species by the more erect and tapering trunk (10–20 feet in height), divergent branches, expanded leaves, narrow and smaller pinnæ with fewer spines, the peculiar deep-pink hue of the pedicels and entire peduncle, but more especially by the remarkable anise-like flavour of the capsules. The plant flowers in May and June; and the fruits, which crown the summit in terminal corymbs, are at first green, but gradually change into a deep-red colour towards the end of September, when they attain maturity. The carpels, as they ripen, dehisce and display a solitary, black, shining and slightly compressed seed, the singular appearance of a large number of which, when exposed at the same period, soon attracts the attention of the botanist. When dried, the carpels are one-third less in size, round or oval, wrinkled, pellucido-punctulate, and not roughly tuberculated as are those of the *X. piperitum*. The pericarp, however, in its unripe state, is studded with minute tubercular prominences, filled with an oleaginous secretion, that exudes on the slightest pressure, and to such a degree as to saturate the folds of paper in which the specimens were kept for preservation. The fruit, when eaten in its mature condition, is endowed with a pleasant sweetish taste and anise-like aromatic flavour, which, however, is dissipated to a great extent either by the process of exsiccation or by transmission to a colder climate. In aroma and other analogous qualities, it is much inferior to the seed-follicles of the *Pa-kioh*, or Star Anise tree (*Illicium anisatum*). By the inhabitants of the districts to which it is indigenous the fruit is apparently valued for its carminative and stomachic virtues; and although it enters into the composition of several of their dishes, it is also frequently administered as a remedial agent, under the form of a tea or infusion, for the relief of various visceral diseases.

III. *Star or Bitter Pepper* (Xanthoxylum (Oxyactis) Danielli, *Benn.*).

This species was discovered on a small promontory to the northward of the village of Taku-shan, adjoining a small joss-house or temple near its extremity. It in general assumed the character of a moderate-sized bushy tree, from 10–20 feet in height, except on the verge of the cliffs, where it became of more stunted growth, dwindling into low brush-like shrubs. The majority of the larger plants flourished on the borders of a field of Sesamum (*S. orientale*), where they had evidently been reared for some specific purpose. An essential difference in the peculiar disposition of the fruit, and the more luxuriant development of the foliage, was observed when placed in comparison with the preceding species. The imparipinnate leaves were also of larger growth, being from 1–$1\frac{1}{2}$ inch in breadth, and 2–3 inches in length, ovate, obtusely acuminate, and almost smooth. The branches were destitute of spines and less tortuous. The flowering occurred in June and July, in numerous corymbose panicles. The fruit consisted of a variable number of oblong or elongated capsules, arranged in stellate groups on a series of terminal panicles, which were at first of a deep green, but imperceptibly altering into a dusky-red colour as they advanced towards maturity, in September and October. The carpels are

8–10 lines long, and about 1–2 broad, dehiscing longitudinally into separate portions, and exposing to view two small, black, shining seeds. The epicarp was completely dotted over with tubercular receptacles or vesicles, containing a straw-coloured oil, or oleo-resin, which copiously oozed forth on any abrasion of its surface. The capsules have a peculiar aromatic odour, with a pungent bitter flavour and warm burning taste, that subsequently imparts to the palate a sensation of coolness when the air has been drawn into the mouth.

Although informed by the natives that these carpels were employed as a condiment, and also for certain medicinal and other economic uses, I was unable to obtain any precise statement illustrating their mode of appliance. That this and the anise-pepper are of some utility, may be inferred from the care taken in the preservation of the trees; for, owing to the great dearth of fuel, no brushwood of any kind is permitted to grow throughout the country, the inhabitants being reduced to the necessity of burning dried grass and the stalks of *Zea, Panicum*, and other Cerealia, to cook their food.

I am indebted for the specific distinctions and following botanical details to Mr. Bennett of the British Museum, who, with unvarying kindness, has embodied the whole in a concise descriptive account contained in the appended letter. He remarks, with reference to the application of the term *Xanthoxylum* to these Chinese species, that he so spells "the name in conformity with its etymology and with the practice of Smith, Sprengel, Martius, and Bentham, and in spite of the authority of Linnæus, Kunth, and DeCandolle, in favour of *Zanthoxylon*.

"Your specimen from Tien-tsin agrees perfectly with *Fagara piperita* of Linnæus, which is entirely founded upon the 'Teo and Tansjo' of Kæmpfer, to whose figure your specimen bears the most striking resemblance. This figure and the description which accompanies it, together with the very accurate character and description given by Siebold and Zuccarini in the 'Abhandlungen der Mathem.-Physikalischer Classe der K. Bayerischen Akademie,' iv. p. 137, leave no room for any addition. We have in the herbarium of the British Museum a miserable specimen from Kæmpfer himself, and a tolerable one from Thunberg, which entirely confirm the identification. I have some doubt with respect to your specimen from the Taku Fort, on account of the total want of prickles, the larger size of the leaflets, and the more ample and almost panicled inflorescence; but as it agrees in all other points, I am disposed to consider it only as a variety.

"You ask me whether this plant is the true source of the Japanese pepper; and of this I imagine there can be no doubt, the authority of Kæmpfer, Thunberg, and Siebold being decisive on this point. But you mention *Xanthoxylum alatum* as having been so regarded. I know of no Asiatic species so called, with the exception of Roxburgh's (Flor. Ind. iii. p. 768), which appears in DeCandolle's 'Prodromus' under the name of *X. acanthopodium*, and differs very widely indeed from the Chinese and Japanese species by its strongly winged and strongly armed petioles, and by its very short and sessile axillary cymes. Its seeds (or, more probably, its capsules), as we learn from Roxburgh, are used medicinally; but this is doubtless the case with many of the species, on account of their peculiar taste and odour. The true Japanese pepper, however, must be that which is found in Japan, and which was originally described by Kæmpfer, and adopted from him by Linnæus*.

"Your Mantchurian specimen from Talie-whan is certainly distinct, and differs, I think, from all the species hitherto known. I characterize it as follows:—

"*Xanthoxylum Mantchuricum.*

"*X.* aculeis sparsis v. infrapetiolaribus rectis conicis armatum, foliis sparsis imparipinnatis 5–9-foliolatis, foliolo terminali sessili, omnibus oblongo-lanceolatis utrinque attenuatis subsessilibus crenato-dentatis superne punctulis elevatis piliferis scaberulis cæterum glaberrimis, in crenarum axillis nec alibi in lamina pellucido-punctatis, corymbis terminalibus, coccis 1–3 punctulato-rugosis.

"The differences between this species and *X. piperitum* are obvious from the character: they mainly consist in the narrower form of the leaflets, the slight scabrities of their upper surface, which I have not noticed in any other species, the entire absence of pellucid glands, except in the axils of the marginal crenatures, and the surface of the cocci, which, instead of being rudely glanduloso-tubercular, as in *X. piperitum*, are merely pellucido-punctulate and wrinkled. The common petioles, which are angular, are from 2 to 4 inches in length, and the leaflets from 8 to 10 lines long by 3 or 4 wide. This species I had at

* "Since I wrote to you on this subject, I have looked over Mr. Hanbury's paper in the 'Pharmaceutical Journal' for the present year (1861), and find that he speaks of the fruits of two species of *Xanthoxylum* as sold in the Chinese markets, the one the produce of *X. piperitum*, L., the other *X. alatum*, Roxb. The fruits of both species are remarkably similar in character; but I have not seen any specimens of the plant from China which can be positively identified as *X. alatum*. I have little or rather no doubt, however, of the identity of *X. alatum*, Roxb., and *X. acanthopodium*, DC. The specimens distributed by Dr. Wallich under the name of *X. alatum*, Roxb., agree in every particular with DeCandolle's character of *X. acanthopodium*; and the fragment preserved in the Indian herbarium of the Linnean Society, from Dr. Roxburgh's own collection, cannot be distinguished from them."

first, as you are aware, considered as identical with *Fagara Avicennæ,* Lam.; and, as far as the description of that plant goes, I see little to distinguish them, except the generally smaller number of leaflets and the little asperities of their surface; but as Mr. Bentham has, in his 'Flora of Hongkong,' identified Lamarck's plant with a totally different species, to which Lamarck's description is at least equally applicable, I adopt his determination without hesitation, and describe your plant as new. I may add to the synonyms of *X. Avicennæ,* DC. and Benth., the *X. clava Herculis,* Lour. nec Linn., as proved by Loureiro's specimen in the herbarium of the British Museum.

"Your other *Xanthoxylum* from Talie-whan is one of the finest and most remarkable species of the genus. Many botanists, I doubt not, would regard it as constituting a new and very distinct genus; but, taking into account the numerous transitional modifications of structure and the consequent phalanx of merely conventional genera that have already been formed at the expense of this extensive and polymorphous group, I cannot but agree with those who prefer to unite them all, or nearly all, under one generic name. I regard your plant, however, as offering sufficient characters to constitute a well-marked subgenus, and I am disposed to consider in the same light *Euodia* and *Boymia* (whether kept separate or combined), inasmuch as approximations to a valvate æstivation of the petals and superposed ovules are to be found in species having alternate as well as opposite leaves. If opposite leaves and superposed ovules were alone to be regarded, your plant would belong to the same division with *Euodia* (*Boymia* included); but as far as I am acquainted with the fruit of the other species, it differs from them remarkably in the form and arrangement of the cocci. I proceed, therefore, to give its characters as a subgenus, premising that I have seen only specimens with ripe fruit:—

"Gen. XANTHOXYLUM.

"Subgen. *Oxyactis,* Benn.

"*Cocci* 5 (rarius 4), stellatim dispositi, in valvulas 2 apice acuminatas dehiscentes, ideoque æqualiter 10- (8-) radiati. *Semina* 2, perfecta, superposita.

"*X.* (*Oxyactis*) *Danielli.* Pl. V. fig. 1.

"*X.* inerme, foliis oppositis imparipinnatis 5–9-foliolatis, foliolo terminali longius- reliquis brevipetiolulatis, omnibus basi rotundatis ovatis obtuse acuminatis superne glabris inferne in nervis margineque puberulis obscure crenulatis nisi in crenularum axillis impunctatis, corymbis (fructiferis) folio brevioribus terminalibus divaricatim ramosis.

"The common petioles are from 3 to 6 inches long, rounded, and perfectly smooth; the leaflets from 2 to 3 inches long, and an inch or more in breadth, rounded or slightly cordate at the base, the lower ones in pairs supported on petiolules of 2 to 3 lines long, while the terminal one has a petiolule of an inch in length; and the terminal corymb expands almost into a panicle. The combined fruit, after dehiscence, measures fully half an inch across. In some respects the plant appears to approach *Euodia meliæfolia*, Benth.=*Megabotrya meliæfolia*, Hance=*Boymia glabrifolia*, Champ., but differs widely in the character of the fruit, in the crenulate margin of the leaflets, and in the pubescence of their nerves, none of which characters are indicated in the several descriptions of the plant of Southern China. A northern plant, *Phellodendron Amurense*, Rupr. in 'Bull. Acad. St. Petersb.' and in 'Maxim. Prim. Flor. Amur.' p. 73, t. 4, also bears considerable resemblance in its habit, in the size and composition of the leaves, and in the form of the leaflets, but, if the fruit be correctly figured, is very different indeed."

EXPLANATION OF PLATE V.

Fig. 1. *Xanthoxylum* (*Oxyactis*) *Danielli*; leaf and inflorescence, two-thirds of the natural size.
Fig. 2. Separate carpella, of the natural size.
Fig. 3. Seeds, of the natural size.

XXI.—*On some additional Species that are common to Carboniferous and Permian Strata; with Remarks on the Recurrency of Carboniferous Species.* By James W. Kirkby.

[Plate IV.]

In a former paper, where I noticed the occurrence of a Permian *Lingula* in the Durham Coal-measures, a list was given of such species as were then known to be common to the Carboniferous and Permian life-groups*. Since the publication of that paper, Mr. Davidson has shown that some additional Brachiopods may be placed on the list of Carboniferous recurrents†; and the present communication is chiefly made for the sake of identifying three forms of *Entomostraca* and *Polyzoa* belonging to the Carboniferous series with species that have hitherto been considered exclusively Permian, and thus to still further increase the list of these recurrent forms.

The Carboniferous fossils were sent to me, along with others, by Messrs. H. W. Crosskey and J. Young, of Glasgow, from the

* Quart. Journ. Geol. Soc. vol. xvi. p. 415.
† Mon. Brit. Carbon. Brach. (Palæont. Soc.), pp. 265–268, pl. 54.

marine shales and limestones of that district. The Permian fossils with which they have been compared are from the Magnesian Limestone of Durham. Two of the species are Entomostraca of the subgenus *Bairdia*; the other is a Polyzoan of the genus *Fenestella*.

1. *Cythere* (*Bairdia*) *plebeia*, Reuss, 1854.

Permian specimens, Pl. IV. figs. 7, 8, 10; Carboniferous specimens, Pl. IV. figs. 5, 6, 9.

Type-specimens of *B. plebeia* are moderately inflated, have a subdeltoid carapace, a lenticular lateral contour, and smooth surface. The posterior extremity is more or less acute and rostrated; the anterior extremity is much deeper and rounded. It is a species, however, that possesses considerable latitude of form, nine varieties having already been described by Mr. T. R. Jones and myself*.

The Carboniferous Entomostraca which are identified with this species agree in all the above characters, as well as in others of minor importance. This, I think, will be evident from the figures given of specimens from both formations.

The Carboniferous specimens, which do not seem to have been hitherto noticed, occur in dark-grey shale at Craigenglen, Campsie.

2. *Cythere* (*Bairdia*) *Schaurothiana*, Kirkby, 1858.

Permian specimens, Pl. IV. figs. 3, 4, 12; Carboniferous specimens, Pl. IV. figs. 1, 2, 11.

B. Schaurothiana is a larger Entomostracan than the preceding species. It is somewhat elongate and almost subhexagonal in outline; the posterior extremity is angulate, and not much produced, its upper half being formed by an abrupt descent of the dorsal margin; the anterior extremity is broad, rounded, and at times subangulate above; the lateral contour is more or less lenticular, and the surface is smooth.

The Carboniferous specimens which I place with this species are generally of larger size and more robust than Permian examples; and in some specimens the ventral margin anteriorly becomes more prominent than I have ever seen it in *Schaurothiana*, but this is probably concomitant with an increase of development. In all essential particulars they agree with the characters of the species to which they are referred, there being, so far as I can observe, no point of specific difference between

* Trans. Tynes. Nat. Field Club. vol. iv. pp. 141–146 and 161, 162.

them. And it should be mentioned that this is not my opinion only, but that of Mr. T. Rupert Jones, to whom I submitted for examination specimens of both the present species and the preceding, each of which he referred to the Permian species named.

3. *Fenestella retiformis,* Schlotheim, 1816–17.

Syn. *Fenestella plebeia,* M'Coy, 1844.

Permian specimens, Pl. IV. figs. 13, 16, 17; Carboniferous specimens, Pl. IV. figs. 14, 15, 18.

Among other Polyzoa that I have received from my Glasgow friends are numerous specimens of a *Fenestella,* labelled *F. plebeia,* which so closely resembles *F. retiformis* of the Permian rocks that I have no doubt as to both being the same species. The specimens are from Beith, and occur, in a more or less fragmentary state, on the weathered surfaces of a hard dark-grey limestone. Generally speaking, they are less robust than well-developed Permian examples; and many of them have scarcely so many cells to the fenestrule as have normal specimens of the latter. But some specimens have precisely the same number of cells, which is about three to the fenestrule, or, rather, eleven to the four fenestrules. Prof. M'Coy having described the species from specimens possessing "four or five cells to the fenestrule," this would seem to be a variable character, and one that cannot be subjected to very exact comparison. In both Permian and Carboniferous specimens the ribs or interstices have the same relative strength compared with the dissepiments, and they branch in the same way, and are connected by similar dissepiments, which thus give to the fenestrules identity of form. Both have the reverse or uncelluliferous face covered with moderately coarse longitudinal striæ; and the cellule-apertures are more or less circular in each. All the Carboniferous specimens I have seen are somewhat worn, and do not show the raised margins of the cellule-apertures, which well-preserved Permian examples often retain, as represented in fig. 17: when worn specimens of both are compared, no difference is to be observed in this feature.

It is just possible that the Beith specimens may be erroneously identified with *Fenestella plebeia* of M'Coy; for the figures of that species in his 'Syn. Char. Carboniferous Fossils of Ireland' certainly do not agree so closely with specimens of *F. retiformis* as they. But, however this may be, there would scarcely seem any doubt of *F. retiformis* being specifically undistinguishable from the Beith specimens.

List of Species occurring in Carboniferous and Permian Strata in Britain.

Carboniferous Name.	*Permian Name.*
1. *Gyracanthus formosus*, Agassiz.	*G. formosus*, Ag., King, in Mon. Perm. Foss. England, p. 221; Howse, Ann. Nat. Hist. ser. 2. vol. xix. p. 33.
2. *Terebratula sacculus*, Martin, 1809. Figured in Davidson's Monograph of Carboniferous Brachiopoda, pl. 54.	*T. elongata*, var. *sufflata*, Schloth. 1816. Figured in Davidson's Monograph of Carboniferous Brachiopoda, pl. 54.
3. *Spirifera Urii*, Fleming, 1828. Figured in Dav. Mon. Carb. Brach. pl. 54.	*S. Clannyana*, King, 1848. Figured in Mon. Carb. Brach. pl. 54.
4. *Spiriferina octiplicata*, J. de C. Sow. 1827. Figured in Mon. Carb. Brach. pl. 54.	*S. cristata*, Schloth. 1816. Figured in Mon. Carb. Brach. pl. 54.
5. *Camarophoria crumena*, Martin, 1809. Figured in Mon. Carb. Brach. pl. 54.	*C. Schlotheimi*, Von Buch, 1834. Figured in Mon. Carb. Brach. pl. 54.
6. *Camarophoria rhomboidea*, Phillips, 1836. Figured in Mon. Carb. Brach. pl. 54.	*C. globulina*, Phillips, 1834. Figured in Mon. Carb. Brach. pl. 54.
7. *Athyris Royssii*, L'Eveillé, 1835. Figured in Mon. Carb. Brach. pl. 54.	*A. pectinifera*, J. de C. Sowerby, 1840. Figured in Mon. Carb. Brach. pl. 54.
8. *Discina nitida*, Phillips, 1836. Figured in Mon. Carb. Brach. pl. 54.	*D. Konincki*, Geinitz, 1848. Figured in Mon. Carb. Brach. pl. 54.
9. *Lingula mytiloides*, Sow. 1812. Figured in Mon. Carb. Brach. pl. 54.	*L. Credneri*, Geinitz, 1848. Figured in Mon. Carb. Brach. pl. 54.
10. *Fenestella plebeia*, M'Coy, 1844. Figured in plate accompanying present paper.	*L. retiformis*, Schloth. 1816–17. Figured in the plate accompanying present paper.
11. *Cythere elongata*, Münster, 1830. Jahrbuch f. Min. p. 65.	*C. elongata*, Münster (Jones). Figured in Mon. Perm. Foss. pl. 18; and Trans. Tyne. Field Club, vol. iv. pl. 11.
12. *Cythere inornata*, M'Coy, 1844. Figured in Syn. Char. Carb. Foss. pl. 23.	*C. inornata*, M'Coy (Jones). Figured in Mon. Perm. Foss. pl. 18; Trans. Tyne. Field Club, vol. iv. pl. 11.
13. *Cythere* (*Bairdia*) *gracilis*, M'Coy, 1844. Figured in Syn. Char. Carb. Foss. pl. 23.	*C.* (*Bairdia*) *gracilis*, M'Coy (Jones). Figured in Mon. Perm. Foss. pl. 18; and Trans. Tyne. Field Club, vol. iv. pl. 11.
14. *Cythere* (*Bairdia*) *plebeia*, Reuss (Kirkby). Figured in the plate accompanying present paper.	*C.* (*Bairdia*) *plebeia*, Reuss. Figured in the plate accompanying present paper.
15. *Cythere* (*Bairdia*) *Schaurothiana*, Kirkby. Figured in the plate accompanying present paper.	*C.* (*Bairdia*) *Schaurothiana*, Kirkby. Figured in the plate accompanying present paper.
16. *Pinites Brandlingi*, Lindley.	For the occurrence of these species in the Rothliegende, see Howse on the Permian Fossils of Northumberland and Durham, in Annals Nat. Hist. ser. 2. vol. xix. p. 38.
17. *Trigonocarpum Nœggerathi*, Brong.	
18. *Sigillaria reniformis*, Brong.	
19. *Calamites inæqualis* (?), Lindl.	
20. —— *approximatus*, Brong.	

Though palæontologists have long been aware of strong resemblances existing between Carboniferous and Permian fossils, it is only of late years that the extent and value of such resemblances have been made the subject of careful inquiry. Among those who have wrought at this subject, there is perhaps no one who has produced greater results than Mr. Thomas Davidson. Most of the Brachiopods of the preceding list have been shown to be both Carboniferous and Permian by his investigation. And this authority is of the greatest value on the subject, and will be held conclusive by most palæontologists. I have, however, been able to examine and compare specimens of most of the species myself, and thus in some degree to corroborate the conclusions of this distinguished investigator. For an account of Mr. Davidson's researches, I must refer the reader to his valuable 'Monograph of Carboniferous Brachiopoda,' and to a paper on "Scottish Carboniferous Brachiopoda" in the 'Geologist.' But I would more particularly direct attention to plate 54 of the Monograph, in which Carboniferous and Permian individuals of each of the Brachiopods identified are figured side by side, for the sake of comparison. The other species of the list have been determined by Mr. T. Rupert Jones, Mr. R. Howse, Prof. King, and myself. And it should not be forgotten that this list is the result of a very partial investigation of Permian and Carboniferous species. The Brachiopoda have certainly been pretty well examined, but this is the only class that has. In other classes much remains to be done; so it is possible that future research may still further increase the number of Carboniferous recurrent species, even in Britain. Had those species which foreign authors consider to be common to Carboniferous and Permian strata been included, the list would have received important additions. Dr. Geinitz, for example, states that some of the plants of the Saxon Rothliegende are identical with Coal-measure species*, as might, indeed, have been suspected from the intimate relation that exists between the flora of these rocks in Britain. M. Gœppert even asserts that there are fourteen Permian plants referable to Carboniferous species†. The interblending of Carboniferous and Permian forms in North America would also seem to be considerable; and American palæontologists have already pointed out cases of recurrency among the species of these formations. According to Dr. F. B. Shumard, *Producta semireticulata*, Martin, and *Spirifera camerata*, Morton, so well known as Carboniferous fossils, occur in the Permian rocks of the Gaudalupe Mountains

* See Dr. Geinitz on the Coal Formation of Saxony, as noticed in Jour. Geol. Soc. vol. xiii. p. cxxviii.

† Schlesische Gesellsch., Naturwiss. Sektion, 1858.

of Texas and New Mexico *. And it has lately been shown by Dr. Prout that the Permian Polyzoan, *Polypora biarmica*, Keyserling, is a Carboniferous species in the western states of the same continent †. And there is little doubt, when the Permian and Carboniferous species of this region become better known, that other examples of recurrency will come to light. The generic relations of these life-groups are certainly more intimate in America than in Europe, as is evident from the occurrence there of *Orthocerus*, *Bellerophon*, and *Phillipsia* ‡ as Permian types; and it will be somewhat remarkable if their specific relations are not found to be as close.

It is by such inquiries as the present that palæontologists will ultimately be able to speak with more precision than they can now on the amount of relationship that exists between the life-groups of formations, and to arrive at juster estimates of the relative value they possess as expressions of periods of geological time. And though there is no reason to assume that we are in a position to speak precisely in the present instance, it must yet be evident that the relations that exist between the Carboniferous and Permian fossils are most intimate—more so, apparently, than usually obtain in the fossils of distinct systems of strata; for this intercommunity of species is accompanied, as palæontologists are well aware, by a more than usual intercommunity of genera, most of the common types of Permian strata being Carboniferous genera as well as Permian. This close alliance of life-groups, viewed in conjunction with other evidence, caused me, in a former paper, to question the propriety of our considering the Permian series of rocks a distinct system. It was there pointed out that its importance as a stratigraphical group is much less than that of other palæozoic systems of strata; and that its life-phenomena, viewed either numerically in respect to species, or generically in regard to the introduction of new types, were of less consequence than those of systems, whether palæozoic or of later age §. Recent investigations have strengthened this opinion. To use the term "system" in speaking of the Permian group of rocks would seem to imply similarity of value with other groups, such as the Silurian and Carboniferous, to which the term more appropriately applies. It would apparently indicate that it was of about equal importance in geological classification, in the history of past life, and as the expression of an interval of time, as either of the later groups, which I think few geologists will be inclined to grant. It therefore seems

* Trans. Acad. Science of St. Louis, vol. i. pp. 389, 391.
† *Ibid.* p. 440.
‡ *Ibid.* pp. 388, 399, 400.
‡ Quart. Journ. Geol. Soc. vol. xvi. pp. 417, 419.

more in harmony with sound classification to employ a term indicative of less magnitude than "system" in speaking of the Permian strata. This some geologists already do, and, among others, Sir Roderick Murchison, who, in his later contributions to science, refers to the Permian strata as a group rather than a system*. But I would further observe that, in adopting a divisional term less likely to lead to wrong impressions in respect to the importance of the Permian group of rocks, it does not follow that the group should lose its distinctive appellation by being considered but a formation or subformation of the Carboniferous system. I do not advocate this in the least, being satisfied that it would tend to confuse rather than improve geological classification; for, notwithstanding its close palæontological relations with the last-named system, it would be useless denying that its fossils are sufficiently peculiar to warrant the employment of the special designation of Permian.

In a paper on Carboniferous recurrent species lately published in the 'Edinburgh New Philosophical Journal' (vol. xiv. pp. 37–45, & vol. xv. pp. 251–253), Professor William King objects to some of the identifications of the Brachiopods of the preceding list. His objections are chiefly confined to the identification of *Spirifera Urii* with *Sp. Clannyana*, King, though other species are made the subject of remarks. Considering the position that Prof. King holds as an authority on species, it will perhaps be well to notice the grounds of his objections, though I shall do so somewhat briefly.

Spirifera Urii and *Sp. Clannyana*.—In respect to these shells, Prof. King maintains that they are distinct species, and that neither the one nor the other was common to Carboniferous and Permian faunæ. In support of these opinions, he says that "*Urii* differs from *Clannyana* in being a wider shell; it has an umbone more incurved; the area of the small valve not so deep; the small valve flatter, and more excavated, as it were, towards the posterio-lateral angles; the spines decidedly less numerous, and the median sulcus more pronounced in both valves." Without disputing the existence of these peculiarities in some examples of *Sp. Urii*, I must still remark that in others, which I have examined myself, there are no such differences to be observed. In these specimens there exist an agreement of general form, relative length and width, convexity and sulcation of valves, size and shape of area, incurvation of umbone, and spinosity of surface, with well-preserved individuals of *Sp. Clannyana*, that could scarcely have occurred had they been distinct species. In fact, there is no character, that I can see, on which to separate

* Siluria, 3rd ed., and "On the Inapplicability of the Term Dyas," &c. Philosophical Magazine, S. 4. vol. xxiii. p. 65.

them; and if they are to be kept apart, it will certainly be upon other than palæontological grounds. But figures form better evidence than assertions either way; and I would refer to Mr. Davidson's representations of both Carboniferous and Permian specimens, given in his Monograph of Carboniferous Brachiopoda, pl. 54, and ask if it is possible to do otherwise than agree with that gentleman in identifying these two forms as one species.

It must be acknowledged that it is not difficult to procure specimens of *Sp. Urii* that show considerable differences when compared with others of *Clannyana*; for this species is no exception to others in possessing considerable individual differentiation. And it would seem to be with some of the most aberrant of these that Prof. King has instituted his comparison. The existence of such differences, however, can scarcely be of much value, when they are wanting in other individuals allowed to belong to the same species. At least, if the contrary is held, in the face of a knowledge of their exceptional character, it would certainly be more in harmony with the evidence to divide the Carboniferous specimens into two species than to separate them from those occurring in the Permian rocks.

One difficulty which, until a recent period, had to be contended with in comparing Carboniferous with Permian examples of this shell was the imperfect condition in which most of the latter occurred, nearly all being in the state of casts. Under such circumstances it was not, perhaps, surprising that some doubt should exist among palæontologists on the propriety of identifying the two forms; but this difficulty is now removed by the acquisition of testiferous Permian examples, one of which Mr. Davidson has figured in the plate previously mentioned.

It may also be observed that there is generally a difference in the size of the Permian and Carboniferous examples—those of *Clannyana* being almost invariably smaller than specimens of *Urii*. And though few palæontologists will be inclined to attach much value to this as a specific character, it should yet be pointed out that it is a peculiarity shared by many other Permian shells when they are compared with those of Carboniferous rocks. Permian Mollusca, as a rule, never attain the proportions of Carboniferous, so far, at least, as those of British strata are concerned.

Camarophoria crumena and *C. Schlotheimi*.—Though Prof. King disputes the identity of these shells, he admits the Permian species to be recurrent from the Carboniferous Limestone. The point of difference, therefore, between him and Mr. Davidson is merely whether the Carboniferous shell, which the latter has compared with *C. Schlotheimi*, is correctly identified with

Martin's figures of his *Anomites crumena* in 'Petrif. Derbiensia.' Mr. Davidson appears, in my opinion, to be right in the identification and, hence, in proposing that the name *Schlotheimi* should be abandoned for the older one *crumena*; for there is no character of importance in Martin's figures to distinguish them from the shell compared, nor is there, moreover, any other Carboniferous shell which can be considered to represent Martin's species.

Camarophoria globulina and *C. rhomboidea.*—Prof. King agrees, "with some reservation," in considering these shells to belong to one species. And the existence of *Lingula Credneri** in the Coal-measures of Durham is also allowed, with "some slight reservation." As to *Spiriferina cristata* being the same as *Sp. octiplicata,* no definite opinion is expressed by the Professor. The tendency of his remarks seems to indicate a belief in their identity.

Terebratula elongata, var. *sufflata,* and *T. sacculus.*—After a careful study of Prof. King's remarks on the first of these shells in regard to its existence during the Carboniferous epoch, I must confess myself still in some doubt as to what opinion he actually holds on the question. For instance, in the commencement of his remarks, he restates an opinion, expressed in the Monograph of Permian Fossils (Palæont. Soc.), to the following effect, that "*sufflata* appears to be identical with a shell found in the Mountain Limestone of Bolland." A little further on, it is said, quoting from the same work, that *T. sufflata* "undoubtedly lived in the Carboniferous epoch;" but towards the conclusion of the paper it is stated, in a foot-note, that "I am more inclined to regard the 'Bolland shell' noticed in a previous page

* The supposed occurrence of this shell in the Lower Red Sandstone at Ferry Hill has led Prof. King to name that deposit "Lingula Sandstone" (Synoptical Table of British Rock Groups, 2nd edit.). Without inquiring whether there is the least occasion to alter a well-established subdivisional name, I would object to the adoption of the term "Lingula Sandstone" for a deposit in which the occurrence of *Lingulæ* is extremely doubtful. The only ground that exists for proposing this name at all is the fact of Prof. Johnson of Durham having told Prof. King that he had met with a *Lingula* in the above-named locality. But neither Prof. King nor any other palæontologist has ever seen a single example of this shell from the Lower Red Sandstone. And, with all deference to Prof. Johnson's scientific reputation, I see no improbability of his observation being at fault on a subject he had not investigated, when it is entirely opposed to the experience of all palæontologists who have pursued researches in the same district. But, granting that in one isolated instance this shell has occurred at Ferry Hill, is the sandstone to be specialized by the name of "Lingula" in consequence? A Lingula-Sandstone with no *Lingulæ* in it, nor even with a specimen to show that can be said to have been found in it! Such a misnomer should never be adopted. Nor is it any credit to geological nomenclature that it should ever have been proposed.

as a variety of *Dielasma* (*Terebratula*) *sacculus,* and simulating *D. sufflata,* than as belonging to that species." Now, what is Prof. King's opinion on this question? Is it that *T. sufflata* is identical with the Bolland shell, and so recurrent from Carboniferous strata? or that it is a distinct species, and merely simulated in form by the Bolland shell? Both these opinions are given in the same paper; it is therefore impossible to see which expresses the views of its author. The former is, of course, that which I feel satisfied to be the correct one.

It would thus appear, in respect to the identification of the Permian and Carboniferous Brachiopods just noticed, that Prof. King in three cases is of the same opinion as Mr. Davidson and myself, or, at least, that he allows three of the species to have had a Carboniferous and Permian existence, and that in two cases he has no decided opinion, while in one he disputes the identification. But notwithstanding that he only in one instance clearly differs from us in respect to the recurrency of the species, he occupies the conclusion of his paper in arguing against the method or "plan" of determining species that has been followed in identifying these Carboniferous and Permian fossils. Prof. King seems to consider that our views of species are too comprehensive, and that in some instances we include two or more distinct forms in one specific group. And in support of this opinion, he refers to the evidence to be derived from the study of recent shells, many of which, he asserts, would have had their specific identity ignored had they been determined on this plan as palæozoic fossils.

I am not aware myself of there being anything novel about the method on which these species have been determined, it having long been used by naturalists; and it, moreover, seems to be the only one that it is possible to use, on the commonly received opinion of the *individuality* of species. For the sake of precision, however, I will briefly state what our method of determining species is; and in doing so I speak for Mr. Davidson as well as myself, our views on this subject being the same.

By species we understand groups of individuals characterized in common by peculiar features. These features or characters are considered to be persistent, and special to the groups they distinguish. Characters which are not persistent, but which are subject to essential modification, are looked upon as only of individual value. The great difficulty of palæontologists, as well as of other naturalists, is to distinguish in all cases between these two kinds of features or characters; for the latter kind often approach the former in apparent value; and it must be allowed that it is not always an easy matter to decide whether a character is of specific or individual worth. The principle, however, which we follow, in common with most naturalists, is to consider all features of individual value that graduate into other features, and all features of specific value that are not subject to such modification, but which stand out as marked characters in all comparisons with other forms. On this method the identifications of the preceding list have been made. Whenever a comparison of a Carboniferous with a Permian form showed that the supposed special characters of one passed, by gradual modification, into those of the other, and that there were no characters of the persistent type but such as were common to both forms, we have thought ourselves warranted in referring them to one species.

Further, we do not consider want of contemporaneity in fossils compared to be of any importance in determinations of species. Time is not, in our opinion, a circumstance that has anything to do with such decisions. And should two individuals present resemblances which we would consider specific in individuals of the same formation, we attach to them the same value, though they belong to separate formations. In both cases we grant equal importance to similar resemblances and differences. We are aware that this is not the principle that all palæontologists follow,—at least, that there are still a few who argue that want of contemporaneity is an element in determining species: and Prof. King, I suppose, adopts this method; for he refers to it in support of his opinion of *Spirifera Clannyana* being distinct from *Sp. Urii.* But we hold, with most palæontologists, that fossil species must be determined on natural-history merits alone, and not in any degree upon differences in their stratigraphical occurrence or geological age. The fact of specimens belonging to different formations ought to be put aside, and the decision arrived at on the same grounds as it is when the specimens are from a single stratum. Palæontologists who rely on this circumstance in distinguishing species rather remind me of those students of entomology who must first know the country of an insect before they venture to say what it is. The former would, moreover, appear to forget that systems and formations of strata are determined to be such by their species being generally distinct from those of other groups. No geologist would consider a series of strata a system or formation, if its fossils were not in the main peculiar. To contend, therefore, that fossils are different because they occur in different formations is to argue in a circle. The formation is first proved to be a formation because its species are principally distinct; and then the species are proved to be distinct because they occur in a different formation!

Such is our method of determining species. And we are not inclined to allow Prof. King's charge of it being too dogmatic, nor yet that it is unsuggestive of philosophical conclusions. If naturalists and palæontologists carry out this method in their determinations of species, we shall perhaps ultimately know what is true and what is false philosophy in respect to them; for it will evidently tend to establish one of two things,—either that species with persistent characters do really exist, according to the old and more generally received opinion; or that there is, literally speaking, no such thing as persistent character, and hence no species except in the Darwinian or Lamarckian sense. And it is, perhaps, just as much in harmony with the spirit of true philosophy to search after truth thus inductively as it is to adopt hasty assumptions as to what truth is when the means of proving it are wanting.

It is further objected that our method involves a cumbrous nomenclature, and that it is wanting in "geologico-chronological" precision. It is asked if "*Spirifera Urii*, var. *Clannyana*, is not a cumbrous name?" I might ask, in return, what nomenclature has to do with the question. It is not concerned in the determination of species; at least, it should not be. I believe the general custom is for naturalists to make names for the species rather than species for the names, though there may be occasional exceptions; and the use of the varietal term *Clannyana* in addition to the specific name is optional, though the Permian specimens of this species scarcely seem to require so much importance. In respect to the want of "geologico-chronological" precision, I would also inquire if it is the object of nomenclature to express the chronological history of a species? When a shell occurs in two formations, it must of necessity be named alike in both. To signify, by the use of one term, that the shell is essentially the same on each horizon, is the first thing to be considered. Other considerations are of secondary importance.

In concluding his remarks, Prof. King draws the attention of palæontologists to the defective state of their knowledge of species compared with that which naturalists acquire of the recent forms. This, I think, no one will dispute. The acquaintance which the palæontologist can attain of species is at the best imperfect. He can have no direct knowledge of the softer parts of the animal: all anatomical details are lost to him; and, as Prof. King remarks, there are other characters which are generally beyond the pale of his investigation. But, without denying this in the least, there would still appear to be no reason for supposing that palæontologists have not materials enough left for the discrimination of species. It rarely happens that all the characters of a species are required in order to determine it; and differentiation of essential anatomical details, and of the more fragile characters, is usually accompanied by differences in those characters which survive fossilization. It is very rarely indeed that a shell is only known to be distinct on account of some anatomical peculiarity. I am therefore not disposed to think, as Prof. King seems to fear, that palæontologists will often arrive at erroneous conclusions in respect to species from their inability to employ all the means that are at the disposal of naturalists. And this opinion is borne out by what we know of such species as occur both fossil and recent. Take those of the Crag, for instance, or of any later Tertiary deposit, and it will be found that absence of colour, epidermis, opalescence, and of all anatomical details has not seriously interfered with their being properly discriminated. There seems, in my opinion, more reason to fear the creation of too many species by palæontologists than that any considerable number will be overlooked by them; for it should be remembered that there is a tendency in fossilization to produce differences where none exist, as well as to obliterate others that really characterize species. Fossils of one species preserved as casts, or in a semi-testiferous state, or with the shell in good condition, present very different appearances, and repeatedly lead to false determinations. And the fragmentary state in which some fossils occur, their being viewed in different aspects, and the various alterations effected by pressure and other causes, all tend to the adoption of species that have no real existence.

However, Prof. King, to illustrate his own views in respect to the influence that fossilization would have on recent shells, remarks that "nearly every British species of *Mactra* and *Litorina*, if occurring as fossils in palæozoic rocks, would have had their independent creation ignored, and have been respectively named *Mactra multiformis* and *Litorina variabilis*" on our method of determining species. Now, though these genera contain certain British species which could never have been confounded even as palæozoic fossils, Prof. King is assuredly aware that they are two of the most difficult groups of British shells, and that several of their reputed species are acknowledged to be mere varieties by most naturalists. Had they, therefore, occurred in palæozoic or any other rocks, the careful palæontologist would certainly have put many of their forms together, just, in fact, as the judicious conchologist does now. Thus the argument which Prof. King wishes to derive from these examples is rendered invalid by this fact; for it is certainly not to be expected that palæontologists would be able to see specific differences after fossililization, where naturalists for the most part denied their existence before that process.

And the difficulty with which palæontologists have to contend from what Prof. King calls simulating forms is, I think, overstated. It is said by this authority that many existing shells have a tendency to simulate the distinctive features of other allied species; and, in support of this assertion, twelve British shells are mentioned, which Prof. King is satisfied would have been reduced to half the number had they occurred as palæozoic fossils. It may be observed, in the first place, that such shells as simulate the distinctive characters of others can be but questionable species at the best; and the conchologist would not, perhaps, be far wrong were he to anticipate the palæontologist by putting them together. This, in fact, has already been done in respect to some of the shells that Prof. King quotes, by most British naturalists. *Astarte Danmoniensis* and *A. Scotica*, for instance, are usually considered to be identical; and there are few conchologists who admit *Mya Uddevallensis* to be distinct from *M. truncata*—an opinion which Prof. King himself held some time ago, as appears by his paper published in 'Ann. Nat. Hist.' ser. 1. vol. xix. It is not to be denied, however, that several of the shells mentioned are good species; but, as most of them occur as Tertiary fossils, and have already been identified as distinct species*, they would not appear to run much risk of being confounded with others, even should they ultimately attain an age as great in comparison as palæozoic fossils at present.

EXPLANATION OF PLATE IV.

Fig. 1. *Cythere* (*Bairdia*) *Schaurothiana*, Kirkby. Carboniferous specimen, left valve. Craigenglen, Campsie.

Fig. 2. The same. Carboniferous specimen. Right valve. Craigenglen.

Fig. 11. The same. Carboniferous specimen. Lateral contour of left valve. Craigenglen.

Figs. 3, 4, 12. The same. Permian specimens, showing same aspects as before. Tunstall Hill.

Figs. 5, 6, 9. *Cythere* (*Bairdia*) *plebeia*, Reuss. Carboniferous specimens, showing left valve and lateral contour of same. Craigenglen, Campsie.

Figs. 7, 8, 10. The same. Permian specimens, showing same aspects as last. Tunstall Hill.

[All the Entomostraca magnified 25 times.]

Fig. 13. *Fenestella retiformis*, Schloth. Permian. Non-celluliferous face; magnified 6 times. Tunstall Hill.

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* *Lutraria oblonga* and *L. elliptica*, for instance, occur together as fossils in the newer Tertiary beds of Sussex (Quart. Journ. Geol. Soc. vol. xiii. p. 51). In the same deposit *Solen siliqua* has been detected (*ibid.* p. 53); and in another Tertiary bed *Solen ensis* occurs (*ib.* vol. xiv. p. 328). *Mya truncata* and *M. Uddevallensis* also both occur in a fossil state (Woodward's 'Mollusca,' p. 357, and Quart. Journ. Geol. Soc. vol. xiii. p. 53).

Fig. 16. The same. Permian. Celluliferous face, worn; magnified 12 times. Tunstall Hill.
Fig. 17. The same. Permian. Celluliferous face, unabraded; magnified 12 times. Tunstall Hill.
Fig. 15. The same (*Fenestella plebeia*, M'Coy). Carboniferous. Non-celluliferous face; magnified 6 times. Beith.
Figs. 14, 18. The same. Carboniferous. Celluliferous face, worn; magnified 12 times. Beith.

[Carboniferous specimens marked C; Permian specimens marked P.]

XXII.—*On* Synapta digitata *and its supposed Parasite.* By A. Baur*.

I. *The attachment of the Molluskigerous Sac to the head of the Synapta.*

The point the elucidation of which is of most importance with regard to the relation of the sac-producing Mollusca to the Holothurid is the case, once seen by J. Müller, in which three molluskigerous sacs were attached within the head of the *Synapta*. J. Müller remained in doubt as to the meaning of this attachment, the mode of adhesion, and the nature of the outer extremity of the sac; he considered further observations upon the constancy or inconstancy of the attachment to the head to be necessary†.

Captures of *Synapta digitata*, continued during three months, furnished me repeatedly with molluskigerous sacs thus attached. It was also possible to examine more closely the mode of attachment, and to settle by observation the question whether it was constant or inconstant, whether it was accidental or connected with the origin of the molluskigerous sac, or perhaps with the immigration of the molluskigerous parasite.

While among 100–200 individuals of *Synapta digitata* it is not easy to find more than one infested by a molluskigerous sac, or now and then by several, there were three out of 120–130 *Synaptæ* containing molluskigerous sacs, in which the sae, besides being attached as usual to the intestinal vessel, at the same time turned its ordinarily free and posteriorly directed end towards the head of the *Synapta*, and was attached there likewise. In all the three cases the sac attached to the head was of the same nature; it differed, also, in no essential point from the others, which in other individuals extended freely backward into the body-cavity of the *Synapta*. None of the three mollus-

* Translated by W. S. Dallas, F.L.S., from the Monatsbericht der Akad. der Wiss. zu Berlin, April 1862, p. 187.

† J. Müller, "Ueber *Synapta digitata* und über die Erzeugung von Schnecken in Holothurien," p. 15. (See 'Annals,' February 1852, p. 106.)

kigerous sacs were smaller, but they were rather amongst the largest observed; they were all sexually mature, and contained either ready-formed mollusks or ova in course of development into mollusks. None of the three cases furnished any support for the supposed possibility that the sacs attached to the head of the *Synapta* might be an earlier stage.

The connexion of the extremity of the sac with the head of the *Synapta,* when it exists, is very intimate. The terminal portion of the molluskigerous sac, when forcibly pulled, is torn before the adhesion will yield. This firmness is not due to any coalescence; its cause is mechanical, and depends upon an interlocking. The terminal portion of the molluskigerous tube was in all three cases wrapped together into the form of a coil—as it were, stuffed into a space enlarged by stretching, and held firmly therein by a narrow constricting portion. After the careful separation of the constricting parts in the head of the *Synapta,* the end of the sac could be completely unfolded and prepared in an uninjured state, with the exception of the loss by stripping off of the outermost layer of cells. The point of attachment always corresponds externally to a spot of the circumference of the oral or cephalic disk, where it borders on the base of the tentacles. The point of attachment is not constant upon this circumference; it is sometimes on one side and sometimes on the other of the median line indicated by the mesentery and sexual orifice. In two of the observed cases a yellow swelling, caused by the more intensely coloured molluskigerous sac shining through it, could be detected even from the outside in the still uninjured and living head of the *Synapta* within the circle of tentacles. The body-wall of the *Synapta* was, however, not perforated; the end of the sac was not bare, but was always distinctly covered, at least, by the outermost reddish layer of the body-wall (epidermis and dermis of Quatrefages). In one case the most careful examination showed that internally the coil-like end of the molluskigerous sac had filled and considerably distended the base of two neighbouring tentacular cavities. These remained distinctly enlarged even after the separation and removal of the coil. In the two other cases the end of the sac had not occupied the cavity of the water-vascular system at its entrance into the tentacles, but the space close by, between the buccal disk, calcareous ring, and œsophagus, and therefore between the canals passing from the annular canal to the tentacles.

The condition described, especially in the first case, in which the entrance into two tentacles was evidently forcibly dilated, admits only of one explanation. The adhesion of the sac to the head can be effected only in the following way :—whilst it usually extends backward in the body-cavity of the *Synapta*, in this case it turns forward towards the head, its extremity is forced, at any spot offering the least resistance, between the parts there existing, and under certain circumstances into the canals, where it is firmly held, like a portion of intestine wedged into a diverticulum of the ventral cavity: such a spot is presented by the tentacular cavities, if we leave out of consideration the delicate and but slightly resistant walls of the aquiferous vessels, by which the tentacular cavities are separated from the body-cavity of the *Synapta*.

When disquieted or irritated, the *Synapta*, or each fragment having a head, endeavours to break itself to pieces. Before this is effected at any definite spot, the worm-like body performs powerful alternate contractions and extensions. The pressure exerted by the muscular body-wall upon its contents is so strong that, at the moment when the wall bursts, the fluid of the body-cavity often spirts out in a stream. At the same time it frequently happens that with the first rupture of the body-wall the intestine, together with the genital tubes, is forcibly driven out laterally. In the same way the molluskigerous sac, with its free end turned towards the head, may be firmly held by a constriction in the neighbourhood of the calcareous ring, where a rupture never takes place. The attenuation which, according to J. Müller, the sac exhibits towards its extremity is explained by the dragging and stretching necessarily accompanying this process.

As appears from the nature of the *Synapta*, as well as from that of the extremity of the sac, the mode of attachment is purely mechanical; it does not consist in an organic connexion of the sac with the head of the *Synapta*. In the effectuation of the cephalic attachment the molluskigerous sac is purely passive: the effective cause is the pressure exerted by the contractile wall of the body of the *Synapta* upon its contents, and consequently also upon the molluskigerous sac.

The cephalic adhesion is, finally, inconstant, and purely accidental, because it is to be ascribed to an accidental vital manifestation, or perhaps more correctly to a phenomenon of the agony of the *Synapta*—a convulsive contraction of the body, perhaps produced only by capture or by violent injury.

The notion that we are to regard the molluskigerous sac, when attached to the head of the *Synapta*, as not organically united, but perhaps as a parasite breaking through the body-wall of the *Synapta* either in immigration or emigration, and the adhesion itself as a transitory act of the molluskigerous sac which, for this reason, so rarely comes under observation, is got rid of by what has been said above. But still there is one circumstance to be considered, which has been referred to this very point.

In one case described by J. Müller, which, among the rare cases of cephalic attachment of the molluskigerous sac, was itself a rare exceptional case, inasmuch as three sacs were present in one *Synapta,* and all three of them were attached to the head, one of the sacs, and this the smallest and shortest, although otherwise not different, and still uninjured, had the extremity usually affixed to the intestinal vessel free in the cavity of the body. J. Müller was inclined to attach much importance to this circumstance in the interpretation of the sacs as parasitic creatures. The mode in which this might happen has been elucidated by the anonymous reporter in the 'Annals of Natural History,' January and February 1852, by reference to the penetration of the Cercariæ into the skins of the Mollusca. J. Müller himself has left it uncertain whether this third sac, with a reversed attachment (that is to say, attached by the usually free extremity, and free at that which is usually attached), was still very young and undeveloped, or whether its development and generation were completed, and itself in course of retrograde metamorphosis,—whether it would attain its position on the intestine only by further growth, or whether the union had previously occurred at the ordinary place, but been dissolved by the gradual reduction of the sac. The reporter in the 'Annals of Natural History' regarded it as an ascertained fact, from J. Müller's observation, that the sac is at first attached only to the body-wall of the *Synapta* (at the head), and subsequently to the intestinal vessel.

The behaviour of the molluskigerous sacs as they occur in the cavity of the body of the *Synapta,* especially when the cephalic attachment is left out of the question, forbids our connecting this circumstance with evolution, whether progressive or retrograde, or with the immigration of the molluskigerous sac It is quite an ordinary phenomenon to find in the cavity of the *Synapta* perfectly free, floating molluskigerous sacs, which have evidently been torn from the intestinal vessel only by the capture and the violent movements of the *Synapta* accompanying it. But if a molluskigerous sac be completely attached to the head, the freedom of the other extremity is still less remarkable. As it may be proved from the cephalic attachment itself that in this case a force has been exerted upon it which pressed it against the head of the *Synapta,* and even wedged it into that part, it is not to be wondered at if the same pressure which, in the case of J. Müller, drove these sacs towards the head, should have separated one of them from its position on the intestinal vessel. Nor is it surprising that this should apply to the smallest specimen—to that whose length is less than the distance of the ordinary point of attachment on the intestine from the head of the *Synapta*, as may be seen from the figure (tab. 2. fig. 3) given by J. Müller. Therefore, as the abnormal attachment to the head is nothing but a mechanical and accidental engagement of one end of the sac, so the simultaneous absence of the normal adhesion in the one case observed by J. Müller is merely a mechanical separation of the other end from the intestinal vessel, referable to the same accidental cause. Neither the one nor the other stands in any nearer relation to the growth, development, or vital history of the molluskigerous sac.

II. *On the adhesion of the Molluskigerous Sac to the Intestine.*

In the natural state we are never to imagine the molluskigerous sac in the *Synapta* otherwise than as attached by one end, in the manner described and figured by J. Müller, to the intestinal vessel opposite to the mesentery, with the other end extending freely backwards in the cavity of the body along the intestinal canal of the *Synapta*. If the sac be quite free, it has been accidentally separated; if it be attached by the free end to the head, it has been accidentally engaged there.

The natural adhesion of the molluskigerous sac is effected in this way: the button-like extremity, probably the buccal portion of the molluskigerous sac, projects into the lumen of the intestinal vessel through a slit in the wall of the latter, and is firmly held therein, exactly like a button in its button-hole. Behind the knob the wall of the vessel clasps the sac so closely, that a forcible separation is not possible without tearing away the button, or enlarging the slit, so that the sac may easily appear to have become organically united with the intestinal vessel. There is, however, no evidence of such a union; on the contrary, the simple engagement of the button is perfectly sufficient to explain the firmness of the connexion between the sac and the intestinal vessel.

The mode of attachment of the molluskigerous sac to the intestinal vessel is, therefore, like its adhesion to the head, *purely mechanical*, and depends no more than the latter upon an organic union. It is not, however, like this, accidental; on the contrary, this attachment is constant for the occurrence of every uninjured sac in the uninjured *Synapta*, and, which is the most remarkable, constant with regard to the spot on the intestinal vessel, although this extends, with the same diameter, and the same properties, and in the same position, along the whole intestine of the *Synapta*, from the stomach to the anus.

How this attachment is effected, that is to say, how the molluskigerous sac buttons itself into the intestinal vessel of the

Synapta, is the next question with which we have to deal. It cannot take place by the molluskigerous sac remaining passive, as in the cephalic attachment. The attachment to the intestinal vessel must, on the contrary, be an act in the life of the molluskigerous sac, an act, however, which is still entirely withdrawn from our inspection.

With regard to the development and early vital history of the molluskigerous sac, its occurrence in the full-grown *Synapta* furnishes no other information than is to be found in the observations of J. Müller. In the full-grown *Synapta*, the molluskigerous sac is never found, at any period of the year, otherwise than in the sexually mature and molluskigerous state, and attached in the manner above described.

III. *The young forms of* Synapta digitata, *Müll.*

Quatrefages, in his observations upon *Synapta Duvernæa* (Annales des Sciences Nat. 2 sér. 1842, p. 73), has pointed out that, much as these Holothuriæ might be observed on the shores of the Mediterranean and in the Atlantic, they are yet never met with otherwise than in a perfectly developed and sexually mature state, and not less than 6 inches in length. This applies also to *Synapta digitata*. The non-appearance of smaller specimens is explained by Quatrefages upon the well-founded supposition that these vermiform Echinoderms, in passing through a metamorphosis, will have a larval form, which, no doubt, will be quite different from that which they afterwards assume.

Among the numerous forms of swimming larvæ of Echinoderms discovered by J. Müller, are some whose metamorphosis could be traced into animals which, from their general anatomical characters, are Holothuriæ. These are the *Auriculariæ* remarkable for their singular form and compared to a rococo coat-of-arms (Abhandl. der Akad. der Wiss. 1848, p. 98; 1849, p. 35; and 1850, p. 37). Of these larvæ J. Müller has made known two different and apparently widely distributed forms; both were first observed at Marseilles in spring, then at Nice in August and September, and lastly at Trieste, one only in the spring, and the other late in the summer. Their external distinctions are, that one bears in the middle of the posterior extremity of the body a calcareous gland running out into radiate teeth—in fact, a calcareous star, and also, in the lobes into which the body of the larva is prolonged all round, a garniture of clear, pale-red spherules, not composed of lime; the other larva is destitute of these spherules, and has in the two lobes of the posterior end of the body which contains the anus, besides an inconstant calcareous sphere, a variable number of very regular calcareous wheels. The young Holothuriæ (still swimming by means of bands of cilia) into which these larvæ are transformed coincide most in their anatomical structure with the footless and abranchiate section to which the genera *Chirodota* and *Synapta* belong. They retain, in the skin at the posterior extremity of the body, the peculiar calcareous structures of the larva.

For the more precise determination of one of these larval forms, and the corresponding young Holothurid, with the globules and the calcareous star, J. Müller possessed no data (*loc. cit.* 1849, p. 55). In the other, the occurrence of the calcareous wheels still at the posterior extremity of the young Holothurid could not but lead to the supposition that it belonged to the genus *Chirodota* (*ibid.* p. 49), because this genus has calcareous wheels in the skin, whilst the nearly allied and anatomically accordant genus *Synapta* has little anchors inserted into a perforated calcareous plate.

Grube has described two Holothurids of the genus *Chirodota* from the Mediterranean — *Chirodota Chiaji* and *C. pinnata* ('Actinien, Echinodermen und Würmer des adriat. und Mittelmeers,' 1840). It has, however, been found that these two, from their zoological characters, namely, the calcareous armature, are not *Chirodotæ*, but *Synaptæ*, and that *Chirodota Chiaji*, Gr. (*Holothuria digitata*, Mont.), and *Chirodota pinnata*, Gr. (*Holothuria inhærens*, O. F. Müll.), must receive the generic name of *Synapta* (Müller, Archiv, 1850, pp. 115, 135, 136). One of them is Müller's *Synapta digitata*, and the other *Synapta inhærens*, the latter again being probably identical with *Synapta Duvernæa* of Quatrefages.

As no true *Chirodota*, no Holothurid with calcareous wheels, is yet known from the Mediterranean, there were two possibilities in regard to the origin of the *Auricularia* with calcareous wheels. Either it belonged to a true *Chirodota* peculiar to the Mediterranean, but still unobserved; or the calcareous wheels in the skin of the larva and young Holothurid could only be transitory structures, and other calcareous structures must subsequently make their appearance in them (Abh. der Akad. der Wiss. 1849, p. 50). The former was the less probable, because, from the abundance of the *Auricularia* with calcareous wheels, it could scarcely be supposed to belong to a still unknown and therefore certainly rare Holothurid; but in the latter case the abundant and widely distributed *Synaptæ* must be taken into consideration. The decision of the question depended on tracing the young Holothurids produced from the larvæ with calcareous wheels (which, in the latest stage seen by J. Müller, still moved by swimming with their bands of cilia) in their further growth and changes, but especially with respect to the appearance of calcareous structures in other parts of the skin.

Krohn has succeeded in keeping alive young Holothurids with calcareous wheels, taken in spring at Messina, until they lost the rows of cilia and crept in a perfectly worm-like manner, "like *Synaptæ*" (Muller's Archiv, 1853, p. 319). In one individual, moreover, Krohn saw the number of the still simple tentacles, which is originally five, increase to eight by the simultaneous growth of three new ones. In the discovery of this later stage, Krohn also thought he found a support for the opinion of J. Müller already referred to, namely, that the small *Holothuria* and *Auricularia* with calcareous wheels belong to the genus *Chirodota* [*Synapta* ?—Ed.].

Synapta digitata, as it occurs in the Bay of Muggia, near Trieste, reproduces in the spring (Leydig, in Müller's Archiv, 1852, pp. 507, 516), and, as I ascertained, only once in the year. I have observed that the appearance in great numbers of the *Auricularia* with calcareous wheels in the Bay of Muggia, where *Synapta digitata* lives in abundance on the sea-bottom, coincides exactly with the time at which the distended genital sacs of the *Synapta* contain mature ova with a germinal spot, and zoospermia, and that shortly afterwards they are all found empty.

I have also succeeded in tracing the development of the larvæ, pupæ, and young Holothurids (which are at first easily caught, but afterwards captured with gradually increasing difficulty) up to the point at which they live, in the form of small transparent worms of about 8 mill. in length, in the fine mud of the sea-bottom, and have gradually acquired all the anatomical and zoological characters of *Synapta digitata*. In the last observed and furthest advanced animals the number of tentacles, by a further pushing out of four new ones, had become twelve, the number occurring in the mature *Synapta*. The originally simple, conical tentacles had acquired the specific form of those of *Synapta digitata*; they terminated in five little feelers, arranged like fingers, of which the middle one was short and curved outwards. They had the suckers on the inside of the base, and performed movements from without inwards, accompanied by alternate extension and retraction. The skin, which was at first unarmed, had become beset all over with peculiar calcareous structures; these were little anchors, each attached moveably, by means of a knob, to a perforated calcareous plate. At the same time, however, the calcareous wheels present in the larva were still retained at the posterior extremity of the body; but their number had not increased.

From this it appears that the Auricularia *with calcareous wheels is the larva of* Synapta digitata, *Müll., and that the* Synapta *has a young stage in which it has already attained its definitive form, and possesses the anchors in its skin, but still bears the wheels of the larva at its posterior extremity near the anus.*

The methods by which I succeeded in rendering the young *Synaptæ* accessible to observation, the details of the developmental processes, so far as they have not already been observed by J. Müller, and the anatomical characters of *Synapta digitata* (visible with remarkable facility in the little transparent creatures, which are perfect from mouth to anus) shall be described in detail. At the same time reasons will be given why the unveiling the vital history of the molluskigerous sac is rendered probable by the discovery of these young *Synaptæ*. The difficulties which set bounds to the further prosecution of this course lie in the fact that it was not possible to capture *Synapta digitata* in the young state described in the same quantity as the full-grown animals, which is the first condition for the observation of the molluskigerous sac, on account of its great rarity.

Together with *Synapta digitata*, the somewhat smaller *Synapta inhærens* (probably *S. Duvernæa*, Quatref.), distinguished by its more strongly adhesive skin and plumosely branched tentacles, occurs in smaller numbers near Trieste, in the Bay of Muggia. I had the opportunity of observing the brood of this species also, mixed with that of *S. digitata*, up to the point at which it likewise had the anchors in its skin and acquired the full number and specific form of its tentacles. The young Holothurids of this species are only distinguished by having no calcareous wheels or globules in the posterior extremity, but, instead of them, a group of irregularly angular calcareous pieces. From the *Auricularia* of *Synapta digitata* that of *S. inhærens* probably does not differ at all, except in this condition of the calcareous structure. The latter would, therefore, not be recognized at the time when only larvæ, without any young Holothurids, occurred.

XXIII.—*On the Discovery of Ancient Remains of* Emys lutaria *in Norfolk*. By Alfred Newton, M.A., F.L.S.

[Plates VI. & VII.]

On the 31st of March last, in the course of a communication to the Philosophical Society of the University of Cambridge, I had the pleasure to announce a fact in British archæontology, which, as far as I am aware, is hitherto unrecorded; and as that paper will not be published in a form likely to bring it under the especial notice of naturalists, I propose to give a short account here of what I venture to think may be regarded as a discovery not altogether unimportant.

In the early part of this year, while examining a considerable collection of ancient remains in the possession of Mr. Birch, of

Wretham Hall, near Thetford, I recognized, to my surprise, some specimens far more interesting than any I had hoped to meet with; and these, by that gentleman's kindness, I was enabled to exhibit at the meeting of the Society above named. They consist of a few bones of the limbs and a good part of the outer skeleton of two individuals of the European freshwater Tortoise *Emys lutaria* of Merrem (*Testudo europæa* of Bojanus, *Cistudo europæa* of Duméril and Bibron), a species whose existence at any time in the British Islands had never before been suspected*. They were found, as testified by a label attached to them in Mr. Birch's handwriting, so long ago as June 1836, in a peat-bog by the side of a spring-pit at East Wretham, about 7 feet below the surface and beneath some fifteen hundred laminations of a species of *Hypnum*, which, I understand from Mr. Birch, was pronounced by Sir William Hooker to be *H. filicinum*†.

I communicated these facts forthwith to Professor Owen and Professor Bell, as being respectively the highest authorities on fossil and recent British reptiles, and subsequently submitted the remains to the first-named gentleman, who kindly determined the species for me, thereby confirming the view I had taken of it. In these days the geographical range of this little Tortoise is somewhat remarkable. I am not aware of any indications of its existence in Holland, Belgium, or Northern France. In the North-west of Germany it is unknown; but it occurs in Baden, Würtemberg‡, Bavaria, Austria, Hungary, Poland, and Silesia, whence it seems to extend in a north-western direction through Eastern Prussia, as far as Rostock. At the present time, it is not recognized as an inhabitant of either Denmark or Sweden; but its remains have been found in both countries under circumstances similar to those of the Norfolk ones I have just recorded, as may be seen from the following abstract of the statements of Professors Dalman, Nilsson, and Steenstrup.

In the Transactions of the Stockholm Academy (K. Vetensk. Acad. Handl. 1820, pp. 286–293, tabb. vi. and vii.) Professor Dalman gives an account of some Tortoise-bones found in digging the Götha canal, near Norsholm, in the province of Œstergöthland. They seem to have been about 15 feet below the surface, in peat-earth, over which a layer of gravel had been

* I believe that as yet no trace of any of the *Testudinata* has been obtained in England from a formation later than that of the London Clay—certainly not from any post-Tertiary deposit.

† Sir Charles Bunbury has been good enough to refer me to a communication of his in the Quarterly Journal of the Geological Society of London for 1856 (vol. xii. p. 355), in which he describes a similar layer of moss found at West Wretham, and there identifies the species as *H. fluitans*.

‡ See G. v. Jäger, in Bull. Soc. Nat. Mosc. 1861, xxxiv. p. 190.

superimposed, and to have been the remains of two individuals, which the writer declares to have belonged to *Emys europæa* of Oken, as distinguished from *E. lutaria*, though, I believe, the best authorities now consider these two supposed species to be identical. He also adds, in a note, that a third and entire skeleton, dug up a long time before in making a deep ditch near Regnaholm, in the same province, had been brought to his notice by Major Gyllenkrook since his communication to the Academy. In a later volume of the same Transactions (1839, pp. 194–211, tabb. iii. & iv.) Professor Nilsson notices a similar discovery made at two places in Skåne, one specimen having been found in 1839 near Gräfve, in the pastorate of Brågarp, at a depth of 8 feet, in peat, and another disinterred the following year, near Fuglie, in the pastorate of Hvällinge. He gives a minute description of the former example, detailing some points of difference observable between it and recent specimens of *Emys lutaria*, Bp., which differences he there considers sufficient to warrant his designating the fossil as *E. lutaria*, "var. *borealis*." In 1842, this veteran naturalist, in his 'Skandinavisk Herpetologi' (p. 11, *note*), mentions that, more than twenty years previously, he had received from a student a living example of *E. lutaria*, captured in the district of Falsterbo, the extreme south point of Sweden, which, at the time, he thought could only have been an imported animal, accidentally escaped, and so neglected to make further inquiries respecting it. He likewise states (p. 10, *note*) that, shortly before the publication of his work, he had obtained, from Medic. Candid. Fornander, fragments of a fossil Tortoise found in a moss in Œland. This he identifies with the existing *Emys lutaria*, and appears content to let his own "*borealis*" sink into obscurity, as if doubtful of its validity even as a variety.

Fourteen years ago, Professor Steenstrup announced to the Copenhagen Scientific Association (Overs. over det Vidensk. Selsk. Forhandl. 1848, p. 74) the discovery of the dorsal portion of the skeleton of a Water-Tortoise in a turf-moss at Overdraaby, near Jægerspris, in Zealand (Sjœlland), and, in doing so, referred to Professor Nilsson's statements just quoted. Some years later, he communicated to the same Association (1855, p. 1) the fact that the sternum and vertebræ of another individual had been found in a similar formation at Egholm, not far from the locality last mentioned; and soon after, the same illustrious zoologist gave an account (1855, p. 384) of the remains of a third, but smaller and younger, example, which had since been obtained at that spot.

I regret that it is beyond my power to furnish a full and detailed description of the specimens whose discovery I now record.

I can only make a few observations upon them; and these, I may add, have been chiefly brought to my notice by my kind friend Dr. Albert Günther.

Of the limbal remains of the two individuals*, I have now before me sixteen bones or fragments of bones, consisting, when fitted together, of *one* right humerus, *one* right and *one* left scapula, *one* right and part of *one* left clavicle, *two* right and *two* left femora, *one* entire pelvis, with *two* portions of another, and *one* right and *two* left tibiæ. From these bones it is plain that the two individuals differed slightly in size.

Of the vertebral remains in the larger specimen, *thirty-six* out of the sixty-three bones, or more than half, remain. To specify them, I shall adopt the system of notation employed by Bojanus in his beautiful Monograph of this species†. The median or vertebral row of the dorsal bones is the most deficient, only *three* out of the ten, namely, V, IX, and X, being left. It is very unfortunate that the sixth, seventh, and eighth are lost, as they appear to vary much in different individuals, and I cannot conjecture what shape they may have had here. Of the twenty-four marginal bones, *nine* are forthcoming; these luckily include XI and XXIII, the nuchal and caudal scutes. The others which have been preserved are XV, XVI, XVII, XVIII, XXVIII, XXIX, and part of XXXIV. The costal bones on the right side all remain, with the exception of the first false rib, XXXV; on the left side, four of the ten are missing, namely, XLV. XLVI, XLVII, and LI. The processes of the tenth false rib on either side, XLIV and LIV, remain attached to XLIII and LIII respectively. The sternal bones of this (the larger) specimen are in a singularly perfect state, the posterior process of the left hinge alone being somewhat damaged. Thus it will be seen that the portions present are such that the size of the specimen can be pretty correctly ascertained; and accordingly I give the following dimensions, which, I am confident, approach the truth very nearly:—

Entire length of carapace, in a straight line,	7	inches.
Ditto, following the curve	8·2	„
Entire breadth of carapace, in a straight line,	5·5	„
Ditto, following the curve	8·6	„
Greatest length of plastron	7·5	„
Greatest breadth of ditto	4·4	„

* I ought to say that I was not aware that the bones were those of *two* individuals, until the fact was mentioned to me by Prof. Owen, though, in justice to myself, I may add that I despatched them to him immediately on their being entrusted to my care.

† 'Anatome Testudinis Europææ,' &c. fol. Vilnæ et Lipsiæ, 1819–21.

In the smaller specimen, *nine* dorsal bones only remain : these I believe to be XIV, XXVII, XXVIII, XXX, XXXVII, XXXVIII, XLIX, LI, and LII ; but I am not very certain that my identification of them is correct. Of the sternum, more than one-half has been preserved, the missing bones being LV, LVI, LVII, part of LVIII, and LIX ; but the cardinal processes are much less perfect than in the larger example. The greatest breadth of the sternum is 4·25 inches ; the length from the transverse articular suture to the posterior extremity is 4 inches, while in the larger example it is 4·25 inches.

For the rest I must refer the student to the plates (Pls. VI. & VII.) accompanying this brief and incomplete notice, which will give a far better idea of the relics of these ancient Britons than anything I can say about them.

Elveden, June 30, 1862.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

February 11, 1862.—Dr. J. E. Gray, V.P., in the Chair.

CONTRIBUTION TO THE KNOWLEDGE OF THE BRITISH CHARRS. BY DR. ALBERT GÜNTHER.

The production of the following paper has been induced by two specimens of the so-called Freshwater Herring of Lough Melvin in Ireland, which were procured by Joshua Walker, Esq., and submitted to my examination. The differences from the allied Continental species were so striking, that, from the first moment, I could scarcely doubt that I had a species before me which I had never seen before. In the first place it appeared necessary to compare it with specimens from other localities of Great Britain—with the true British Charr ; but, although the period of the year (November and December) appeared to be the most favourable for the capture of those fishes, as they approach the shores to spawn, afterwards returning to the deepest parts of the lakes, I have been only partly successful in obtaining more specimens, and I particularly regret not having been able to examine specimens from Scotland, either in a fresh state or preserved in spirits*. I have obtained, however, materials sufficient for the determination of the Charrs of three localities, by the kind assistance of the gentlemen who will be mentioned hereafter. Our knowledge of the representatives of the Charr on the Continent is chiefly due to Heckel, Nilsson, and Rapp, in whose descriptions due attention has been paid to those characters by which the species may be distinguished ; and for a comparison of the British Charrs with those of the Continent I have had to rely chiefly on them. My materials were the following :—

* Dried and stuffed specimens of Charr are of little or no use.

a. *Freshwater Herring of Lough Melvin.*

Two fresh specimens, mature males; by the kindness of J. Walker, Esq.

One specimen (dried skin) in the British Museum.

b. *Welsh Charr, or Torgoch.*

Nearly twenty specimens from Llanberris, all mature males; received by the kindness of S. P. W. Ellis, Esq., Chief Constable of Carnarvonshire, and G. Ellis, Esq.

Four young specimens from the lake Coss-y-gedawl, transferred with Mr. Yarrell's collection to the British Museum (*Salmo salvelinus,* Jenyns).

c. *Charr of the Lake of Windermere.*

Two mature males, procured by the kindness of Sir J. Richardson.

For further comparison I had the "Röthel" of the Lake of Constance, the "Ombre chevalier" of the Lake of Geneva, four specimens of a Charr from Iceland, and twelve without known locality.

Before we enter into a historical account of our knowledge of the British Charrs, we must consider the question, what fishes have been originally intended by the Linnæan denominations of *Salmo umbla, Salmo salvelinus,* and *Salmo alpinus*—names by which the British Charrs have been designated by various authors.

The original descriptions themselves are too short and too general to give anything like specific distinctions; but fortunately we see that question settled, once and for ever, by the very names of the fishes and by the localities from which the typical specimens had been procured. J. Heckel has made inquiries into this subject with regard to the *Salmo salvelinus* of South Germany*, and the following is the result:—

a. *Salmo salvelinus,* L. Linnæus has founded this species on the tenth species of *Salmo* in Artedi's 'Genera,' or on the eleventh in his 'Synonymy'; and Artedi had derived the whole of his knowledge of this fish from Willughby, who (p. 195) gives a description of the "Salvelin" from a specimen captured near the Austrian town of Linz. Therefore there cannot be the slightest doubt that the Linnæan denomination is intended for the South-German fish, which, up to the present day, is called *Sälbling* at various localities.

The best account of the Sälbling has been given by Heckel, who says that they are found in several lakes of South Germany, Tyrol, and Switzerland. First (*l. c.*) he distinguished three species according to the different arrangement of the small teeth on the vomer; afterwards†, having convinced himself that this character is subject to some variation, he reunited those three forms, stating at the same time that those fishes from different localities of Central Europe considerably differ in their *forms.* And it is not at all improbable that there are really several species confounded by him, but differing

* Reisebericht, p. 89, in Sitzungsber. Akad. Wiss. Wien, 1851, July.

† Süsswasserf. Oestr. p. 280.

and distinguishable by other, more constant, characters than by that of the arrangement of the vomerine teeth. Be this as it may, it suffices for our purpose that Heckel distinguishes those fishes of Central Europe by the considerable breadth of the interorbital space, which is twice the diameter of the eye. The figure*, also (which is rather indifferent), represents a remarkably small eye; the pectoral fin occupies only one-half of the distance of its root from that of the ventrals; and when we compare the British specimens, we find that their head is much narrower, their eye much larger, and their pectoral fins much longer than in the fishes described by Heckel, and consequently that none of them can be identical with the South-German Sälbling or with the *Salmo salvelinus* of Linnæus.

b. *Salmo umbla*, L. Linnæus has founded this species on the ninth species of *Salmo* in Artedi's 'Genera,' or on the seventh in his 'Synonymy,' the latter ichthyologist following Rondelet, who described the "Salmo Lemani lacus, seu Umbla†," or the "Ombre (chevalier)" of the Lakes of Geneva and Neuchatel. Jurine‡ and Agassiz§ have given figures of this fish. Far superior to them is that published by Rapp‖, who has identified the "Röthel" of the Lake of Constance with the *Salmo umbla*, L.

This species never assumes the red colours of the *S. salvelinus*, or of the Charrs of Windermere and of Wales. It could be compared in this respect only with the "Freshwater Herring" of Lough Melvin, from which it is readily distinguished by its much larger teeth, by its wide mouth, the maxillary extending to behind the orbit, by its much more elongate body, and by the proportions of its fins. *Salmo umbla* of Linnæus differs from the British Charrs (as far as we treat of them in this paper) in nearly every one of the external characters, and agrees with the Irish species only in its plainer coloration and in the size of its scales.

c. *Salmo alpinus*, L. Linnæus, on his tour through Lapland, discovered in the mountain-lakes of that country a species of Charr, which he described in the 'Fauna Suecica,' p. 117, no. 310, and which he named *S. alpinus* in the 'Systema Naturæ.' He adopts the opinion of Artedi in referring the British Charr (which he knew from Willughby's description) as a synonym to this *S. alpinus*. Even the few details which are given in his and Nilsson's descriptions do not admit of an identification of those species. Linnæus says that the length of the head of the typical specimen was $1\frac{1}{2}$ inch, and the distance from (the front margin of) the dorsal to the adipose fin 3 inches: in the British Charrs the head is much longer. He found the length of the head equal to that of the base of the dorsal fin: in British Charrs the base of that fin is much shorter. Nilsson describes the *S. alpinus*, L., as a distinct variety of *S. salvelinus*, distinguished by short fins; but *S. salvelinus*, Nilss., has shorter fins than any of the British Charrs.

* Süsswasserf. fig. 155.

† Rondel. ii. p. 160.

‡ Poiss. du lac Léman, pl. 5.

§ Poiss. d'eau douce, pls. 10 & 11 (but not pl. 9).

‖ Bodensee-Fische, p. 32. taf. 5.

We are, therefore, not justified in admitting one of those Linnæan denominations for the British species which will be described in this paper. This view being in contradiction with that of all former writers, I think it necessary to give a *historical review* of what has been done on the subject. Not a love of starting novel views, much less an ill feeling towards any of the previous inquirers, but the plain necessity of supporting the truth of my opinion forces me to show where observations have been imperfect, or where they do not agree with nature. Conscious of the imperfectness of my own labour, I should not be wise to provoke just retribution by unfair severity towards others.

1685. Willughby is the first who with the practised eye of an ichthyologist examined the Charrs of England and Wales, devoting a separate article to their description*. He recognizes their affinity to the Sälbling (*S. salvelinus*), and lets the descriptions of the German and British fishes follow one another; but the "Torgoch" of Wales and the "Red Charre of Winander-mere" appear to him to be the same species, with which he unites even the "*Reutele*" or Röthel of South Germany—a fish which, however, appears to have been known to him rather by name or by recollection than by actual examination and by comparison with the British fish.

At a time when naturalists were only beginning to advance beyond the individual specimen to the conception of classification, and to form the ideas of species and genera, it was creditable enough to note the British Charrs on the whole as different from the Sälbling, and, at the same time, to indicate their affinity.

Willughby mentions the *Gilt Charr* besides the Red Charr, also from the lakes of Westmoreland, considering it identical with Salviani's Carpione from the Lago di Garda†. In the description of the latter he says (p.197), "*In palato quinque dentium areolæ,*" whilst he expressly and correctly mentions that the middle of the palate is toothless in the Sälbling as well as in the Red Charr. Therefore the Gilt Charr, as it is understood by Willughby, cannot be a true Charr without teeth along the middle of the vomer (*Salmo* sensu stricto); but it is a species of *Salar* or *Fario*, with five series of teeth along the roof of the mouth, viz. two along the maxillaries, two along the palatines, and one along the vomer.

We shall see that Pennant and Yarrell mention the Gilt Charr (of which I have not seen an example) as a variety of the common Charr; but what Pennant says about its habits and propagation tends to show that Willughby was perfectly right in referring it to (or near to) a very different species.

1738. The confusion commences with Artedi and Linnæus, who, without knowing the British fish, refer Willughby's Red Charre to the *Salmo alpinus* from Lapland.

1755. Farrington, in a letter printed in the 'Philosophical Transactions' of that year, gives some notes about the general appearance

* Will. Hist. Pisc. p. 196.

† See Heckel, Reisebericht, p. 98 (*Salmo carpio*, L.; *Fario carpio*, Heck.).

and the habits of the Torgoch. He very truly remarks that the fish is "slimy, nearly allied to the eel and the tench." From the specimens which I have examined I cannot confirm his observation that "the male is not adorned with the beautiful red hue of the female;" "yet," he continues, "he is finely shaded and marbled upon the back and sides with black streaks." "The Turgoch makes its appearance at the shores of the Llanberris lakes about the winter solstice; the whole number annually taken in the two pools of Llanberris does not amount to a hundred dozen."

1776. PENNANT knows that the Charr occurs not only in England and Wales, but also in Scotland, whilst he had not received any evidence of its existence in Ireland. He first mentions the fact, which is repeated in all other works, that the Charrs of the Lake of Llanberris were entirely destroyed by noxious waters flowing from copper-mines in the neighbourhood*. He has examined the *Red or Case-Charr* and the *Gilt Charr*, but considers both as the same species, although the former spawns about Michaelmas, ascending the river Brathay, whilst the spawning-season of the latter extends from the month of January to that of March, the fishes remaining in the sandy parts of the lake. If this Gilt Charr (Pennant's) is identical with that of Willughby, and if the observations of both these naturalists really refer to the Gilt Charr of the present day, it is clear that it is not a variety of the common Charr, but a species widely different from it.

1802. The knowledge of those fishes is considerably advanced by DONOVAN, who well perceives the differences between the Torgoch and Charr, but is unable to fix the distinctive characters in specific terms, resorting for the purpose of diagnosis to the differences in colour, which in his figures are much exaggerated and untrue. In his description, he is quite right in directing particular attention to the slender form of the Torgoch; and he might have added another important character which is indicated in the figures, namely, that whilst in the Charr the root of the pectoral is quite free, and not overlapped by a prolonged suboperculum, the latter is produced backwards and downwards in the Torgoch. The physiognomy of the fishes has lost much by representing the eye too small; whilst the differences in the structure of the nostrils apparently have been noticed by him. He employs for the Charr the Linnæan name of *S. alpinus* (pl. 61), and for the Torgoch that of *S. salvelinus* (pl. 112).

* This fact is doubted by Mr. S. P. W. Ellis, who writes, in answer to my inquiry on this subject, "Llanberris Lake is three and a quarter or four miles long; the width varies, the greatest width being about three-fourths of a mile; the greatest depth is said to be 40 fathoms. The quantity of water coming from copper-works is not more than one-tenth part of the whole volume, and this portion flows about five miles before falling into the lake, and, besides, passes through a mountain lake after having left the mine. Below this mountain-pool the water is not poisonous to fish. The quantity of water from copper-mines has decreased in this valley, owing to the stoppage of works. I cannot think there ever were mines worked to any such extent as seriously to injure fishes. The chief works are slate-quarries." J. Petherick, Esq., who has a thorough knowledge of these mines, a part of which are worked by himself, is also of the same opinion.

1807. Turton follows Donovan, and evidently has examined the Torgoch, as he gives the correct number of the dorsal rays, viz. thirteen. The statements of the different authors, especially of the earlier, with regard to the fin-rays, can be used only with great caution,—first, because they had only partly recognized the value of that character; and secondly, because they counted them in different ways, frequently omitting the small rays in front of the fins.

1812. The first definite notice of the occurrence of a Charr-like fish in Ireland appears to be due to Dubourdieu, who, in his 'History of the County of Antrim' (vol. i. p. 119), in a list of the fishes of Lough Neagh, enumerates the *Whiting*, which by a friend of the author, Mr. Templeton, is declared to be the *S. alpinus*. A rough drawing is added. As the description does not give any specific characters, we are left in doubt about the correctness of the determination. It is probable that the Whiting of Lough Neagh is now extinct.

Thompson* says that, when visiting Lough Neagh in 1834, he was assured by the fishermen that they had not known of any of those Whitings being taken in that lake for at least ten years previously. This is confirmed by R. Patterson, Esq., of Belfast, in a letter addressed to me, in which he states that the Charr "has been believed to be extinct in that lake for more than thirty years." Therefore the question whether the Whiting of Lough Neagh was identical with one of the other species, or whether it was a distinct species, will remain unsolved. Surely, if any group of fishes requires particular care in collecting and preserving its representatives at different localities, it is that of the Charrs, which, confined to very limited localities, and extremely susceptible to the changes of their element, are exposed to the danger of easy destruction: the Torgoch of Llanberris disappears for a series of years, (as it is said) in consequence of the poisonous fluids carried down from the copper-mines of the neighbourhood; the Charr of Lough Neagh becomes extinct, from reasons unknown. We are afraid there are other similar instances, but unrecorded in natural history.

1834. Agassiz, engaged in the examination of some of the Continental *Salmonidæ*, and having compared them with those in Great Britain, declared, at the meeting of the British Association of that year, that the Charrs of England and Ireland, the Ombre chevalier of the Lake of Geneva, and all the different Charr-like fishes of Sweden, Switzerland, and all the southern parts of Germany were one and the same species—or that *S. umbla*, L., *S. salvelinus*, L., *S. alpinus*, L., and *S. salmarinus*, L., were merely synonymous†.

Heckel already has shown, with regard to the Swiss representatives of Agassiz's *S. umbla*‡, that two very different species are comprised in it, different in the size of the scales, in the shape of the body, in the coloration, and, according to Rapp's researches, in the number of

* Ann. & Mag. Nat. Hist. 1841, vi. p. 448.

† Report of the Fourth Meeting of the British Association, at Edinburgh, p. 622.

‡ Reisebericht, p. 91.

the vertebræ—or that the *S. umbla*, figured by Agassiz, 'Poiss. d'eau douce,' pls. 10 & 11, is the true *S. umbla* of Linnæus, from the Lake of Neuchatel, but that the *S. umbla*, Agassiz, pl. 9, is identical with *S. salvelinus*, L., from the Lake of Zurich.

Nor can I arrive at the same conclusion as M. Agassiz with regard to the British Charrs known to me. It is much to be regretted that in that paper neither the localities are mentioned whence the specimens examined were obtained, nor that the opinion started was supported by a comparative description; and we cannot assume that M. Agassiz's opinion referred to Scotch specimens only (which I had no opportunity of examining), as he speaks of the Charr of England and Ireland. M. Agassiz opposes those naturalists who, for distinction of the species, have especially attached themselves to the form of the head and to the arrangement of the colours, and says that the characters ought to be found in the structure of the head, in the opercular bones, in the surface of the cranium, and in its proportions relative to the whole body, and that the shape of the body also is important for the distinction of the species. When we add the size of the teeth and of the scales, characters as constant and excellent as any of those named, every one who peruses the descriptions terminating this paper will satisfy himself that our three British species have been distinguished from one another and from those of the Continent by those very characters which have been recommended by M. Agassiz. Ichthyology has been so much advanced within the last thirty years that it would be hardly fair to take the same view of a paper written in 1834 as if it were of a recent date; and I make these lengthened remarks only because there may still be some who, having adopted M. Agassiz's former views, will be inclined to adhere to them.

When M. Agassiz denounces the form of the *head* and the arrangement of the colours as too variable to supply precise characters, I can only partly agree with him. With regard to the former, it is only the *snout* which varies in its form according to age, sex, and season; but, according to my experience, this variation is subject to certain laws: if a male of a certain age has a hooked prominent lower jaw at a certain time of the year, all the males of that species, of the same age and at the same season, are provided with a hooked mandible; and this character may be well used as a specific distinction from another species without such a hook. Differences in the shade of colours are of no value for distinction of species. Sharply defined markings, as cross-bands or large spots, may be dependent on age, and peculiar to the young state of all the species of a whole group (dark cross-bands in the genus *Salmo* equivalent to the white streaks in the genus *Sus*, to the white spots in the genus *Cervus*, to the dark spots in the young Lion, to the light dots in *Muscicapa*, *Rubecula*, &c.); yet two species may differ, and really differ, in the development of those colours, and then they become a precise and valuable character, which is nearly always joined with another. By the colours alone, fresh specimens of *S. salvelinus* and *S. umbla*, of *S. Grayi* and *S. Willughbii*, may be always distinguished.

Agassiz's view was adopted by Sir W. Jardine*, who, however, prefers to adopt another Linnæan name, *S. alpinus*. He ascertained its occurrence in most of the lochs of the north-west of Sutherlandshire.

1835. Jenyns† adopts only a part of the view advocated by Agassiz, distinguishing a *S. umbla* and a *S. salvelinus*. With regard to the former it is not stated whence the specimens had been obtained which served as types for the description. "The elongated form, the gill-cover produced behind into a rounded lobe, the axillary scale nearly half as long as the ventrals, the fourteen dorsal rays," are characters which tend to show that a species was examined different from that of the Lake of Windermere, and closely approaching the Llanberris Torgoch, although I should not venture to identify it with the latter.

Mr. Jenyns describes his second species as the Torgoch, and calls it *S. salvelinus*. If unfortunately the specimens from which this second description was taken had been lost, everybody, like Parnell, would have been at a loss to reconcile it with any of the Charrs known. "The dorsal fin is exactly in the middle of the entire length; the body is not so much elongated in proportion to its depth; posterior portion of the dorsal very little less elevated than the anterior," &c. Such are the characters attributed to the Torgoch; but they are not in accordance with the typical specimens, which are still preserved and now in the British Museum. They, indeed, are identical with the Llanberris species, the proper characters of which may be found in the detailed description subjoined to this paper.

1838. If Parnell's description‡ has been taken from a Scotch specimen, it is the only one which has been drawn up of the so-called Northern Charr; but much is detracted from its value when we consider that the author preserved his specimens as flat skins; therefore his statement, that the height of the body of a specimen $15\frac{1}{2}$ inches long was equal to the length of the head, and *one-sixth of the total*, does not express a peculiarity of the Northern Charr, but this elongate form of the body was probably caused by the mode of preservation. Parnell's other observations on the Charr are borrowed from other authors, who had made their observations chiefly on English and Welsh specimens.

1840. The view of Agassiz was essentially supported by the late W. Thompson of Belfast, who, having had opportunity of examining the Charrs of Windermere, Loch Grannoch, Lough Melvin, and of nine other lakes in Scotland and Ireland, came to the conclusion that they are but one species—one, however, that is subject to extraordinary variety§.

But Mr. Thompson has not brought forward any other proof for this assertion than the other assertion, that the differences presented by the Charr from various localities are very manifold. The following appeared to him the most striking differences:—

* Report of the Fourth Meeting of the British Association, at Edinburgh, p. 614.
† Man. Hist. Vertebr. pp. 427, 428.
‡ Fishes of the Firth of Forth, p. 148 (*S. umbla*).
§ Ann. & Mag. Nat. Hist. 1840, vi. p. 439.

1. In specimens from Loch Grannoch the male fish has the colours of *S. salvelinus*, Donov.; the female those of *S. alpinus*, Donov. The male has a much larger head and larger fins than the female. Number of ova, 500.

2. In specimens from Lough Melvin both sexes are coloured alike; nor can they be distinguished from each other by the size of the fins. Number of ova, 959.

The differences observed in the Charrs from the other localities are not pointed out. Certainly, if Mr. Thompson had really seen those in the size of the scales and of the teeth, he would have mentioned them, and probably arrived at a different conclusion; but having found that some authors before him distinguished the species by the coloration as the chief character, and having satisfied himself that there is a great difference in this respect between the two sexes in the Loch-Grannoch fish, he did not make any further distinction between the other differences he was aware of, between accidental differences of individuals, between those of the two sexes, and, finally, between those of the fishes from various localities, but, considering all of them as equivalent, he was lost in a maze, out of which there was no other escape than to cut the Gordian knot by declaring those fishes to be varieties of one and the same species.

We will not enter into a fruitless investigation as to the possibility of the differences which we observe in those fishes being induced by the physical peculiarities of the localities indicated by Mr. Thompson. We will take and examine them as they are, and as they will be, as long as zoologists of the present species of man exist, provided that human interference does not put a premature termination to the whole tribe. We find, then, that there are other constant differences in the Charrs from various localities, *besides* those of individuals, age, or sex—*which, derived from different parts, form an assemblage of characters affording easy specific distinctions**. If the difference were confined to a single character, to a slight modification of one organ only, I should not consider it sufficient to establish a separate species on it; if the difference consisted merely in the presence or absence of white margins of some of the fins, or if the fishes of one locality had only one fin-ray more, or one of the fins rather more elongate, than their representatives in another locality, one might call this a local variety. But if such a character is found always combined with a second, or with more, so that from the one an inference may be drawn as to the presence of the other, we are certainly obliged to make a specific distinction.

Thus, although we cannot agree with Mr. Thompson that the Windermere, the Welsh, and the Lough-Melvin Charrs are identical, we nevertheless consider his paper as highly important to our knowledge of the geographical distribution of the Charrs in Great Britain.

1. A Charr is found in Loch Grannoch, Kirkcudbrightshire, which makes its appearance only during ten days, never before

* Haller, in 'Correspondence of Linnæus,' ed. by Sir J. E. Smith, ii. p. 267.

about the 13th of October*. The sexes are distinct from each other in colour, and in the size of the head and of the fins (in the number of the vertebræ, the male having 60, the female 62–63?); number of ova, 482. Beside a detailed description of the colours, the account does not contain anything from which we could determine the species.

2. Of other localities in Scotland, Loch Inch and Loch Corr are mentioned. They appear to be inhabited by a species identical with, or similar to, *S. Willughbii*; at all events by one very different from the "Haddy" of Loch Killin in Invernesshire. The latter is very interesting, inasmuch it appears to be closely allied to the Freshwater Herring of Lough Melvin. They are only caught when spawning, about the 26th of September.

3. The freshwater Herring of Lough Melvin appears to be confined to that locality.

4. Lough Dan (county Wicklow, Ireland) is inhabited by a Charr "presenting some of the characters both of the northern and Welsh Charr." Specimens were caught in summer with the fly.

5. Other localities in Ireland are—L. Kindun, L. Gartan, L. Derg, Lake of Luggela, Loughnabrak, and L. Corrib. The Charrs from those localities have a deep-red belly, and appear to approach *S. Willughbii* or *S. cambricus.*

6. The following localities in Ireland are named on the authority of other writers:—L. Esk (co. Donegal); Cummeloughs, in the mountains of Cummeragh; Lake of Inchigeelagh (co. Cork), and one or two other small lakes in this neighbourhood; L. Neagh†; a lake near Dunfanaghy (co. Donegal); L. Eaghish (co. Monaghan).

1841. Yarrell, in the first edition of his work, distinguished, according to the view of Donovan, a *S. umbla* and a *S. salvelinus*, adopting afterwards the opinion of Agassiz and Thompson. His account is composed of the observations of the different writers mentioned. As new localities, are mentioned Keswick, Crummock Water, Coniston Water, Loch of Moy, Loch Inch, &c. The Gilt Charr is mentioned as a variety of the Red Charr.

I conclude this paper with the descriptions‡ of three species, which certainly are not the only ones by which Great Britain and Ireland are inhabited. I look forward with great hopes for the assistance kindly promised by various friends of natural history, trusting that with their help I shall finally be enabled to make up a complete series of specimens from all the localities which are inhabited by

* Objections have been made to my occasionally calling the Charr "in season during some of the winter months." The different species of Charrs appear to be "in season" at very different parts of the year—the freshwater Herring in November, the Torgoch towards the end of the year, the Charr of Windermere in May and August. Considering that those fishes are nearly secure from the persecutions of man during the rest of the year, they ought to be allowed to be taken when, once a year, they approach the shores in large shoals to spawn, at least in those localities where such a control might be kept over their capture that all danger of their becoming scarce would be avoided. Carnivorous fishes inhabiting a certain confined locality, like the Charrs, increase in number only to a certain degree; when their food becomes scarcer, they feed on their own progeny.

† See p. 233.

‡ We insert here merely an abstract of the more detailed descriptions which are given in the Proceedings of the Zoological Society.

this obscure and therefore so interesting group of *Salmonidæ,* and to give a more satisfactory account of them after having compared them with their congeners of the Continent.

Salmo Willughbii.

(The Charr of Windermere.)

Body compressed, slightly elevated, its greatest depth being one-fourth of the distance of the snout from the end of the middle caudal rays; the length of the head is a little more than one-half of the distance of the snout and of the vertical from the origin of the dorsal. Head compressed; interorbital space convex, its width being less than twice the diameter of the eye. Jaws of the male of equal length anteriorly; teeth of moderate strength, four in each intermaxillary, twenty in the maxillary. Length of the pectoral less than that of the head, much more than one-half of the distance between its root and that of the ventral. Dorsal rays twelve. 165 transverse series of scales above the lateral line. Sides with red dots; belly red; pectoral, ventral, and anal with white margins.

Through the kindness of F. T. Buckland, Esq., I have received four specimens of a closely allied species from Iceland. They are from 19 to 15 inches long, and were imported in large quantity by Mr. Hogarth: having been prepared like smoked Salmon, they are not in a state fit for an accurate examination, although in their external characters (even in the colours) they are pretty well preserved. The vertebral column, gills, and intestines had been removed from the fishes before they were smoked. Now those fishes agree *externally* very well with the Charr of Windermere; and I should not hesitate to consider them as one species, but for a statement made by Valenciennes, according to which the vertebral column of that northern species is composed of sixty-seven vertebræ*. Having laid bare the spine on one side of the Windermere specimen, which I have described and figured, I have found only fifty-nine vertebræ —a number stated also by Yarrell. A difference of eight vertebræ will not be found within the limits of one species of *Salmo*; but it is a question whether the skeleton in the Paris Museum really is that of an Iceland Charr†, Valenciennes having comprised under the name of *Salmo alpinus* "plusieurs Truites rapportées de Norvège par Noël de la Morinière, ou de Suède et d'Islande par M. Gaimard," without adding whether the skeleton referred to belongs to a Scandinavian or Iceland specimen.

Faber ('Fische Islands,' p. 168) also mentions the Iceland Charr under the name of *Salmo alpinus,* a name which cannot be applied to the specimens brought by Mr. Hogarth, for the same reasons as stated above. The description given by him is valueless with regard to specific distinction; and as he unites a true (freshwater) Charr with another fish regularly entering the sea, it is probable that he has confounded two species.

* Cuv. et Val. xxi. p. 250.

† *Salmo umbla* (Lake of Constance) has sixty-five vertebræ (Rapp, Bodenseefische, p. 33).

Salmo cambricus.

(The Torgoch of Llanberris.)

Body slightly compressed and elongate, its greatest depth being one-fifth, or two-ninths, of the distance of the snout from the root of the caudal fin; the length of the head is considerably more than one-half of the distance of the snout from the vertical from the origin of the dorsal. Head rather depressed, *interorbital space flat,* its width being less than twice the diameter of the eye. Male with the lower jaw longest; teeth of moderate strength,—six in each intermaxillary, twenty in each maxillary. Length of the pectoral less than that of the head, much more than one-half of the distance between its root and that of the ventral. Dorsal rays thirteen (fourteen). 170 transverse series of scales above the lateral line. Sides with numerous red dots, belly red; pectoral, ventral, and anal with white margins.

Salmo Grayi.

(The Freshwater Herring of Lough Melvin.)

Body compressed, slightly elevated, its greatest depth being one-fourth of the distance of the snout from the end of the middle caudal rays; the length of the head is scarcely more than one-half of the distance of the snout from the vertical from the origin of the dorsal. Head compressed; interorbital space convex, its width being less than twice the diameter of the eye. Jaws of the male of equal length anteriorly; *teeth very small,* four in each intermaxillary, sixteen in the maxillary. Length of the pectoral equal to, or rather more than, that of the head, terminating at no great distance from the ventral. Dorsal rays thirteen or fourteen. 125 transverse series of scales above the lateral line. Sides with scattered light-orange-coloured dots; belly uniform silvery whitish, or with a light-reddish shade; fins blackish.

The typical specimens were taken in the beginning of November, evidently with a net; the state of their sexual organs shows that the spawning commences at that time of the year. It must be very difficult to catch the fishes after the middle of November, partly because they retire into the deeper parts of the lake, and partly because the attempts to set nets are frustrated by the stormy weather of the season. Repeated endeavours to obtain more specimens, made by the Earl of Enniskillen, proved to be unsuccessful. In a letter from Mr. J. Walker, this gentleman mentions that he saw one taken with a fly in the month of August.

The Earl of Enniskillen mentions, in a letter directed to Mr. Thompson, that the "Freshwater Herring" is plentiful in the middle of November. "The people are now taking them in cartloads. The flesh of such as I send is white and soft, and different from what that of Charr is in any other lough." Mr. Thompson* saw the female; and, according to him, it is externally not different from the male. The ovaria contained 959 ova in a specimen 11 inches in length, each being two lines in diameter.

Number of vertebræ sixty, as ascertained by Thompson in a male and a female fish, and by myself in two males.

* Ann. and Mag. Nat. Hist. 1841, vi. p. 443.

MISCELLANEOUS.

On the Hyracotherian Character of the Lower Molars of the supposed Macacus *from the Eocene Sand of Kyson, Suffolk.*

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

GENTLEMEN,—The fossil teeth from the Eocene sand at Kyson, referred by me to a species of *Macacus**, are most probably the lower molars of a species of *Hyracotherium* (*H. cuniculus*). The great difference of shape between the upper and lower molars of *Pliolophus*, and the pattern according to which the lower molars are differentiated in that Hyracotherioid animal, led me to suspect that the degree of difference between the upper molars of *Pliolophus* and those of *Hyracotherium* might be attended with a corresponding degree of difference in the lower molars of the two genera, and that such degree might render the lower molars of *Hyracotherium* as much like the lower molars of *Macacus* as the detached two molars are which were first discovered by Mr. Colchester, and described by me. In the collection of the late Mr. Acton were a series of both upper and lower molars from the Kyson deposits, the upper ones of the *Hyracotherium* type, and the lower ones analogous in their modifications to those in *Pliolophus*, but more resembling the type of *Macacus*, and the same in character as the original molars which I referred, in the volume of the 'Annals' before cited, to *Macacus*.

I am, Gentlemen, yours faithfully,

RICHARD OWEN.

A New British Mygale.

To the Editor of the 'Brighton Gazette.'

SIR,—May I record in your columns the discovery of a Mygale new to the British fauna? The *Atypus Sulzeri*, recorded by Dr. Leach, has hitherto been the only representative of the Mygalidæ in the British fauna; and the new species is the *Dysdera erythrina* of Latreille.

I took it, on the 19th of July last, from a steep, sunny clay-bank, ill-famed for adders, near Brighton. It is a male, and is still alive and active. I took it in a lump of crumbling clay containing the tube and an egg-bag, the mouth of which is stopped with the corslet of a spider of the same species. The falces act horizontally; the eyes are six, placed upon a tubercle, and arranged horse-shoe fashion, with the opening in front. This Mygale climbs up the side of the bottle when he pleases, and rests, back downwards, for hours, on the linen rag covering the mouth of it; and *Dysdera erythrina* is evidently a Mygale built for crawling and struggling through the small cracks and crevices of loose and dry clay-banks, and for seizing and killing his prey with fangs acting horizontally.—JOHN ROBERTSON.

"On Thursday evening," says the 'Brighton Herald' of August 16, 1862, "Mr. Robertson exhibited to the members of this Society [the Brighton and Sussex Natural History Society] a living male specimen of *Dysdera erythrina*, a new species of Mygale."

* Ann. & Mag. Nat. Hist. ser. 1. vol. iv. p. 191 (1840).

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XXIV.—*Contributions to the Natural History of the Infusoria.* By T. W. Engelmann*.

[Plate III.]

The author commences by noticing the rapid progress made, during the last ten years, in respect of our acquaintance with the structure of the Infusoria, and, in particular, the establishment of the fact of sexual reproduction among them. He had the advantage of pursuing his researches under the eye of Prof. Stein, and procured the subjects for them in the neighbourhood of Leipzig.

Stein and Balbiani have both shown that among the Infusoria there is an act of conjugation, and a sexual reproduction consequent thereupon. For instance, they proved that during the conjugation of two individuals, spermatozoa were developed in the substance of the nucleolus, and that in all probability these organisms penetrated the nucleus and gave rise to the formation of germinal corpuscles and embryos. These observations were made on the *Paramecium aurelia* and *P. Bursaria*; and Engelmann is able to confirm their general accuracy. In two conjugated individuals of *Paramecium Bursaria* he observed the nucleolus to be much enlarged, and to constitute two capsules, each filled with rod-like corpuscles; but, though he followed up his examination of such conjugated forms until their separation, and even subsequently, he failed to remark the development of embryonic corpuscles. In one instance, conjugation was extended to three individuals of *Paramecium Bursaria*, in two of which the nucleus was much extended and band-like, whilst in the third it retained its usual oval form. This triple conjugation he wit-

* Abstract, by Dr. Arlidge, from the 'Zeitschrift für wissenschaftliche Zoologie,' vol. xi. part 4 (1861).

nessed in only one other animalcule, viz. in *Vorticella convallaria.* Claparède records the fact in *V. microstoma.*

Engelmann confirms John Müller's discovery of spermatozoa in *Paramecium aurelia,* the nucleus being more or less enlarged and filled with them. When pressed out, they exhibit no independent power of motion. They are not, as usually represented, thin rods equally pointed at both extremities, but have a more bulky anterior and a thinner posterior extremity of greater transparency. Their maximum length is 0·008 of a millimètre. Among specimens of conjugated *Paramecia,* some, evidently only recently united, possessed a nucleus of the usual oval form; in others it was more or less spherical, and presented constrictions at different portions of its surface; whilst in others, again, it consisted of a coil of longer or shorter band-like segments. Among such examples of conjugated forms, he also met with single beings which contained, instead of a nucleus, from two to four larger oval or round bodies, and a number of similar but smaller ones. What had become of the nucleolus in these beings, Engelmann was unable to surmise, nor could he, notwithstanding his best efforts, discover the large seminal capsules recently described by Balbiani. Lastly, individuals were met with having embryonic globules, mostly lying in the posterior half of the animals; and frequently acinetiform embryos were seen to detach themselves from these globules and make their way to the surface through a special wide canal in the parent animalcule.

Engelmann observed conjugation, besides, in *Paramecium ambiguum,* a new species, found in the lake at Eisleben, having the figure of *P. Bursaria,* but colourless like *P. aurelia,* and having a longer bundle of cilia at the posterior extremity.

Instances of conjugation were also encountered in *Paramecium Colpoda* (*Colpidium,* Stein), in several species of *Trichoda, Cyclidium glaucoma, Cinetochilum margaritaceum, Coleps hirtus,* in a small *Prorodon,* in *Nassula aurea, Lacrymaria elegans* (new species), and in *Amphileptus fasciola.* With the exception of the conjugated individuals of the species last named, the union took place at the fore part of the body; so that where the mouth occupied that position, as in *Coleps, Prorodon,* and *Lacrymaria,* the oral apertures were in apposition.

In the case of *Amphileptus,* the animals were united throughout their length, with the exception of the distal ends of their long necks and the contracted posterior extremities. No more advanced phases of development were met with among the conjugated individuals; but, in company with those of *Amphileptus fasciola,* unusually broad specimens were encountered at times, which possessed four nuclear bodies instead of the usual two spherical nuclei. In such instances Engelmann surmises that the act of conjugation has occurred; and he also finds parallel examples in Oxytrichina. The process of conjugation he further noticed partially on one occasion in *Vorticella Convallaria,* in *V. microstoma,* and in *Urocentrum Turbo.*

Stein has figured *Chilodon cucullulus* in conjugation, and Engelmann has witnessed several stages of the process. Among specimens of this animalcule, he met with some having the dorsum of one individual united with the ventral surface of another, and, again, other specimens with the ventral surfaces in apposition and the oral openings closely conjoined. He confirms the existence of rod-like corpuscles in the nucleus of this species, and remarks on some examples where the nucleus had become spherical and contained such corpuscles scattered irregularly within it, and resembling in figure those of *Paramecium aurelia,* but only one-half their length.

Stein observed conjugation in *Aspidisca lynceus* and *A. costata*; to these Engelmann adds *A. turrita,* and states that he has met with examples where the right border of the ventral aspect of one animalcule has overlain the left border of the dorsum of the other. He questions whether this position represents a later stage of development, since, at the first, the left side of the right animalcule is opposed to the right border of the dorsum of the left animalcule, as is seen likewise in Oxytrichina (Pl. III. figs. 4–6). The nucleolus of Aspidiscina, previously overlooked by observers, is stated by Engelmann to be of comparatively large size, and always placed, as in *Euplotes,* more or less close to the middle of the left side of the body, and in intimate contiguity with the horseshoe-shaped nucleus. This last sometimes presents, at no great distance from each of its two extremities, a transverse fissure-like cavity, such as Stein has figured in *Euplotes* and Oxytrichina.

Conjugation was noticed by Ehrenberg in *Euplotes,* but mistaken by him for longitudinal fission. Stein and Balbiani have since studied the process in this genus, arriving at the conclusion that it is an act of sexual reproduction. Commonly the two individuals are united along the left of their ventral aspect (fig. 1); the nucleus is horseshoe-shaped, the nucleolus distinct from it, and eventually divided into two progressively receding segments. The conjugation is limited to the portion of the body anterior to the peristome. Among such conjugated ordinary specimens are others which present a newly-formed adoral fringe of cilia on the posterior half of the ventral surface, and an entirely new system of ventral cilia (fig. 2). These new cilia progressively enlarge in length and width, and become closely set, whilst the old cilia so far disappear that, when conjugation is at an end, only 3–4 of the anterior and a few of the posterior are extant. At the same time two curved longitudinal folds make their appearance, extending backwards or inwards from the newly formed wreath of adoral cilia, constituting the boundary of a new peristome, which proceeds to develope as the old one progressively vanishes along with its surrounding cilia (Pl. III. figs. 2, 3). Even after the separation of two of these peculiarly conjugated animalcules, many of the characteristics of the usual forms of *Euplotes Charon* are deficient, one of the most remarkable of which is the absence of a mouth; for the adoral cilia end at the middle of the area of the peristome, and the two folds indicating this structure coalesce so as to constitute a rib-like elevation ending at the base of the fifth posterior cilium. Moreover the ventral surface is traversed by a distinct fold, not seen or very slightly developed in animals of the ordinary type. The most striking variation, however, in the new being is witnessed in the nucleus, which divides into two portions either before or simultaneously with the commencement of the formation of the new ciliary appendages in the conjugated animals. One segment is anterior, and much larger than the other, and occupies the whole anterior third of the ventral cavity, whilst the other, globular in figure, is thrust backwards and to the left side. The nucleolus undergoes fission yet earlier, and one section of it continues in apposition with each portion of the nucleus. After the separation of the animals a pale discoid body is noticed near the posterior extremity and on the left side, which gradually advances more forward and to the centre, and acquires an increased diameter and transparency, until at length it forms a perfectly clear, somewhat compressed spherical body, filling ofttimes two-thirds of the whole interior of the animalcule, and occupied by an extremely fine, granular, homogeneous substance (fig. 3). Beside or behind this body, a considerable portion of the original nucleus is noticeable, together with a constantly fluctuating number of larger and smaller, strongly refracting (fat?) corpuscles. Two or three days, or thereabouts, after the separation of the two individuals, they are found to have re-assumed the customary form and structure of the species, including the peristome, mouth, and the original horseshoe-shaped nucleus.

The question suggests itself, What is the origin of the large transparent globule in the interior, and what purpose does it serve? To this question Engelmann is at present unable to give a decisive answer. He is in doubt whether this corpuscle originates from the posterior half of the nucleus after its fission, or whether it takes its rise prior to the detachment of the conjugated animals, as an independent formation from the nucleus. The latter assumption derives support from the circumstance that, in two conjugated individuals on the point of separating, there existed, besides the two detached halves of the nucleus, a clear, delicate, and sharply defined globular body in the posterior half of each animal. Nevertheless Engelmann did not see this structure in a large number of other specimens at the same stage of conjugation.

In the course of the further development of the bodies in question, they break up, after attaining their maximum distention, into several (mostly from two to three) spherical segments of nearly equal or of different dimensions. The further history of these corpuscles is unknown, though the idea may be hazarded that they are concerned in the formation of germinal corpuscles. But whether these last, when formed, are further developed into embryos within the parent beings is questionable; on the other hand, Engelmann traced the re-assumption by a conjugated pair of the ordinary characters of *Euplotes Charon* without seeing any embryonic development take place. But, further, it is possible that the germinal corpuscles of *Euplotes* may not, as in Vorticellina, attain their maturity within the parent, but may do so externally to it. In this opinion Balbiani seems to concur.

Engelmann has observed two entirely different forms of conjugation in *Stylonychia pustulata* and in *S. histrio.* In one variety, two originally independent individuals so completely coalesce that in the end the resultant being is undistinguishable from any ordinary example of the species. In the other form, the conjugation is limited in its results to the formation of a new ciliary apparatus on the anterior portions of the conjoined animals, which gradually replaces the old one; after this is accomplished, separation takes place. This latter form has been already noticed in the case of *Euplotes.*

The act of conjugation in *Stylonychia pustulata* (Pl. III. fig. 4) commences by the adhesion of the two animals by their adoral wreaths and strong frontal uncini, so that the left anterior extremity of one is overlapped by the right of the other. Soon a band of union, composed of the substance of the body, unites the two, and gradually increases in width, the bristles and uncini, together with the adoral cilia, disappearing in the meantime in the case of the left individual. Within a short time, the bodies of the two beings have so coalesced that they have an anterior extremity in common, and a divided body posteriorly; but even this latter indication of their original duality gradually vanishes, until at length the two have become as one being, undistinguishable from an ordinary species of *Stylonychia pustulata,* except perhaps that it is commonly broader. In this process the four nuclei have also coalesced into two. This act of complete coalescence is accomplished in from twelve to fourteen hours. On watching the subsequent history of the compound being, it is found to commence division after from six to ten hours' union; and this unloosing is at length completed, the resultant individuals differing in no perceptible features from the ordinary specimens of the species; and, as far as Engelmann could make out, all this marvellous process stood in no relation whatever with sexual reproduction.

The second variety of conjugation has already been described by Stein in *Stylonychia pustulata* and *S. histrio*. In a not uncommon form of this partial conjugation, the two individuals are found united only by their anterior extremities, and a reproduction of the ciliary apparatus of the ventral surface is seen to proceed (Pl. III. fig. 5). This continues to extend itself, and the adoral wreath of cilia especially stretches forward, whilst the old adoral and frontal cilia become absorbed (fig. 6). The act of fission extends from behind forwards, until the separation is complete (fig. 7). All this is effected in such a way that the individual on the right side retains the residue of the old frontal region with its three largest bristles and the remnants of the old adoral ciliary wreath; but these original parts themselves vanish in another fifteen minutes. The nucleus has in the meantime undergone various changes, and generally appears broken up into several spherical segments. The beings resulting from these metamorphoses resemble those of *Euplotes Charon* in being destitute of a mouth and peristome, and in giving origin to those peculiar corpuscles, having a large transparent central body, which are always found in company with the conjugated forms of *Stylonychia pustulata*. Engelmann followed up the observation of some such specimens, and found that, after a while, they resumed the characters of the species, and proceeded to undergo fission, or else, as in the case of some, they underwent the peculiar process of encysting.

Stylonychia histrio exhibits, in all essential particulars, the same two forms of conjugation.

Once, among various examples of *Stylonychia histrio* in conjugation, Engelmann met with an animalcule of the same species, which exhibited, in the place of the nucleus, three large, clear, discoid bodies, of which one possessed a central granular and circular nucleus (Pl. III. fig. 8). After rather more than an hour, two of these bodies began to coalesce, so that, three hours afterwards, the interior of the animal presented one much larger discoid body, and behind this a smaller one; but, twenty minutes later, this last also first adhered and then ultimately united with the other, so that in the end the individual presented a single large spherical body having a granular central nucleus. The further history of this animalcule could not be traced, as it was lost to observation by death.

To Stein's account of the conjugation of *Stylonychia Mytilus* Engelmann adds that in one instance two individuals were coherent by their posterior extremities, and that the two varieties of conjugation noticed in the other species above described occur likewise in this one.

The embryonic development observed by Stein also fell under the notice of Engelmann. In 1859 he found specimens containing embryonic corpuscles; but it was not until the autumn of 1861 that he met with examples which illustrated a further phase in their history. These latter were individuals of medium size, and mostly contained but one large embryonic globule, placed between the two nuclei, close behind the angle of the oral aperture. Placed over it, on the ventral aspect of the animal, there always existed an elliptic or rounded opening, of variable size, which was the outlet for the escape of the mature ovum. On one occasion only was an elongated and rounded dorsal aperture found, in addition to the abdominal foramen just named, and serving, like it, for the escape of the embryos. The act of birth was several times witnessed: sometimes the embryonic globules escaped as such, at others they developed tentacles and assumed the acinetiform figure as usually described. The subsequent history of the embryos is unknown to Engelmann; however, he does not believe in their immediate transition to the ordinary form of *Stylonychia*; for the smallest examples of the species are more than ten times the length of the largest embryos, and he is therefore disposed to accede to Stein's view, that an "alternation of generation" takes place.

Engelmann protests strongly against the doctrine recently promulgated by Balbiani, that the acinetiform beings seen to emerge from the interior of various Infusoria, and generally held to be their embryos, are nothing less than parasitic Acinetæ (*Sphærophrya* of Claparède), which have previously made their way into them. If this were the case, it would be difficult to explain why the Acineta should always penetrate *Stylonychia Mytilus*, for example, at the same spot; for the oviduct is constant in position, and the integument of the animalcule of considerable firmness, particularly at the part perforated. Balbiani indeed figures a *Stylonychia Mytilus* with three dorsal apertures; but such a specimen Engelmann has never encountered, in more than a hundred individuals examined by him containing embryonic corpuscles. Is it likely that a parasite should always penetrate at one spot in *Stylonychia Mytilus*, whilst in other Infusoria, as, for example, in *Paramecium aurelia* and *Urostyla grandis*, which have several oviducts, it should pierce at several points? Why, again, should the supposed parasite bore its way into some species, whilst in others, even those closely allied (as

Stylonychia histrio), it should never be known to enter? It is moreover very doubtful if such beings as the acinetiform embryos of *Stylonychia* or of *Paramecium* are so organized as to be able to penetrate their bodies from without. Their structure, indeed, teaches to the contrary; for their soft, weak tentacula are not calculated to penetrate the resistant cuticle of *Stylonychia* or the thick wall of *Paramecium* with its contained acicular bodies (trichocysts or thread-cells of Allman), and to hollow out a wide canal such as we meet with in those Infusoria. On the other hand, there are direct observations opposed to this hypothesis. Thus, Engelmann recounts several instances in which small Acinetæ have affixed themselves to Infusoria and withdrawn their contents by the agency of their tentacula, but have in no degree bored through their integuments. Again, the uniformity always met with in the structure and contents of the embryonic globules is remarkable. In these particulars they exactly resemble those of Vorticellina, the non-parasitic character of which is unquestioned. On the contrary, the substance of the smallest Acinetæ is dissimilar; for this, instead of being clear, homogeneous, and destitute of granules, is highly granular, cloudy, and occupied or discoloured with absorbed nutritive material. Lastly, the circumstance is to be noted that the animalcules with which such acinetiform beings are connected, are actually at the time concerned in the development of germs; and the rule is, as Stein pointed out, that acinetiform embryos are found in most or in all the examples of a species existing in the same fluid—a fact which also holds good with respect to the phenomenon of conjugation. If due weight be allowed to these various considerations, the opinion that the acinetiform beings in question are really extraneous parasitic Acinetæ cannot with propriety be maintained.

Stein was the first to collect facts relative to the development of the embryonic corpuscles of *Stylonychia Mytilus*, by showing the conditions and changes of the nuclei and of the nucleoli. Among numerous examples of individual animalcules containing several embryonic corpuscles, only a few presented the two normal nuclei, with either no nucleolus at all, or a single one. In by far the greater number, the nuclei were replaced by three or four, rarely six, oval or sometimes round bodies, and from two to four nucleoli of larger size than in the ordinary specimens of the species (Pl. III. fig. 9). Sometimes three or four nuclear bodies were present but no nucleolus. The nature of two of these spherical or oval bodies having the widest dimensions is in all probability that of nuclei, whilst the rest may be considered embryonic corpuscles. These last do not seem always to originate in the same fashion: thus, in some cases, the nucleus is seen to break up into several segments, of which two retain the nuclear character, whilst the rest become perfectly homogeneous and exhibit no nuclei in their interior. In other examples a few nuclear-looking structures take their rise within the substance of the nucleus, at the enlarged end of the elongated and sometimes ramified nucleus. According to Engelmann's observations, the germinal corpuscle arises by a constriction of a portion of the enlarged nucleus, which proceeds to complete separation, and contains within itself a nuclear particle; for he has never been able to discover such a body lying within a special cavity of the nucleus. Moreover those spherical corpuscles which differ from germinal bodies only by the absence of nuclei within them, and which appear to originate by repeated fission of the original nucleus, eventually become germinal and embryonic corpuscles. Lastly, these embryonic bodies undergo repeated fission, and are ultimately transformed into embryos.

A very remarkable phenomenon was noted by Engelmann in very many specimens of *Stylonychia Mytilus* containing embryonic corpuscles, viz. that, in addition to these bodies, there were also present in them several (often as many as four) examples of the beautiful cysts of *Podophrya fixa,* which have been described by Weisse under the name of *Orcula.* Among other specimens of the same animalcule the same observer also met with some which, instead of two nuclei, possessed two large clear spherical bodies. In one of these animals, each globule presented a nucleus with an irregular outline, giving off from its periphery several delicate processes like those of *Amœbæ* and other Rhizopods. Three hours later, these nuclei had acquired a clustered outline, and had evidently broken up into a multitude of sharply defined, rounded particles, still retained in relation with the periphery of the enclosing corpuscle by fine filiform processes. Seven hours afterwards this specimen was unfortunately destroyed by the evaporation of the water around it.

In some other Oxytrichina, Engelmann finds similar conditions of conjugation as in the *Stylonychiæ* quoted, and among others in *Pleurotricha lanceolata.* Another phenomenon noticed by him in the animalcule just named is that of encysting. The resulting cysts are precisely like those of *Stylonychia Mytilus* in appearance, but of much greater size. Conjugation was also investigated by him in *Oxytricha pellionella,* in *O. ferruginea,* and in *O. parallela*—the last-named a new species.

To sum up the foregoing observations:—Two forms of conjugation occur in the class of Infusoria, but only one of these appears to be connected with the process of reproduction. The first form consists in the complete coalescence of two previously distinct individuals into one being. Though hitherto noticed only in some of the Oxytrichina, its occurrence is rendered probable, by Claparede's researches, in *Vorticella microstoma, Carchesium polypinum, Epistylis brevipes,* and in several Acinetina. All that can be predicated with certainty respecting this variety of conjugation is, that it has no direct relation to the process of reproduction, but appears analogous to the coalescence observed between individuals of the class of Rhizopods, particularly those of the genus *Actinophrys.*

The second form of conjugation proceeds by means of a union of a portion of the bodies only of two individuals, as a rule, of their anterior parts, in the region of the mouth; it persists several days, and then the animalcules once more separate. When separation has occurred, the two beings are found changed in various ways, both externally and internally, from their original characters, although, after the lapse of some days more, those primitive features are resumed. This statement holds good, at least, with respect to the Oxytrichina and Euplotina. But in the case of the *Paramecia* and *Colpidia,* and other holotrichous Infusoria, whose organization differs widely from that of the other two families named, the recently conjugated individuals differ very little or scarcely in any perceptible degree in external characters from the normal form. The purpose served by this second mode of conjugation, as particularly illustrated in the *Paramecia,* stands in immediate relation with the process of sexual reproduction. Another conclusion arrived at from the study of the conjugation process is, that in no species of Infusoria do longitudinal and transverse fission occur together, but every species multiplies either by one form or by the other alone.

It will not be uninteresting to append some observations respecting the nucleolus. Siebold seems to have been the first to notice this organ, in *Paramecium Bursaria.* The researches of Stein and Balbiani, however, have so added to the number of instances of its occurrence, that from thirty to forty may be enumerated. To these Engelmann is able to add a dozen other examples in other species. In *Glaucoma scintillans* the nucleolus occurs as a small round corpuscle lodged in a hemispherical cavity in the round nucleus. In *Frontaria leucas* three nucleoli of tolerable size may be brought into view, particularly after the application of water or acetic acid, adherent to the oval elongated nucleus. In *Trachelophyllum apiculatum* two comparatively large nucleoli are lodged, one in a hollow at each extremity of each of the two oval nuclei. *Conchophthirus anodontæ* (Pl. III. fig. 15) and *C. curtus* have one or two nucleoli lying close to or upon their oval nucleus. A nucleolus also occurs in *Aspidisca lynceus, A. turrita,* and *A. costata. Vorticella Convallaria* and *Epistylis flavicans* likewise possess a tolerably large nucleolus, usually situated on the concave side of their elongated nucleus. In several new forms described by Engelmann this same organ is found, viz., in *Drepanostoma striatum, Chasmatostoma reniforme, Lacrymaria elegans*; some new Oxytrichina, as *Pleurotrocha setifera, Gastrostyla Steinii, Uroleptus fragilis, Oxytricha strenua,* and *O. parallela.* With less certainty he refers to a nucleolus in *Opercularia coarctata, Zoothamnium Aselli, Urocentrum Turbo,* and in some other well-known Infusoria. On the other hand, he has convinced himself of its presence in all the Oxytrichina known to him, in *Euplotes,* in *Chilodon cucullulus, Nassula aurea, Prorodon teres, Lacrymaria olor, Panophrys flava* (=*Bursaria flava,* Ehr.), *Colpidium,* Stein (=*Paramecium colpoda*), *Balantidium entozoon, Paramecium Bursaria,* and *P. aurelia, Entodinium bursa* and *E. caudatum, Carchesium polypinum* and *Epistylis digitalis.* All Engelmann's attempts to find a nucleolus in *Epistylis plicatilis* have failed; and he is unable to confirm the existence of one in *Blepharisma lateritia,* although Balbiani has described it. Nevertheless in one specimen of the species last named he noticed a large sac, placed in front of the nucleus, filled with rigid, motionless, acicular bodies resembling, both before and after the addition of acetic acid, the spermatozoa of *Paramecium aurelia.* He found also other specimens of the same animalcule in which the nucleus was broken up into five or six spherical segments, of homogeneous consistence—an appearance Stein has also noted and figured.

In one and the same species, among several of the Infusoria, the nucleoli vary in number. A remarkable instance of this fact occurs in *Stylonychia Mytilus,* in which from two to four nucleoli are present. In *Urostyla Weissei* from two to eight occur; and *Stylonychia histrio* has at one time two, at another four nucleoli.

The purpose of the slit-like openings in the nucleus, as observed by Stein in Oxytrichina and in *Aspidisca,* is not determined. One supposition is, that they may serve an important end in sexual reproduction by giving passage to the spermatozoa. They are usually arranged quite symmetrically, and are approximated towards each other, or placed at opposite extremities of the nucleus. Anomalies, however, occur at times.

Engelmann remarks on a slit-like aperture in the area of the peristome of *Onychodromus,* lying obliquely across the direction of the anterior nucleus, and recalls, in connexion with this observation, the presence of a crescentic line described by Stein and Balbiani as dividing the peristome of *Stylonychia Mytilus* into an anterior and a posterior segment. Balbiani has further remarked the like structure in *Trachelius ovum,* and imagines that these slits may be structurally connected with the reproductive organs—an opinion Engelmann considers not improbable, although he is unable to adduce any facts in confirmation of it.

Engelmann, moreover, has been able to follow out the researches of Stein, Claparède, and Lachmann relative to the history of development in various hypotrichous and peritrichous Infusoria. In *Epistylis plicatilis* he met with those buds from the base, noticed by Stein, and called by Claparède *Urnulæ* (Pl. III. fig. 10), remarkable for their acinetiform development. They spring from the *Epistylis* at its junction with the pedicle, exhibit a rigid and more dwarfed outline than do the ordinary gemmæ, which, on the contrary, elongate themselves, and take on the ordinary characters of their parent. Engelmann witnessed the transverse division of these Urnulæ, but was unable to detect their further development in this species of *Epistylis*.

The same kind of organism is produced from the *Epistylis crassicollis*. The rounded, sharply defined body of the Urnula is enclosed in an oval, firm, and colourless sheath (Pl. III. fig. 10) having a tapering posterior extremity, and terminated anteriorly by a triangular aperture of moderate dimensions, through which the animalcule protrudes a single moveable tentacle, or, rarely, two such organs. In the interior of the animal a granular nucleus and one or more contractile vesicles are discernible. A transverse constriction followed by fission proceeds, and the anterior uniformly ciliated segment quits the sheath. The Urnula has a very close resemblance to *Acineta mystacina*, differing from it in no other respect than in the figure of its sheath and in its primitive position. Claparède assumed it to be a member of the family Rhizopoda, especially as he observed its tentacles ramify. This circumstance is not deemed by Engelmann of sufficient moment to induce its transfer to such a wholly different class of animals from that with which in all other respects it seems related. For, he asks, what Rhizopod has a sheath like *Urnula*, or what Rhizopods can employ their pseudopodia as sucking-tubules? or which of them, again, can multiply themselves by means of ciliated fission-products, as the Urnula can do? But in all these peculiarities the Urnula coincides with the true Acinetæ; whereas, if it were considered one of the Rhizopoda, it would be difficult to determine the boundary-line between this class and that of the Infusoria (Ciliata). The amphileptoid cysts, first described by Claparède and afterwards by Stein and Udekem in various Vorticellina, were seen by Engelmann also in *Epistylis plicatilis*. The *Amphileptus* underwent fission within the cyst before leaving it.

Similar Urnulæ and amphileptoid cysts were encountered in *Epistylis crassicollis*. In *E. flavicans*, which has a distinct oval nucleus, the preliminary stage in the formation of germinal corpuscles was observed taking place in the nucleus, and ending in the production either of a very large number of small ones closely packed and having a central vesicle, or else of a smaller number imbedded within the substance of the nucleus. At the same time, one, or, seldom, several elongated sharply outlined bodies, having clear vesicles internally, were visible in the nucleus; and these after a while broke up into many smaller segments. Within other nuclei one or more extended, sharply defined, homogeneous masses, of firmer consistence than the nuclei themselves, were detected, but no spherical corpuscles.

The somewhat reniform corpuscles remarked by Claparède scattered in pairs through the parenchyma of *Epistylis flavicans* appear to be peculiar to this animalcule. They strongly refract light, and vary much in number, sometimes are absent altogether. Their purpose is obscure.

In *Carchesium polypinum* Engelmann observed the origin of germs and embryonic corpuscles several times in May and October 1860. Usually only one globular germ appeared at a time, close under the integument of the anterior portion of the body, distinguishable by its clear homogeneous substance and its very large central nucleus. At one point in its periphery a hollow space, slowly changeable in its dimensions (a contractile vesicle), was also perceptible. The nucleus of the parent animal was always present unchanged in appearance.

In June 1860, Engelmann met with a specimen of *Carchesium polypinum* having a thick bud-like outgrowth from near its stem, gently tapering in front, with a circular opening at its apex. In its interior were several rather large, strongly refracting corpuscles, of an oval figure, not dissimilar to germinal corpuscles. In course of time this process collapsed, and hung like a flabby sac from the *Carchesium*. Stein has recorded a similar formation in *Vorticella nebulifera*.

But it was in the *Carchesium Aselli*, a new species discovered by himself, that Engelmann was enabled more fully to explore the phenomena of embryonic development. On the 1st of April, 1860, he met with a full-grown dead specimen of this species, containing a large spherical homogeneous body, 0·042 millimètre in diameter, possessing a round nucleus of considerable magnitude. Contiguous to it lay the smaller, curved, horseshoe-shaped nucleus of the animalcule. On the following day, he saw eight examples, each containing one such embryonic globule, which lay close beneath the peristome. A slowly contractile vesicle existed on the surface of each; and, by the addition of acetic acid, an opake distinctly defined nucleus was brought into view. The nucleus of the parent being could not in all cases be distinguished. In company with these forms were others, belonging evidently to a later phase of development. Thus the large circular nucleus of the embryonic body was subdivided into two oval segments, which, on the addition of acetic acid, were seen to be enclosed within the common transparent capsule of the embryonic corpuscle (Pl. III. fig. 12). One or two similar oval bodies are sometimes found in addition within the parenchyma of the animalcule; and occasionally the nucleus of the *Carchesium* is not discoverable. It also at times happens that an outgrowth or protuberance appears on the surface of the animalcule, either about its middle or at its anterior part; but these conical tapering swellings exhibit no distinct aperture, though possibly one may eventually make its appearance. In these prominences an embryonic corpuscle was several times seen; nevertheless it is doubtful whether the embryos make their exit through them, for Engelmann observed their escape through a fissure near the peristome (fig. 11). The escaped embryo is oval, very small, and furnished with two zones of long cilia in front, by means of which it swims about in an impetuous manner. Internally it presents a contractile space and a rounded nucleus (fig. 11*a*). From these observations Engelmann concludes it to be probable that one or several embryos are derived from the nucleus of the original embryonic corpuscle, which advance in growth at the expense of the matter contained within the corpuscle, and after a time effect their escape through its surrounding wall, and lastly through the coats of the parent animal by means of a special foramen. This interpretation coincides with the observations recorded by Claparède respecting the formation of embryos in the *Epistylis plicatilis.*

Engelmann has met with but few examples to illustrate the development of embryonic corpuscles from the nucleus of the parent animal. In one instance where there was a large embryonic body, the reduced nucleus presented several nuclear structures. In another animal which had no such large corpuscle, the nucleus was likewise reduced in size, and in contact with it were six small spherical corpuscles having a central vesicle. In a third example, along with a large embryonic body there were five rounded corpuscles, each with a central vesicle, apparently derived from a breaking-up of the nucleus, but differing materially in size among themselves. These were probably produced after the first embryonic corpuscle had developed its embryo, and a series of such corpuscles were prepared for successive elaboration into embryos.

In the production of embryonic corpuscles another phenomenon is presented in the case of *Carchesium Aselli*, corresponding with that seen by Stein in *Vorticella nebulifera.* This consists in the outgrowth of more or fewer large convex processes from the body of animals found in company with others bearing the embryonic corpuscles. These protuberances are mostly situated on the posterior half of the body, and contain a considerable number of small spherical refracting corpuscles, similar, indeed, to others collected in large numbers within the parenchyma of the parent animalcule. They are evidently the products of a fission-process in the nucleus, some very slight remnants of which are only now and then perceptible. In one instance these same corpuscles were noticed, though no outgrowths existed. The purpose of such products is still a question. Stein has supposed them to be connected with the origin of the fertilizing elements.

In *Carchesium Aselli* Engelmann further observed that peculiar condition in which the disk of the peristome assumes a spherical figure and projects from the strongly contracted animalcule (Pl. III. fig. 13) very much like a yet adherent embryo, but from which it is distinguished by its want of a nucleus and its absence of independent locomotion. If torn from the animal, it does not lose its cilia for some time, though it never swims far with them, but settles down to the bottom of the water, and soon lies motionless there.

The small corpuscles derived from a breaking-up of the nucleus have been seen also in *Zoothamnium affine.* The processes containing them are of very large size, and either of an elliptic elongated figure or conical and thick, surrounded by a short tubular-looking process, having a distinct aperture at its summit (fig. 14). The corpuscles themselves varied in size, but never exceeded 0·005 mill.

The extrusion of embryonic corpuscles was noticed in *Vorticella Convallaria.* Usually, as in *Carchesium polypinum,* only one such corpuscle, of considerable size, having an opake nucleus, was present.

The development of germinal corpuscles in *Didinium nasutum* (Stein) is interesting. This remarkable animalcule ordinarily presents a horseshoe-shaped nucleus, but no nucleolus; but in October 1860, Engelmann encountered very many specimens in which the nucleus enclosed numerous small spherical corpuscles having a central vesicle in their interior. Among these were several (four to six) considerably larger globular bodies, containing each a distinct nucleus. In other individuals the nucleus was seen divided into several more or less globular segments, lying close together, furnished severally with a nucleus, though still enclosed within the membrane of the parent nucleus. These structures assuredly represent the early phases in the formation of germinal and embryonic bodies. During the transverse fission of *Didinium,* the nucleus becomes much elongated, and then appears striped longitudinally; but on the completion of fission the longitudinal striæ disappear.

In the group of Acinetina, development by internally produced embryos has been demonstrated by Stein and Claparède in almost all the species known. Engelmann remarks that he has seen the embryos of *Acineta opercularioæ, A. quadripartita, A. Astaci,* and *A. infusionum.* In the last-named species and in *A. quadripartita,* Engelmann further observed the reverting of the ciliated embryos to Acinetæ; and he remarks that the embryos of Acinetæ known to him are distinguished from those of ciliated Infusoria (e. g. *Stylonychia Mytilus, Paramecium aurelia, Epistylis plicatilis,* &c.) by the remarkable circumstance that their entire body is not, as in those of the latter animalcules, devoid of granules, and transparent, but filled with the same nutritive materials as occur in the parent beings. For example, the embryos of *Acineta quadripartita* and of *A. infusionum* are so filled with the fat-globules and other nutritive matters derived from the parent animals, that it is difficult to discover their nucleus and contractile sac. Indeed, this single circumstance renders it highly improbable that the entire Acineta-embryo can be derived solely from the substance of the parent nucleus. This last is certainly frequently seen broken up into numerous coarse granules, but only a small portion at most of the frequently extremely large and opake embryo can be derived from them; on the contrary, it is much more probable that only their nuclear portion arises from the nucleus of their parent, the rest of their large body being derived directly from the contents of the parent Acineta. Stein, in fact, has heretofore intimated the same. Thus in *Acineta infusionum* he describes the nucleus as giving off from its middle, at right angles to itself, a process, of a bud-like form, which presently becomes surrounded by a clearer ring of tissue derived from the substance of the parent being. Engelmann observed precisely the same thing take place in a large specimen of *Acineta quadripartita.*

The origin of the offspring of Acinetina by sexual reproduction is highly improbable, and has no support from observation. It is probably an act of internal gemmation. It is only in *Acineta mystacina, Urnula epistylidis,* and *Podophrya fixa* that the production of these internal germs has been unnoticed; and as far as our knowledge at present extends, these three species multiply only by simple fission. But even in other Acinetina the internal production of germs is not an act of embryonic reproduction, but simply one of fission.

A second variety of reproduction, however, does occur among the Acinetina, as first noticed by Claparède in *Acineta quadripartita* and *A. cucullulus.* This consists in the breaking-up of the nucleus into several spheroidal segments, from which a still larger number of small ciliated germs derive their origin, distinguishable in no respect from the embryos of *Epistylis plicatilis.* Claparède represents this offspring so derived as similar to the usual form of Acineta-germs: but with this view Engelmann cannot agree; for he maintains that both the mode of origin and the nature of the mature germs so derived differ altogether from those of the usual offspring of *Acinetæ.* Thus it is a circumstance of much weight that these little Acineta-embryos derive their substance entirely from the nucleus, and receive no addition from the parenchyma of the parent animalcule. Again, they exhibit this peculiarity in their formation in common with the embryos of ciliated Infusoria, as, for instance, with those of Vorticellina; and if their external resemblance to these latter be also considered, we must admit the existence of a remarkable similarity between the embryonic development of Ciliata and that form of the reproduction of *Acinetæ* by these remarkable little germs. This being granted, it has an important bearing upon Stein's celebrated hypothesis of Acinetiform development of Infusoria. To show, for example, that the little Acineta-products in question are true embryos developed by a sexual reproductive act, is to overturn the Acineta-theory. On the other hand, if, as is possible, and as the completely similar organization of the little offspring of *Acineta quadripartita* to the embryos of *Epistylis plicatilis* intimates, this method of development has a special character, and is concerned in a transformation of the *Acinetæ* back again into ciliated Infusoria, then the Acineta-theory becomes established. Future researches must decide this difficult problem.

As an appendix to his general remarks on the organization and reproduction of Infusoria, Engelmann appends a systematic history of several new genera and species he has discovered. The new genera named and described are *Chasmatostoma, Microthorax, Drepanostoma, Gastrostyla,* and *Astylozoon;* and the new species of previously described genera are *Lacrymaria elegans, Conchophthirus* (Pl. III. fig. 15) *curtus, Pleurotricha setifera, Uroleptus mobilis, U. agilis, Oxytricha strenua, O. parallela, Carchesium Aselli,* and *Epistylis nympharum.*

The new genera are thus severally characterized:—

Chasmatostoma. Pl. III. fig. 16.

Figure constant, reniform, somewhat compressed, uniformly ciliated. A small oval oral aperture, having an undulating membrane affixed within it, occupies the middle of the flat ventral surface.

Chasmatostoma reniforme (Pl. III. fig. 16)

has probably been often confounded with *Colpoda cucullulus* and similar Ciliata. Anteriorly the reniform body rather tapers, but posteriorly it is obtusely rounded-off. A short œsophagus extends inwards and to the right side from the oval mouth, which is further furnished along its right side within its margin with an actively undulating fine membrane. Sometimes a second smaller membrane of the same kind is imperfectly seen on the left side. The nucleus is circular, placed in the median line in the posterior half of the body, and having a clearly defined round nucleolus occupying a hollow on its surface. The contractile vesicle is situated at the posterior extremity, and in its contraction acquires a stellate figure. It swims actively, mostly in a circuitous direction, by means of its uniform cilia, usually with its ventral surface downwards. Fission not observed. Size 0·06 millimètre.

MICROTHORAX. Pl. III. figs. 17, 18, 19.

Body loricated, compressed, oval, widely rounded posteriorly, uniformly ciliated. Mouth placed within the concavity of a rounded peristome situated in the left half of the body, and close to the posterior extremity. Nucleus and contractile sac single.

M. pusillus. Pl. III. fig. 17.

One of the smallest holotrichous Infusoria. It often occurs in large numbers together and in company with small Chilodons, with *Cyclidium glaucoma, Cinetochilum margaritaceum,* and *Pleurochilidium strigilatum,* and it is most closely allied to the two last-named animalcules. The left border of the rigid body is straight, whilst the right is convex. The peristome-depression is on the right side, and has an active valvular membrane within it. The right margin of the body is much thickened; and along the ventral aspect are two furrows, commencing from the anterior extremity, on the left side, and traceable to the middle of the body. The dorsal surface is not striated, but bears cilia. The round nucleus is central; the contractile vesicle near to and above the peristome, on its right side. Individuals colourless, their largest dimensions only 0·032 mill. Movements active; swims on the ventral aspect.

M. sulcatus. Pl. III. figs. 18, 19.

Much larger than the preceding, but of the same form. Along the dorsum are three deep longitudinal furrows; and the ventral sulci extend to the hinder border. The contractile vesicle is on the left side, and immediately above the peristome. Swims actively, on its ventral aspect. Size 0·057 mill.

Drepanostoma.

Figure of body constant, but flexible, elongated, tapering gently in front and behind; ventral aspect flat, dorsal convex; the whole undersurface traversed by longitudinal striæ, with cilia of uniform length. The dorsum is smooth, but bears along each margin a row of bristly cilia. Mouth placed beneath a crescentic horny band not far from the anterior extremity, and close to the left margin of the body. Nuclei two, each with a nucleolus; no sharply circumscribed contractile space.

D. striatum,

the only species yet determined, is allied on the one side with hypotrichous Ciliata, such as *Chilodon,* and, on the other, with holotrichous *Amphilepti.* On account of the cilia being limited to the ventral surface, it must be placed among the hypotrichous Infusoria. The anal outlet is on the dorsal surface, not far from the posterior extremity. The body is from 4 to 5 times as long as broad, and somewhat pointed at its two ends. Fission not observed. Size from 0·185 to 0·25 mill.

Gastrostyla.

Figure constant; body loricated, elliptic, contracted anteriorly, and more or less obtusely rounded posteriorly. Five or six strong unciform setæ are situated on the anterior extremity, and a row of bristly cilia stretches obliquely across the ventral surface as far as the four or five strong cilia about the anal orifice, beyond which only a few extend to the posterior border. The two rows of marginal cilia increase in dimensions posteriorly, and overlap no setæ at the posterior extremity. Nuclei four.

G. Steinii

was noticed in January 1860, and belongs to the larger forms of Oxytrichina. It is two and a half times as long as broad. The frontal region is surmounted by a semilunar labium. The peristome is small in diameter; on its inner margin a strong undulating membrane is attached. The oblique row of setæ, stretching from the first adoral cilia in a gently curved line to the five or six strong cilia about the anal outlet, is a characteristic feature of the genus. Three stout uncinate setæ are inserted on the frontal region, and anteriorly to the oblique row of cilia are two other such setæ, and behind the angle of the mouth from one to three powerful cilia. A remarkable feature in this species, as in *Onychodromus,* is the existence of four nuclei, each with its nucleolus, situated in a line one behind the other. Movements rapid, not long in one direction. Fission proceeds as in *Stylonychia Mytilus.* The four nuclei coalesce into one large body, which by and by breaks up into eight segments, from each of which four germs proceed. The segments so subdividing generally present about their centre a fissure-like fold, recalling what happens in the nucleus of *Aspidisca*, *Euplotes*, and Oxytrichina under like circumstances. On the water around the *Gastrostyla* drying up, the animal readily encysts itself, the cysts resembling those of *Stylonychia Mytilus*, but rather more indented on their surface.

In company with *Gastrostyla* and *Cyclidium glaucoma*, some small circular *Acinetæ* were sometimes met with, resembling the embryos of *Stylonychia Mytilus*, and not improbably embryos of the Gastrostyle itself. This, however, is uncertain, as specimens of this animalcule were discovered with embryonic corpuscles. Size 0·15 to 0·32 mill.

Astylozoon. Pl. III. fig. 20.

Body contractile, unstalked, campanulate, with an acutely pointed posterior extremity having a curve backwards. Surface smooth. Rotary organ extrusile, furnished with a spiral ciliary wreath. Peristome swollen, thickened. Posterior extremity terminated by one or two long locomotive setæ. Nucleus short, reniform.

A. fallax. Pl. III. fig. 20.

The only species known. At first sight, it looks like a detached *Vorticella microstoma*, but differs from it by its curved posterior pointed extremity, its rotary organ becoming wider behind obliquely, its small reniform nucleus, and its terminal locomotive setæ, whereby it can execute movements not effected by any detached *Vorticellæ*. It is frequently encysted. Size 0·1 mill. Size of cysts 0·038 to 0·05 mill.

EXPLANATION OF PLATE III.

Fig. 1. *Euplotes Charon*, in process of conjugation.

Fig. 2. The same animalcule at a later stage of conjugation: the new system of cilia is further developed, and the two beings are in course of separation.

Fig. 3. The globular vesicle developed internally has attained about its maximum growth.

Fig. 4. *Stylonychia pustulata*, in conjugation. The anterior extremities of the two animals connected by an intermediate band.

Fig. 5. The same, in conjugation according to a second variety of that process. The two beings, united most of their length, have begun the development of a new series of cilia.

Fig. 6. The same animalcules two hours later.

Fig. 7. One of the animalcules after the termination of conjugation and separation, twenty minutes after the stage shown in fig. 6.

Fig. 8. *Stylonychia histrio,* a peculiar phase of; the three globular vesicles subsequently coalesced into one large one, containing numerous granules.

Fig. 9. *Stylonychia Mytilus,* showing the formation of embryos and the development of germinal globules.

Fig. 10. *Urnula Epistylidis,* growing on the stem of *Epistylis plicatilis.*

Fig. 11. *Carchesium Aselli,* with a large embryonic vesicle: *a,* a detached embryo.

Fig. 12. Development of embryos within embryonic vesicles in the same animalcule.

Fig. 13. *Carchesium Aselli* strongly contracted, and with its ciliary disk elongated and circumscribed by a constriction, making it resemble an independent germ in course of growth.

Fig. 14. *Zoothamnium affine.* The nucleus has broken up into numerous minute globular corpuscles, collected within an outgrowth from its side, terminated by an aperture.

Fig. 15. *Conchophthirus Anodontæ* (Stein).

Fig. 16. *Chasmatostoma reniforme.*

Fig. 17. *Microthorax pusillus,* ventral aspect.

Fig. 18. *Microthorax sulcatus,* ventral aspect.

Fig. 19. The same, dorsal aspect.

Fig. 20. *Astylozoon fallax.*

XXV.—*Descriptions of a new Genus and some new Species of Naked Mollusca.* By Joshua Alder and Albany Hancock, F.L.S.

The following species of Nudibranchiate Mollusca have recently come under our notice, mostly through the kindness of our friends, to whom our thanks are due for the liberal manner in which they have communicated to us all specimens met with in this department of natural history that were likely to prove new or interesting.

Family **Dorididæ.**

Doris testudinaria, Risso.

Doris testudinaria, Risso, Hist. Nat. de l'Europe Mérid. vol. iv. p. 33, f. 15; Philippi, Enum. Moll. Sic. vol. ii. p. 78.

Body ovate or broadly elliptical, convex. *Cloak* large, of a chestnut-colour, with indistinct pale-yellowish blotches towards the sides, covered with smallish unequal tubercles, interspersed with a few larger ones, with minute pale lines radiating from them. *Dorsal tentacles* stout, yellowish, with fifteen to seventeen laminæ, divided in front by a groove: *oral tentacles* linear. *Branchial plumes* eight, tripinnate, forming an incomplete circle, open behind, retractile within a large cavity. Underside of the cloak orange- or lemon-coloured, spotted with reddish brown:

the foot orange, grooved in front, with the upper lamina notched in the centre.

Length $1\frac{1}{2}$ to 2 inches.

A specimen of this fine Doris was got by Messrs. R. S. Brady and G. Hodge, under a stone between tide-marks, on the Island of Herm, in June last. It is known as a Mediterranean species, but its range further north had not been before ascertained.

The resemblance between *D. testudinaria* and our *D. planata* suggests the question whether the latter may not be the young of the present species. The very depressed form, however, of *D. planata*, its much smaller branchial plumes, their conspicuous dark-brown markings, and the presence of a central plume, which is not the case in *D. testudinaria*, induce us to consider them distinct. The character of the tongue is similar in each.

Doris Loveni.

Doris muricata, Lovén, Index Moll. Scand. p. 5. no. 18.

Body ovate, rather convex, yellowish white. *Cloak* with very large, rather distant, clavate tubercles, larger and more numerous towards the sides, interspersed with smaller ones. *Tentacles* robust, yellowish, placed considerably apart. *Branchial plumes* eleven, pinnate, set in a small incomplete circle or ellipse. Veil large, undulated. *Foot* broad and ample.

Length half an inch; breadth 0·35 inch.

A single specimen of this species was found by the Rev. A. M. Norman among stones between tide-marks, on the south side of Bantry Bay, in the autumn of 1858. It is remarkable for the enormous size of its tubercles, which, though soft and having a puffed appearance, contain each a bundle of spicula. That this is the *Doris muricata, a*, of Professor Lovén we are able to state with confidence, that distinguished naturalist having kindly sent us a specimen. We think, however, that the *D. muricata* of our Monograph is probably the true *D. muricata* of Müller, as the tubercles come nearer in character to those represented in his figure; and the former may perhaps be the var. *β* of Lovén, though it does not in all respects correspond with his description. The two varieties described by Professor Lovén are clearly distinct species, differing not only in the size of the tubercles as well as of the animal, but also in the character of the tongue, which, in the present species (the typical form of Lovén) has numerous small lateral plates or spines, similar to those of *D. proxima*, in addition to a large and rather slender falcate spine on each side. In *D. muricata*, var. *β*. Lov., there is a very broad-based falcate spine and an obtuse small one only on each side, the large spine having very minute lateral denticulations. There is also a rectangular central plate.

Family Polyceridæ.

Crimora, nov. gen.

Body limaciform. *Cloak* nearly obsolete, forming a veil with branched appendages over the head, and a papillated ridge on the sides of the back. *Dorsal tentacles* laminated, retractile within sheaths: *oral tentacles* tubercular. *Branchiæ* plumose, non-retractile, placed about two-thirds down the centre of the back. Tail short, without a fin-like crest.

Tongue.—Lateral spines twenty-six or twenty-seven on each side, of three kinds: the first next the centre large, hooked, bicuspid; the next five or six short, obtuse, and supported on subquadrilateral plates; the remainder very long, slender, curved and minutely denticulated on the inner margin. No central spine.

This genus comes very near to *Plocamophorus* of Rüppell, agreeing with it in having a branched veil in front, but differing in the absence of the large fin-like tail, and somewhat in the character of the lateral appendages, which in *Plocamophorus* are fewer, larger, and a little branched or papillated. It has also considerable relationship with *Thecacera*, in which genus, however, the veil is either absent or very imperfectly developed, and there are no oral tentacles. The members of this family, though bearing great general resemblance, are so variable in details that it is difficult to avoid raising each species to the rank of a genus. We have been rather reluctant, in the present instance, to add another to the number; but the species above described will not come into any of the known genera as at present understood; and the peculiar character of the tongue strengthens its title to generic rank. This organ differs from that of any of the allied genera in having very numerous, slender, denticulated, lateral spines, as in the *Trochidæ*.

Crimora papillata, n. sp.

Body ovate-oblong, swelling a little in the centre and tapering to a blunt point posteriorly; white, with the processes tipped with yellow. *Dorsal tentacles* subclavate, pale yellow, retractile within short sheaths: *oral tentacles* short, tubercular. *Veil* bilobed, each lobe furnished with five more or less branched appendages, leaving a small vacant space in the centre. A slight pallial ridge runs along each side of the back, bearing numerous small filamentous papillæ tipped with yellow, terminating behind in a bifid process of no great size: an indistinct ridge runs down the centre of the tail, also bearing yellow-tipped papillæ, the anterior one of which is larger than the rest, and bifid; similar small papillæ are disposed over the body, forming a line on the centre of the back, and one or two imperfect rows at the sides. *Branchial plumes* three, tripinnate, tipped with yellow. *Foot* narrow, produced a little at the sides in front.

Length (in spirit) $\frac{6}{10}$ inch.

This interesting addition to our fauna was dredged among *Zostera*, in a few fathoms water, in Moulin Huet Bay, Guernsey, by Mr. Norman, in July 1859.

Family **Eolididæ.**

Doto cuspidata, n. sp.

Body nearly linear, slender, smooth, white or yellowish, spotted on the back with pink or purple, the spots forming two lines of curves between the branchial processes, bending towards each, and extending from the tentacles to near the tail. *Tentacles* filiform, slender, tapering a little upwards; the sheaths trumpet-shaped, with scalloped margins, extending into a point in front. Veil entire, arched in front, and produced into obtuse recurved points at the sides. There is a raised portion of the surface in front of each tentacle, as in *D. fragilis*. *Branchiæ* six pairs, rather distant; the first pair placed not far behind the tentacles, the last pair very small. They are ovate-conical, with four whorls of strongly pointed conical tubercles, and a terminal one at the apex; apices without spots. *Foot* narrow, a little expanded in front, and tapering to a point at the tail.

Length (in spirit) a quarter of an inch.

Dredged in deep water on the outer Haaf, Shetland, by J. Gwyn Jeffreys, Esq., and Edward Waller, Esq., in the summer of 1861.

This new species of *Doto* is somewhat intermediate in character between *D. fragilis* and *D. coronata*, but approaching more nearly to the latter, from which it differs in the conical form of the branchial processes and their more pointed tubercles, as well as in the absence of the dark spots at their apices. The tentacular sheaths, too, have scalloped margins, and the veil is more arched than in *D. coronata*.

Family **Limapontiadæ.**

Limapontia depressa, n. sp.

Body oblong-ovate, depressed, swelling behind the centre and terminating in a blunt point posteriorly, but varying much according to the degree of expansion or contraction; black, with minute yellowish-white spots or freckles, not always present, and very inconspicuous. *Head* rounded in front, and slightly angulated at the sides; the lateral crests less elevated than in *L. nigra*, with the eyes situated near the centre of a white oblong area at the side of each. *Anus* placed in a depression at the posterior extremity of the body. *Foot* yellowish white, linear, and squared in front.

Length upwards of a quarter of an inch.

A few individuals of this species were obtained, last October, in brackish-water pools at the mouth of Hylton Dene, near Sunderland, associated with *Alderia modesta*, on a Conferva (*Vaucheria submarina*?).

The same animal, apparently, was taken by Mr. Muggridge and Mr. C. Spence Bate, in Loughor Marsh, South Wales, in 1849, similarly associated, and was figured by the latter gentleman in the Report of the Swansea Literary and Scientific Society for 1850, where it is named *Limapontia nigra*. It is, however, readily distinguished from that species by its greater size, more depressed form, and wider lateral expansion, by the backward position of the anus, and the more branched hepatic organ, besides other minor characters. Mr. Spence Bate's specimens seem to have been nearly twice the length of ours.

This species comes very near to the *Fasciola capitata* of Müller, perhaps more so than the *Limapontia nigra*, which has been referred to that species by Professor Lovén; but as Müller had not observed the characters by which these two species are more especially distinguished from each other (namely, the position of the anus and the branching of the liver), we think it better to consider our animal as new than to revive an old name that may prove to be erroneous.

XXVI.—*A Synopsis of the Species of Crocodiles.* By Dr. J. E. Gray, F.R.S. &c.

The distinction of the species of Crocodiles has hitherto been one of the difficult problems in systematic zoology; and therefore I believe that it may be of some slight use to lay before the readers of the 'Annals' the result of my examination of the very large collection of Crocodiles, of all ages and from various localities, which are contained in the British Museum. Knowing the difficulty that surrounds the subject, I have made great exertions to obtain specimens from different countries; and the examination of these specimens has shown that the characters of the species, when allowance is made for the changes that take place in the growth of the animal, are quite as permanent as in any other group of Reptiles.

One of the difficulties in distinguishing the species of Crocodiles arises from the changes that take place in the form of the head during growth. When the Crocodile is just hatched, the face is very short; it elongates as the animal grows, at first very gradually, and, at length, assumes the typical form of the species when the animal has reached about one-fourth or one-third of its natural size. The head continues to increase in firmness and strength; and when the animal has attained nearly its adult size, the bones of the head become thickened, the face becomes broader and higher, and the general form of the head is considerably altered. Thus the half-grown specimens give the most characteristic form of the species.

I have noticed that there is considerable variation in the width of the face in specimens from different localities, but which appear in other respects to belong to the same species. Some naturalists might be inclined to regard them as distinct species; but in our series, large as it is, we have not sufficient materials to decide the question with any confidence. Perhaps, if the skulls of specimens from each locality could be compared, other characters might be found; but this must be left for my successors in this field of research.

I may remark that the observation of MM. Duméril and Bibron (Erp. Gén. 25 & 47), that Crocodiles are not found in Australia, and that the American Crocodiles are confined to the islands of that continent, is no longer consistent with fact; indeed, long before the publication of their work, various travellers had recorded the occurrence of Crocodiles on the north coast of Australia; and we have received specimens of the skull of *Oopholis porosus* from thence.

The genera here proposed have the following geographical distribution:—

Asia and Northern Australia: *Oopholis* and *Bombifrons.*
Africa: *Crocodilus, Halcrosia,* and *Mecistops.*
Tropical America: *Palinia, Molinia.*

The skulls of Crocodiles may be arranged thus:—

1. Nasal bone produced, and separating the nostril into two parts. *Halcrosia.*

2. Nasal bone produced, and dividing the edges of the nostril. *Oopholis, Crocodilus, Molinia* (*americana*), *Bombifrons, Palinia.*

3. Nasal bone not reaching the nostril. *Molinia* (*intermedia*), *Mecistops.*

The large front teeth of the *Gavials* fit into a notch in the front of the upper jaw, and the canines into a notch also. In the *Crocodiles* the canines fit into a notch, as in the Gavials, but the large front teeth fit into a pit or perforation in the front of the upper jaw; and in the *Alligators* both the canines and large front teeth fit into pits or perforations in the edge of the upper jaw.

The intermaxillary bone in *Bombifrons* and *Palinia* is short and truncated behind. In *Halcrosia* it is rather produced behind, the straight sides converging to a point. In all the other genera it is produced behind, with the hinder edge converging on the sides and truncated at the ends.

The palatal bone in all the genera is truncated or rounded in front, except in *Mecistops,* where it is narrow, short, and acute in front.

The dorsal scales present considerable variations in different specimens from the same locality; but, allowing for such variations, the genera may be arranged thus:—

1. The dorsal scales nearly uniformly keeled, in four or six longitudinal series; the outer series ovate-elongate. *Oopholis.*

2. The dorsal scales nearly uniformly keeled, quadrilateral, as broad as long. *Crocodilus, Palinia, Molinia,* and *Mecistops.*

3. The dorsal scales quadrilateral, as broad as long; the vertebral series scarcely keeled, the lateral series irregular and keeled. *Halcrosia* and *Molinia.*

The eyelid of the genus *Halcrosia* is thickened, with three hard bony plates, as in some of the Alligators, with which it also agrees in the external form of the head and the disposition of the nuchal shield. In all the other genera they are thin and membranaceous.

The Crocodiles (*Crocodilidæ*) may be thus divided:—

I. *The nape with a rhombic disk formed of six plates, which is well separated from the dorsal shields.* Normal Crocodiles.

A. Nuchal scutella none. Dorsal scales in four or six longitudinal series; the outer series ovate-elongate. Toes webbed. Legs fringed. The intermaxillary bone produced, truncated, and converging on the sides. Estuarine or brackish-water Crocodiles.

1. Oopholis.

Face oblong; orbits with an elongated, longitudinal, more or less sinuous ridge in front. Nuchal shields none, or rudimentary. Cervical disk rhombic, of six shields. Dorsal shields uniformly keeled, in four or six longitudinal series; the vertebral series with straight internal edges, the outer ovate-elongate. Legs acutely fringed. Toes broadly webbed. Intermaxillary bone produced and truncated behind the suture, sloping backwards and converging, and then transverse or sinuous.

a. *The dorsal scales in six longitudinal series; the vertebral ones elongated like the others.*

1. *Oopholis porosus.*

Crocodilus porosus, Schn. Amph. 159; Gray, Cat. Brit. Mus. 58.
C. oopholis, Schn. Amph.

Crocodilus biporcatus, Cuvier, Oss. Foss. v. 65, t. 1. f. 4, 18, 19 (young skulls), t. 2. f. 8; Müller and Schlegel, Verh. t. 3. f. 6 (middle-aged skull).
Champse fissipes, Wagler, Amph. t. 17.
Crocodilus biporcatus raninus, Müller and Schlegel, Verh. t. 3. f. 7 (aged skull).

Hab. Asia and Australia. India, Bengal and Pinang (*Hardwicke*); China (*Lindsay*); Trincomalee; Borneo (*Belcher*); North Australia (*Ince, Elsey*); Tenasserim coast (*Packman*).

The Museum specimens vary in length from 18 to 52 inches; but the skull shows that it grows to a very large size. We have one skull 29 inches long; another, which is 26 inches long, is said, by the gentleman who sent it from India, to have been taken from an animal 33 feet long.

Cuvier figures the skulls of young and half-grown specimens. S. Müller and Schlegel figure two skulls, one under the name of *C. biporcatus* (f. 6), and the other *C. biporcatus raninus* (f. 7): the latter seems to be from an adult or aged animal; the former (f. 6) from a full-grown one, before the skull is thickened and spread out. Another specimen figured as *C. biporcatus raninus* (f. 8) appears to be from a specimen of *Crocodilus Siamensis.* It certainly is not an *Oopholis*, from the form of the dorsal scales and the presence of the nuchal ones.

b. *The dorsal scales in four series; the vertebral series broader than long, the outer series elongate-ovate.*

2. *Oopholis Pondicherianus.*

Hab. Pondichery, 1851.

The specimen of this species in the British Museum is small, and only just hatched, but it is quite distinct from all the others. The vertebral series of shields are nearly twice as broad as the vertebral shields in *O. porosus*; the others are also rather wider in comparison; all the dorsal scales are more keeled, and the keels on the scales on the side of the base of the tail are higher and more prominent. The black spots are larger and further apart.

The specimen was purchased of M. Parzudaki of Paris, it having formed part of a collection which he received from the French Museum.

B. Nuchal plates four, or rarely two or five, in a cross series. The dorsal plates as broad as long, in four or six series. Fluviatile or River Crocodiles.

a. The intermaxillary bones truncated behind, with a nearly straight premaxillary suture. Face broad, oblong.

To discover the form of the premaxillary suture in the preserved specimens, it is only necessary to elevate the skin of the front of the palate, and lay the bones bare.

* *Toes webbed. Legs distinctly fringed.* Asiatic Crocodiles.

2. Bombifrons.

The premaxillary suture straight, or rather convex forwards. The face oblong; forehead with nodules in front of the orbits. The cervical disk formed of six shields. Nuchal plates four, in a curved line. Dorsal shields oblong, rather elongate, all keeled, in six longitudinal series, and with two short lateral series of keeled scales. The legs fringed with a series of triangular elongated scales. Toes webbed.

1. *Bombifrons trigonops.*

Crocodilus bombifrons, Gray, Cat. B.M. 59, 1844 (adult).
C. biporcatus, Cautley, Asiat. Research. xix. t. 3. f. 1 & 3 (not Cuvier).
C. trigonops, Gray, Cat. B.M. 62, 1844 (young).
C. palustris, Gray, Cat. B.M. (young).
C. palustris (part.), Dum. & Bib. Erp. Gén. ii.
C. biporcatus raninus, Müller & Schlegel, Verhand. t. 3. f. 7 ?
C. marginatus, Falconer, Ann. & Mag. Nat. Hist. 1846, xviii. 361, t. 7 (skull).

The intermaxillary short, nearly semicircular.

Hab. India, Ganges (*Dr. Sayer*); Madras (*Jerdon*); Ceylon (*Kelaart*).

The smallest specimen in the British Museum is 19 inches, and the largest nearly 10 feet long; but we have skulls showing that it grows to a much larger size.

There may be two species included in the above, as in one of the heads (that from Ceylon) the intermaxillaries appear to be longer and narrower than in the others. I have not sufficient materials to satisfy myself as to the distinction of this species and the permanence of the forms.

This species has been generally confounded with *Oopholis biporcatus* and *C. palustris*.

The face of the younger specimen is rugulose and depressed, with a deep pit on the sides over the eighth and ninth teeth; there are two arched ridges on each side behind the nostril, and some rugosities in front of the orbits. In the older skull the face is very convex and rounded, rugose, with some more or less distinct rugosities in front of the orbits, but not the distinct longitudinal ridge so characteristic of *Oopholis porosus*.

2. *Bombifrons Siamensis.*

Crocodilus Siamensis, Schn. Amph. 157; Gray, Syn. 60, & Cat. B.M. 63 (monstrosity).
C. galeatus, Cuvier, Oss. Foss. v. 52, t. 1. f. 1; Dum. & Bib. Erp. Gén. ii. 113 (monstrosity).
C. palustris, Lesson, Bélanger, Voy. 305?

Crocodilus vulgaris (part.), Gray, Syn. 58; Dum. & Bib. Erp. Gén. ii. 108; Müller & Schlegel, Verh. t. 3. f. 9 (head?).

The face depressed, elongate, nearly smooth, with a slight nodule in front of the orbits. Intermaxillaries rather elongate, half-oblong.

Hab. Siam, Cambogia (*M. Mouhot*).

We have a well-preserved half-grown specimen of this species in the British Museum. It differs from all the specimens of *Bombifrons trigonops* in the Collection in the face being much longer, and not so tubercular and pitted.

As the head agrees with the figure of the head from which Schneider named his species, I have retained it; and I have little doubt that the two keels which are present in that specimen are either an individual peculiarity, or perhaps a character that developed itself as the animal approached old age.

** *The legs with an indented fringe of short narrow scales. Toes short, nearly free.* American Crocodiles.

3. Palinia.

The premaxillary suture straight (see Cuvier, Oss. Foss. iii. 72, t. 3. f. 1, 5). The face oblong; forehead very convex, with a ridge in front of each orbit, converging in front and forming a lozenge-shaped space. Nuchal plates two or four, unequal. Cervical disk rhombic, of six large shields. Dorsal shields large, broad, in six series; the vertebral series nearly smooth, the lateral one strongly keeled.

1. *Palinia rhombifer.*

Crocodilus rhombifer, Cuv. Oss. Foss. v. t. 3. f. 1–5 (skull); Sagra, Cuba, t. 4; Dum. & Bib. Erp. Gén. iii. 97.
C. (*Palinia*) *rhombifer*, Gray, Cat. B.M.

The upper surface of the fore-arms and thighs covered with convex keeled scales; the outer edge of the legs and feet with a series of very elongated scales, forming only a slight fringe; the toes short, scarcely webbed.

In the British Museum there is a nearly adult stuffed specimen, received from M. Ramon de la Sagra, and two young specimens sent from Cuba by Mr. W. S. Macleay. The young specimens (in spirit) are pale brown, with small dots on the head, and a dark spot on the middle of many of the dorsal scales. Tail subtessellated, with square brown spots.

C. planirostris, Graves (*C. Gravesii*, Bory), is only described from an old specimen, in a very bad state, in the Museum of Bordeaux. The description and figure agree with those of *P. rhombifer* in almost every respect, except that the hind toes are said to be webbed. It was supposed to come from Congo; but that is very doubtful.

2. *Palinia*? *Moreletii.*

Crocodilus Moreletii, Dum. Arch. du Mus. vi. 255, t. 20; Cat. Rept. 28. n. 5*.

Dorsal scales keeled, nearly square; scales of the sides and limbs smooth, without tubercles.

Hab. Yucatan, Lac Flores (*M. Morelet*).

This species is from a specimen in the Museum of Paris, which is very badly figured and indistinctly described in the memoir above cited.

There are two young specimens of Crocodiles, in spirit, without habitats, in the British Museum, which are peculiar in the large size of the nuchal shield, the strength of the keels of the dorsal shields, and the large keeled scales of the fore-arms and thighs, in which they agree with *Palinia rhombifer*; but there is so much difference between the two, and between them both and the specimens of that species from Cuba, that I think they must be left in doubt, for further elucidation. There are also two small stuffed specimens in the Collection (purchased in shops, and without any locality attached), which are peculiar in having six series of uniform, squarish, very strongly keeled dorsal scales: they are very unlike any other specimen in the Collection, and may be new; but I do not like to describe them in the present imperfect state of our knowledge.

b. The intermaxillary bone elongate, produced and truncated behind; the suture sloping backwards and converging, and then transverse or sinuous. Toes webbed. Legs with a fringe of elongated triangular scales.

4. Crocodilus.

Face oblong, depressed, without any ridge in front of the orbits. Nuchal shields four, in an arched series. Cervical disk rhombic, of six shields. Dorsal shields quadrilateral, as broad as long; the vertebral series rather the widest and most keeled.

Crocodilus vulgaris.

Le Crocodile de Nile, Daud. Rept. ii. 267.
Crocodilus vulgaris, Cuvier, Oss. Foss. v. 42, t. 1. f. 5 & 12, t. 2. f. 7.
C. Chamses, Bory, Dict. Class. H. N. v. 105.
C. lacunosus, Geoff. Croc. d'Egypte, 167.
C. suchus, Geoff. Ann. Mus. x. 82, t. 5. f. 2, 3, 4.
C. marginatus, Geoff. Croc. d'Egypte, 165; Gray, Cat. Rept. B.M. 61.

Hab. Africa. North Africa, Egypt; West Africa, Senegal, Gaboon; South Africa, Cape of Good Hope; Central Africa (*Baikie*).

Our largest specimen is nearly 15 feet long.

The specimens from Egypt, West Africa, and the Cape show some slight differences; and perhaps a complete series of the perfect specimens and skulls, of different ages, from each locality might prove them to be distinct; but, unfortunately, I have not such a series at my command, all the specimens from the Cape and West Africa being either in the adult or very young state.

5. Molinia.

Face elongate; forehead swollen, convex, especially in the adult; orbits without any anterior ridge. Nuchal shields two or four, small. Cervical disk rhombic, of six shields. The legs fringed with a series of triangular elongate scales. Toes webbed. Scales of the fore-arm and thigh thin, smooth.

* *Face slender. Dorsal shields irregular; the central series small, keeled; lateral scattered, strongly keeled. Nasal bones produced to the nostrils.* Molinia.

1. *Molinia americana.*

Crocodilus americanus (*Plumieri*), Schn. Amph. 167; Gray, Cat. B. M. 60.
C. acutus, Geoff. Ann. Mus. ii. 53, t. 57. f. 1; Cuvier, Oss. Foss. v. t. 1. f. 3 & 14, t. 2. f. 5; Gray, Syn. 60; Dum. & Bib. Erp. Gén. iii. 120.

Hab. Tropical America. Cuba (*W. S. Macleay*); West Ecuador (*Fraser*); Nicaragua (*Richardson*); West coast of America (*Belcher*); St. Domingo (*Cuvier*).

Our specimens vary in length from 19 to 103 inches; and the skulls show that they grow to a larger size.

Var. with two additional small cervical scutella behind the others.

C. americanus, var. *c*, Gray, Cat. Rept. B.M.
C. acutus, var., A. Dum. Cat. Rept. 28; Arch. du Mus. vi. 256.

Hab. West coast of America (*Belcher*); Mexico (*Warwick*).

** *Face very slender. Dorsal shields nearly uniform. Nasal bones not produced quite to the nostrils.* Temsacus.

2. *M. intermedia.*

Crocodilus intermedius, Graves, Ann. Sci. Phys. ii. 248; Gray, Syn. 59.
C. Journei, Bory, Dict. C. H. N. v. 111; Dum. & Bib. E. G. iii. 129; Huxley, Proc. Linn. Soc. iii. 11.
Croc. de Journie, A. Dum. Arch. du Mus. x. t. 14. f. 3 (head).

Dorsal shields in six rows, all slightly and nearly equally elevated; the keels of the two vertebral series rather larger than the others, quadrilateral, rather broader than long; the lateral ones oval, with five or six large shields forming an interrupted line on the sides.

Hab. America.

We have a young specimen, in spirits, sent by Mr. Brandt of Hamburg, as *Crocodilus acutus*, and an adult skull received from Paris, as *Crocodile de l'Orénoque.*

II. *Nape with a broad ridge, strongly keeled on each side, and nearly continuous with the dorsal shield, formed of two or three pairs of keeled shields. Legs fringed. Toes webbed.* Abnormal Crocodiles.

* *Face broad; nasal bone produced into the nostril.* Alligatorian Crocodiles.

6. Halcrosia.

The premaxillary suture transverse, rather convex backwards. Nasal bones produced beyond the intermaxillary, and forming a bony septum between the nostrils. The face oblong, broad, without any ridge in front of the orbit. Eyelid with two bony plates. Nuchal plates four, in a cross row, strongly keeled. Cervical plates three or four pairs, forming a ridge on each side, the hinder one smaller. Dorsal scales in four series; the central broad, slightly keeled, the outer narrow, distinctly keeled: sides with large convex scales.

Halcrosia frontata (Black African Crocodile).

Krokodile noir de Niger, Adanson, MSS., Mus. Paris; see Cuvier, Oss. Foss. iii. 41.
Crocodilus palpebrosus, var. 2, Cuvier, Oss. Foss. iii. 41, t. 2. f. 6 (part.).
C. trigonatus, part., Cuvier, Oss. Foss. iii. 65.
?*C. biscutatus*, Cuvier, Oss. Foss. iii. 53, 65 (jun.).
?*C. bisulcatus*, Bory, Dict. Class. H. N. v. 108 (a misprint?).
C. frontatus, A. Murray, Proc. Zool. Soc. 1862.

Hab. West Africa. Senegal (*Adanson*); Gaboon; Old Calabar.

The *Crocodilus biscutatus* (Cuvier, Oss. Foss. v. 53, 65, t. 2. f. 6, nuchal plates), from a young specimen labelled "*Gavial de Sénégal*" by Adanson, is probably a young specimen of this species; but Adanson's name would appear to apply to *Mecistops*.

There is a specimen nearly 4 feet long in the Liverpool Museum; indeed, this seems to be the most common Crocodile of the West-African rivers.

Cuvier evidently confounded this species with the *Alligator palpebrosus* of South America; and it is still confounded with that species by the French naturalists, for we have a skeleton lately sent from the French Museum under that name.

** *Face very long, slender; nasal not reaching to the nostril.* Gavialian Crocodiles.

7. Mecistops.

Face subcylindrical, scarcely dilated in the middle; orbits simple. Nuchal shields numerous, small, in two cross series. Cervical disk narrow, containing two or three pairs of shields. Dorsal shields small, all keeled, in six longitudinal series, lateral one narrowest. Intermaxillary produced behind, and embracing the front end of the nasal.

This genus has some resemblance to the Gavials; but the structure of the skull and the position of the teeth are those of a true Crocodile.

Mecistops cataphractus.

Crocodilus cataphractus, Cuvier, Oss. Foss. v. t. 5. f. 1, 2; Dum. & Bib. E. G. iii. 126 (younger) [copied A. Dum. Arch. du Mus. x. t. 14. f. 2]; Bennett, Proc. Zool. Soc. 1834, 110.
C. leptorhynchus, Bennett, Proc. Zool. Soc. 1835, 129; A. Dum. Arch. du Mus. v. 252 & i. 171. t. 14. f. 1.
M. cataphractus, Gray, Cat. B.M. 58.
M. Bennettii, Gray, Cat. B.M. 57.

Hab. West and Central Africa. Fernando Po (*Bennett*); Gaboon; Lagos; Central Africa (*Baikie*).

I think there can be no doubt that the *Crocodilus cataphractus,* figured by Cuvier from a specimen in the College of Surgeons, and the *C. leptorhynchus* of Bennett are one species, the difference in the length of the beak (in the figure) and in the form of the nuchal disk being derived from the state and age of the specimen.

XXVII.—*Notes on rare and little-known Fishes taken at Madeira.* By James Yate Johnson, Cor. Mem. Z. S.

No. II.

Order ANACANTHINI, Müll.

Suborder Thoracici.

Fam. Gadidæ.

Phycis blennoides, Bl., Schn.

Blennius gadoides, Risso.

1st D. 9. 2nd D. 58. P. 17. V. 1. A. 53. C. III. 18. III. M.B. 7. Scales of lat. line about 100.

Body elongate-oblong, much compressed behind, of a brownish-grey colour; the belly pale grey, marbled with dirty white.

The *head* is depressed, unarmed, and, compared with the total length, is as 1 to $4\frac{1}{3}$. Gill-openings large; the gill-covers, which are black inside, are small, and leave much of the branchiostegal membrane exposed. The scaly cheeks are slightly convex, and the skin covers and conceals the preopercle. The opercle is without a notch, and it terminates behind in a rounded projection. The snout is short, rounded, and covered with small scales; there are also scales on the mandible, but none on the thick cartilaginous lip. There is no coloured skin on the maxillary, which fits under the skin behind, and forms no part of the border of the mouth. It reaches back to the vertical from the middle of the eye. The mouth, when open, is nearly circular.

The under jaw is shorter than, and closes inside the upper. The premaxillary and mandible are set with small *teeth* in scobinate bands which have no larger teeth outside. The band in the upper jaw narrows backwards, but is much broader in front than the band of the lower jaw. There is a chevron-shaped patch of small teeth on the vomer, and also small teeth on the pharyngeals, but none on the palatines. The tongue is white, like the whole interior of the mouth; it is broad, with a slight projection in front. The chin carries a barbel of moderate length. There are no scales on the membrane between the mandible and the branchiostegal membrane. The *eye* is round and moderately large, being contained about five times in the head. It forms no part of the profile, and is distant from the tip of the snout about $1\frac{3}{5}$ of its diameter. There is a space equal to a diameter between the eyes. The *nostrils* are small, and the anterior one has a skinny appendage at its hinder border.

The vertical fins are fleshy and scaly; none of them have white edges. The *first dorsal* fin, which commences in the first third of the total length, is triangular, and has a short base. The elongate third ray is setiform above, and is nearly twice as long as the fourth, the next in length. The order of the length of the rays is 3, 4, 2=5, 6, 1, 7, 8, 9. The *second dorsal* fin is separated by a short space from the first, than which it is less high. It is long, being more than half the total length of the fish, and its middle portion is lower than the rest. It extends nearly to the caudal fin, and its posterior extremity is truncate. The pointed *pectoral* fins are inserted above the middle of the height, in the first fourth of the total length in front of the first dorsal. The fourth and fifth rays are nearly equal, and longer than the rest.

The forking *ventral* ray is very long, reaching back much beyond the commencement of the anal fin, and being equal to about one-third of the total length of the fish. About the middle there is a knot or dilatation forming a kind of elbow.

The *vent*, surrounded by a ring of black, is placed in the first half of the total length. The *anal* fin commences not far distant from it, under the eleventh or twelfth ray of the second dorsal fin. Its length is considerably more than one-third of the total length. It is not so high as the second dorsal fin, but has precisely the same shape, with its truncate termination a little nearer the *caudal* fin, which is also truncate.

The *lateral line* is a somewhat undulating groove which rises a little under the first dorsal fin; it then falls gently until there is a rapid descent over the commencement of the anal fin, which continues to the ninth or tenth ray of the anal fin; thenceforth it is straight. The scales of this line are about 100 in number.

In the height of the fish, at the anterior dorsal fin, 7+28=35 scales were counted.

Only a single specimen of this fish has been obtained by me at Madeira, where two other species have been taken, viz. *P. mediterraneus* and *P. Yarrellii*, as well as a specimen of the subgenus *Læmonema*. M. Valenciennes has described and figured in his 'Canarian Ichthyology' (p. 78, pl. 14. fig. 2) another species of *Phycis*, under the name of *P. limbatus*. From *P. Yarrellii* and *P. limbatus* it is distinguishable by the presence of teeth on the vomer, by the elongation of the third ray of the first dorsal fin, by the ventrals being much longer than the head, and by the uniform coloration of the vertical fins, which in the two fishes referred to have white edges. From *P. mediterraneus* (which has its first dorsal fin no higher than the second) it may be discriminated by the elongation of the third ray of the first dorsal fin, by the smaller eye (contained five times in place of three times in the head), and by the ventrals being much longer than the head. From *Læmonema* (*Phycis*) *robustum*, recently described by me in a paper read before the Zoological Society, it is to be known by the chevron-shaped (not rounded) patch of vomerine teeth, by the elongation of the third in place of the first ray of the first dorsal fin, by the larger number of rays in that fin (nine in place of five), and by the vertical fins being fleshy and scaly. From *Phycis blennoides*, Risso (Hist. Nat. de l'Eur. Mér. vol. iii. p. 222), I considered it distinct on account of the elongation of the third (not the first) ray of the first dorsal, and by the larger number of rays in the second dorsal fin, Risso stating that the Mediterranean fish has but thirty-six rays in that fin. But Dr. Günther assures me that there are mistakes in Risso's description, and that the present fish is really identical, not only with the *Phycis blennoides* of Schneider (Bl. Schn. p. 56) and of Risso, but with the *Phycis furcatus* of Fleming and Yarrell.

The specimen, which was taken in the month of April, and is now in the British Museum, has the following dimensions in inches:—

Total length	$29\frac{1}{2}$
Height under 1st dorsal	$6\frac{3}{4}$
Thickness behind pectorals	$3\frac{1}{3}$
Head, length	$6\frac{7}{8}$
„ thickness below eye	$4\frac{1}{5}$
Eye, diameter	$1\frac{4}{10}$
Mouth, width from side to side when open	$3\frac{3}{8}$
„ width of band of teeth in front	$\frac{3}{10}$
Barbel	$1\frac{4}{10}$
1st dorsal, distance from snout	$8\frac{1}{8}$
„ length of base	2

1st dorsal, length of third ray	$4\frac{3}{10}$
,, ,, fourth ray	$2\frac{2}{10}$
2nd dorsal, distance from snout	$8\frac{5}{8}$
,, length of base	$15\frac{1}{2}$
,, height towards front	$1\frac{7}{10}$
Pectorals, distance from snout	$7\frac{1}{4}$
,, length	$4\frac{1}{2}$
,, width of base	$\frac{9}{10}$
Ventrals, length on right side	$10\frac{1}{2}$
,, ,, left side	$8\frac{1}{8}$
Vent, distance of its vertical from snout	13
Anal, distance from vent	$\frac{1}{2}$
,, length of base	$11\frac{3}{4}$
Tail, height behind second dorsal	$1\frac{1}{10}$
Caudal, length at middle	$3\frac{1}{3}$
,, ,, sides	$4\frac{1}{10}$

Order MALACOPTERYGII.

Suborder Apodes.

Saccopharynx ampullaceus, Harwood, sp.

The curious fish which I am about to describe was taken in the month of March, off the coast of Madeira, but under what circumstances I could not learn. The man from whom I obtained it stated that he had a fish with two heads, two mouths, four eyes, and a tail growing out of the middle of the back, which had astonished the whole market; and the fishermen one and all declared they had never met with anything like it before. At first sight it really did appear to be the monster described; but a short examination brought to light the fact that one fish had been swallowed by another, and that the features of the former were seen through the thin extensible skin of the latter. On extracting the fish that had been swallowed, it proved to be a Gadoid *, and to have a diameter several times exceeding that of its enemy, whose stomach it had distended to an unnatural and painful degree.

As to the fish whose voracity had brought it to an untimely end, it was immediately pointed out to me by Dr. Günther, when I showed him a sketch of the head, that it is closely related to a fish described at some length by Dr. Harwood, in a memoir printed in the 'Philosophical Transactions,' in the year 1827, under the name of *Ophiognathus ampullaceus*. That eminent ichthyologist also informed me that a member of the same genus had been previously described by Dr. S. L. Mitchill, in the Annals of the Lyceum of New York' for 1824, under the name

* This Gadoid is the type of a new genus, and has been described by Dr. Günther under the name of *Halargyreus Johnsonii*.

of *Saccopharynx flagellum.* On referring to these descriptions, I am led to think that, although the three fishes fall into the same genus, the Madeiran fish is specifically distinct from that forming the subject of Dr. Mitchill's memoir, but is perhaps specifically identical with Dr. Harwood's fish. I will first describe the specimen obtained at Madeira (which now forms part of the rich collection in the British Museum), and then make some remarks on the relationship of the three.

The Madeiran fish is 32 inches in length. It has a thin, soft, scaleless skin, which is jet-black. From its narrow elongated form, and from the absence of ventral fins, it would be referred, at the first glance, to the Eels; but from that tribe it is distinctly separated by the structure of its singular jaws. The upper jaw is apparently composed of the maxillary or premaxillary—bones which are invariably wanting in the tribe of true Eels. The bones of both jaws are slender and curved; those of the under jaw meet at an acute angle in front, and they are armed with a single row of small, sharp, delicate teeth, similar to those of the upper jaw, but rather more numerous. There are no teeth on the palatine bones or elsewhere in the mouth.

The gape is of enormous extent; and the animal had the power of throwing down the lower jaw until it was almost in a line with the upper, the two being subequal, and $2\frac{1}{3}$ inches in length. There is no tongue in the mouth, nor are there any branchiostegal rays. A conical snout projects nearly four-tenths of an inch beyond the upper lip; and the small oval eye, which is covered with skin, is placed on the head not far from the base of the snout. In front of each eye is a single small nostril, which does not issue in a tube.

The gill-openings are small slits, seven-tenths of an inch in length, on the underside of the body, placed only one-sixth of an inch apart, and at a distance of about $3\frac{1}{6}$ inches from the tip of the snout. What is very remarkable about these apertures is that, within the lips of each, the opposite sides are connected by three narrow cutaneous bands—two near the anterior end of the aperture, and one near the posterior end.

The minute pectoral fins are placed immediately behind the gill-openings, but a little above them. Each is about one-fifth of an inch in length, and has about thirty-two delicate rays. In reference to the pectoral fins of the fish described by Dr. Harwood, he mentions that they were principally composed of an adipose disk terminated and nearly surrounded by the rayed portion of the fin. In my fish I do not see anything of this kind; but that may be owing to the specimen being young.

A low dorsal fin, having extremely slender rays, commences in front of the vent, and at a distance of about $7\frac{1}{2}$ inches from the tip of the snout. There is no trace of ventrals. The vent is about $8\frac{1}{2}$ inches distant from the snout; and behind it begins a low anal, which, though it may be traced for a considerable distance, stops, like the dorsal, short of the end of the tail.

The hinder part of the body tapers off gradually; and the finless tail is characterized by extreme tenuity, being reduced to the thinness of a thread. Two bluish-white, parallel, closely approximated lines begin at the distance of rather more than an inch from the tip of the snout, and are traceable for a considerable space along the back, one at each side of the dorsal fin. Dr. Mitchill speaks not only of a whitish line extending on each side of the dorsal fin of his fish, but of a similar stripe at each side of the anal fin.

No lateral line is visible. The vertebræ are without ribs, and all the bones are weak.

And now as to the relationship of these three fishes. Whilst it is pretty certain that all three are members of the same genus, and whilst there is scarcely ground for holding that Dr. Harwood's fish and the Madeiran fish are specifically distinct (for their differences may be due only to their different ages), yet there is one part of Dr. Mitchill's description which makes it difficult to suppose that his fish was identical in species with mine. He says that it had filiform processes or excrescences about an inch in length, and about fifty in number, depending on each side of the back, all the way from the head to the tail. In my fish there is no trace of such processes. Hence I venture to conclude that if Dr. Mitchill's fish retains the name of *Saccopharynx flagellum*, Dr. Harwood's and mine ought to be designated *Saccopharynx ampullaceus*.

I will only remark that Dr. Mitchill proposed the name *Saccopharynx* in substitution for Shaw's *Stylephorus*, supposing the two fishes thus designated to belong to the same genus. But modern ichthyologists cannot admit this to be the case; for (to say nothing of other points) the structure of the mouth is totally different, as may be at once seen by an inspection of Shaw's unique specimen, now preserved in the Museum of the College of Surgeons.

Suborder ABDOMINALES.

Fam. Scopelidæ.

Gonostoma denudata, Buon. Faun. Ital. (with a fig.).

Gasteropelecus acanthurus, Cocco.

The genus *Gonostoma* was indicated by Rafinesque, and defined by Buonaparte, as having an elongated body entirely covered with large caducous uniform scales; uniserial teeth in both jaws; pectoral fins inserted low down; the first dorsal fin rather far back, *i. e.* behind the ventral and over the anal fin. A single specimen of the genus has been taken at Madeira.

1st D. 15. 2nd D. rudimentary. A. 29. P. 11. V. 8.
C. III. 16. IV. M.B. 13.

The back and belly are black, the sides silvery grey, and there are two rows of small silvery spots extending at each side from the head to the tail, near the lower edge of the body. The skin is delicate, and the large scales easily removed. Their edges are even, and their surfaces concentrically striated.

The body is oblong and compressed; the highest part is at the nape, from which place it attenuates backwards. The sides of the body, when the skin is removed, are seen to be marked with furrows diverging from the lateral line.

The *head* is high, compressed, and unarmed; the cheeks flat; the vertex marked with low ridges. The round *eye* is contained about seven times in the head; it is distant about one diameter from the snout, and it is so high up that its border forms part of the profile. The rictus is large, extending downwards with an oblique curve much beyond the eye. The under jaw shuts inside the upper, except anteriorly, where the upper jaw reverses its curve. The mouth is black inside. Its upper border is formed entirely by the premaxillary, which is thin and dilated downwards, the slender maxillary lying behind. The *dentition* is curious. In both jaws there is a single row of delicate, acicular, nearly straight teeth, with four or five very small teeth, of similar shape, in the intervals between two larger ones. Of the larger teeth, in the specimen there are twenty-nine in the upper, and twenty-one in the lower jaw. There is a row of teeth on the palatines, a few teeth on the vomer, and a row along the middle of the fleshless tongue—all very minute. The opercular pieces are delicate, smooth, and with entire margins. There are two low crests on the opercle, starting from the same point, one vertical and the other oblique; the posterior margin of the opercle is nearly vertical.

The triangular first *dorsal* fin is placed far back over the anal fin, and both are sprinkled with minute black dots. The first two rays are very short and unbranched, the third ray is the longest; the posterior rays are very delicate. The second dorsal fin possesses rays, but is very minute.

The *pectoral* fins are oblong, and inserted very low down near the angle of the subopercle. The *ventral* fins are rather shorter than the pectoral fins, and are placed close together a little in advance of the first dorsal. The *anal* fin commences under the commencement of the first dorsal, but extends beyond it; it is high in front, but the first two rays are short, the third being the longest in the fin, from which it falls rapidly backwards. The *caudal* fin is forked. On the under edge of the tail there are five short glassy spines, which curve backwards.

The *vent* is placed at the middle of the total length.

The single specimen obtained, though measuring $5\frac{8}{10}$ inches in length, was extracted from the stomach of a malacopterygian fish, having a length of only $3\frac{7}{10}$ inches, whose black skin, frightfully distended, entirely covered it! It was doubled up, and a good deal injured. So many of the scales had been removed, that those of the lateral line could not be counted.

It is to be observed, with reference to the description of *Gonostoma denudata* given in the 'Fauna Italica,' that ten rays are assigned to the branchiostegal membrane, whereas I certainly found thirteen; that the fifth, sixth, and seventh rays of the first dorsal fin are said to be the longest, whereas in my fish the longest rays were the third, fourth, and fifth; and that, whilst the two agree in the number of the rays of the first dorsal fin, there were in my fish eleven in place of the ten rays in the pectoral fin, eight in place of six rays in the ventral fins, and twenty-nine in place of thirty rays in the anal fin.

The fish was taken in the month of March, and is now in the British Museum. The following are the dimensions of the principal parts:—

	inches.
Total length	$5\frac{8}{10}$
Height at nape	$\frac{8}{10}$
Head, length	$1\frac{1}{10}$
Eye, diameter	$\frac{3}{20}$
Mouth, width at back	$\frac{7}{20}$
,, length of upper jaw	1
Longest teeth	$\frac{1}{16}$
1st dorsal, distance from snout	$2\frac{8}{10}$
,, length of base	$\frac{11}{20}$
,, length of third ray	$\frac{9}{10}$
2nd dorsal, distance from snout	4
Pectorals, distance from snout	$1\frac{2}{10}$
,, length	$\frac{1}{2}$
Ventrals, distance from snout	$2\frac{3}{10}$
,, length	$\frac{4}{10}$
Anal, length of base	$1\frac{4}{10}$
,, length of third ray	$\frac{8}{10}$

Scopelus Bonapartii, Val. H. N. Poiss. xxii. 449.

Lampanyctus Bonapartii, Fauna Ital.

1st D. 14. 2nd D. rudimentary. P. 14. V. 7. A. 13.
C. III. or IV. 10+9. III. or IV. M.B. 8.

Black, the large scales reflecting purplish blue and silvery white; the fins white. There is a row of small silver spots at each side of the belly, with about four oblique rows of two or three similar spots ascending to the lateral line.

The head, compared with the length, is as 1 to 4; and the height compared with the length is as 1 to 7 nearly.

The head is somewhat compressed; it has a thin bony crest on the snout, terminating abruptly between the eyes, which are large and round. They are contained three times in the head, and are situate less than a diameter from the snout. The upper side of the orbit takes part in the outline of the head. At the antero-superior part of the orbit there is a short spine, which projects forwards. The opercular pieces are scaly, but unarmed; the opercle has an emargination above the base of the pectoral fin. The mouth is of large dimensions, and extends much beyond the eyes. Both jaws are set with minute teeth in narrow villiform bands; and there are three longitudinal rows on the tongue, separated by grooves. The upper border of the mouth is formed by the dentiferous premaxillary. The palatine bones are armed with teeth, but not the vomer. The entopterygoids carry a broad patch of minute teeth. The inside of the mouth and the gill-covers are deep black. The branchiostegal membrane has three silver blotches at each side.

The first *dorsal* fin is short, high, and placed at the middle of the back. The first two rays are short. The second dorsal fin is rudimentary. The *pectoral* fins are inserted rather below the middle of the height, and are narrow, pointed, and long, reaching back nearly to the end of the first dorsal fin, and a little beyond the vent. The abdominal *ventral* fins are inserted under the anterior part of the first dorsal, and are about as long as the pectoral fins. The *vent* is placed a little before the middle of the fish, and the *anal* fin commences just behind it. The *caudal* fin is deeply forked and tipped with black.

On the under edge of the tail there are four short stout spines, which are hooked and directed backwards; on the under edge are three similar spines*.

The *lateral line* is straight, and there are about thirty-four scales upon it.

This description has been drawn up from an individual taken in the month of November. It appears to belong to the Mediterranean species which has been described by Valenciennes under the name of *Scopelus Bonapartii*, to which, however, he assigned a fin-formula slightly differing from that of my fish, viz. 1st. D. 13. A. 13. C. 25. P. 13. V. 8. In the 'Fauna Italica' it is suggested that *S.* (*Lampanyctus*) *Bonapartii* and

* Valenciennes describes the tail of *S. Bonapartii* as having three spines above and four below.

S. Crocodilus, Val., may be the same species, but the fin-formula assigned to the latter (1st D. 20. A. 18) hardly admits of this supposition. It is not impossible, however, that the fish shortly described by Mr. Lowe, under the name of *Scopelus maderensis* (Trans. Zool. Soc. iii. p. 14) may have been an example of *S. Bonapartii.* The fin-rays were thus counted by him: 1st D. 13. A. 14. C. 15. P. 13. V. 8; but he is silent as to the spines on the tail, and the spine above the eye.

The example above described, now in the British Museum, yielded the following measurements:—

	inches.
Total length	3
Height over base of pectorals	$\frac{7}{16}$
Head	$\frac{6}{8}$
Mouth, rictus	$\frac{6}{10}$
„ width behind	$\frac{1}{5}$
1st dorsal, distance from snout	$1\frac{1}{10}$
„ length of base	$\frac{4}{10}$
Pectorals, distance from snout	$\frac{17}{20}$
„ length	$\frac{7}{10}$
Ventrals, distance from snout	$1\frac{1}{10}$
„ length	$\frac{7}{10}$
Vent, distance from snout	$1\frac{9}{20}$
Anal, length of base	$\frac{4}{10}$

Paralepis coregonoides, Risso, Hist. Nat. iii. 472.

1st D. 14. 2nd. D. adipose. P. 16. V. 8 or 9. A...... C. 18. M.B. 7.

Elongate, compressed, of a brown colour; the scales minute, cycloid. The height of the body compared with the total length is as 1 to $10\frac{1}{2}$. The head is large, being nearly one-fourth of the total length. The large oval eye is distant two diameters from the tip of the snout, and is contained about four times in the head, which is channeled between the eyes, and has two ridges converging forwards. It is unarmed, and the opercular pieces are toothless. The opercle and the scapulary bones are concentrically striate. The lower jaw is rather longer than the upper, and the mouth is slightly oblique. All the teeth are uniserial and minute; those at the sides of the premaxillary, which forms the upper border of the mouth, are alternately acute and rounded, with a cutting edge. In the lower jaw there is a single series of sharp, conical, curved teeth, larger at the sides than those of the upper jaw; and the palatines are armed with similar teeth. The tongue is spoon-shaped, and its margin carries a few small acute teeth.

The short and moderately high first *dorsal* fin is placed behind the middle of the body. The second dorsal fin is rudimentary, and placed over against the anal fin, the rays of which, being damaged in the specimen, cannot be given with certainty.

The obliquely truncate *pectoral* fins are inserted a little behind the edge of the opercle, and their length is less than half that of the head.

The abdominal *ventral* fins are placed underneath the first dorsal fin; they are not quite half as long as the pectoral fins.

The *anal* fin is higher in front; its base is about half as long as the head, and it is situate rather more than its own length behind the ventral fins. The *caudal* fin is emarginate.

Only a single specimen of this fish has occurred, and it has been sent to the British Museum. M. Valenciennes has registered *Paralepis sphyrenoides,* Risso (Hist. Nat. iii. 473) as having been taken at the Canaries; but the distinctness of that species from *P. coregonoides,* Risso, is doubtful. Bonaparte thought that they were forms of the same species; but, if distinct, he would define them thus:—

P. coregonoides, corpore extenso; maxilla breviore quam mandibula; pinna dorsali ventralibus oppositis; anali radiis 22.

1ª D. 10. 2ª D. 6, rud. P. 13. V. 1/8. A. 2/20. C. 17.

P. sphyrenoides, corpore subextenso; maxillis æqualibus; pinna dorsali ventralibus post-posita; anali radiis 30.

1ª D. 10. 2ª 3 ? rud. P. 9. V. 1/8. A. 30. C. 18.

In my specimen the anal fin is damaged, and the number of rays cannot be ascertained; in other respects it seems nearer the form named *P. coregonoides* than the other supposed species. The Mediterranean fish is said not to exceed 5 inches in length. The following measurements were taken from the fish which afforded materials for the foregoing description:—

	inches.
Total length	$7\frac{3}{8}$
Height behind pectorals	$\frac{6}{10}$
Thickness	$\frac{1}{5}$
Head	$1\frac{7}{8}$
Eye, longer axis	$\frac{9}{20}$
First dorsal, distance from snout	$4\frac{1}{5}$
„ length of base	$\frac{4}{10}$
Pectorals, length	$\frac{7}{10}$
„ distance from snout	2
Ventrals, length	$\frac{3}{10}$
Anal, length of base	$\frac{9}{10}$
„ distance from ventrals	1

Fam. **Alepocephalidæ**, Val.

Alepocephalus rostratus, Risso, Hist. Nat. iii. p. 449, f. 27; C. & V. xix. p. 465, pl. 554.

D. 16–18. P. 10–11. V. 9. A. 19–22.
C. VIII. or IX. 10+11. VIII. or IX. M.B. 6–7.

Compressed, elongate, the outlines of the back and belly nearly parallel for a considerable space and hardly beginning to approximate before the posterior portions of the dorsal and anal fins. The belly is ecarinate. The body is covered with large cycloid scales inserted in a very delicate brown skin. The scales are easily displaced, and the skin upon them has a purplish-blue or violet colour. The largest scales measure eight-tenths of an inch by five-tenths. All the fins are bluish black.

The *head* is compressed, unarmed, flat above, and covered with a soft, muciferous, scaleless skin, of a dark-indigo colour. A clear, colourless, gelatinous matter, containing dark spots, lies under this skin upon the bones. A strip of smooth scaleless skin advances upon the body from the head as far as the commencement of the lateral line. The large, nearly round eyes are lateral, but placed high up, a diameter apart. Each is contained nearly five times in the head, and is at the distance of a diameter from the snout, and two-thirds of a diameter from the nearest part of the jaw. The pupil reflects a pale-indigo colour. Below the eye the skin is marked with a few radiating ridges. In front of each eye is a pair of nostrils, the hinder one being larger. On stripping away the skin from the opercular pieces, two oblique ridges are seen on the opercle, which project at the margin as flexible spines; on the preopercle there is a vertical ridge. The snout is broad, rounded, and projecting, with a depression in the profile between its tip and the eyes. The gill-openings are large. The throat and mouth are nearly black within; tongue thick and smooth; the chin is without appendages, but has a large bony boss. The gape is wide, but the cleft does not reach beyond the vertical of the anterior margin of the eye.

The *jaws* are of equal length; the upper border of the mouth is formed partly of the premaxillary and partly of the maxillary; but the former alone carries the uniserial teeth, which are very small, conical, acute, and slightly curved. The teeth of the lower jaw are similar, but in front a few are rather larger. There is also a row of similarly shaped teeth on the palatine bones, but the vomer is unarmed. The branchiostegal rays in one specimen were six in number, in others seven. The membrane is very large.

The single short *dorsal* fin is placed far behind, over against the anal fin; its base is scaly. The first three or four rays are short; the longest rays are about equal to the diameter of the eye.

The oval *pectoral* fins have their bases covered with scales; their length is not quite twice the diameter of the eye, and they are inserted at a distance of about one-half of that diameter behind the edge of the opercle.

The *ventral* fins are shorter than the pectoral fins, and are placed about the middle of the body minus the caudal fin. The first ray is unbranched.

The *anal* fin has a base longer than the dorsal fin; five or six of its rays seem to be unbranched.

The forked *caudal* fin has a scaly base, and its lobes are of equal length.

The *lateral line* inclines gently from the vertical of the pectoral fin, and its course to the tail is uninterrupted. From fifty-two to sixty scales have been counted.

On dissection, the peritoneal lining was found to be fuscous, the coats of the cæcal stomach very thick, the pancreatic cæca from twenty-four to twenty-six in number. The intestinal tube was long and much convoluted, and the rectum had a spiral valve of seven or eight whorls. The gall-bladder was attached to the small lobe of the liver. The liver was not large, and was found lying on the left side of the stomach. There was no air-bladder. The ova formed a long yellowish mass, extending nearly the whole length of the abdominal cavity. The muscle of the body was white and firm. In several parts of the abdominal cavity, entozoa of different species were discovered, of one of which (a *Tetrarhynchus*) Dr. Baird has given a description in the Proc. Zool. Soc. for 1862, p. 115.

The systematic position of this fish amongst Malacopterygians has been much debated. By Duméril it was placed in his family of *Opisthoptères*, between *Galaxias* and *Stomias*, near *Esox* and *Belone*. Valenciennes has considered it the type of a peculiar family. Risso first described it from Mediterranean specimens. During the last two or three years several examples, varying in length from 23 to 27½ inches, have occurred at Madeira, where it is known to the fishermen under the name of "Trista-linda." They were taken in the months of January, February, and March.

The following measurements were taken from the largest example:—

	inches.
Total length	$27\frac{1}{2}$
Height behind pectorals	6
Thickness	2
Head	7
Eye	$1\frac{1}{2}$
Under jaw, length	2
Hinder nostril, length $\frac{1}{2}$ inch; width	$\frac{1}{3}$
Dorsal, length of base	3
,, ,, longest ray	$1\frac{1}{2}$
Pectorals, length	$2\frac{3}{4}$
,, distance from tip of under jaw	$7\frac{1}{2}$
Ventrals, length	$2\frac{1}{3}$
,, distance from tip of under jaw	$12\frac{1}{2}$
Anal, length of base	$4\frac{1}{3}$
,, distance from roots of ventrals	5

In a specimen 23 inches long:—

Gall-bladder, diameter	$\frac{6}{10}$
Liver, length of larger lobe	$2\frac{8}{10}$
,, width ,,	$1\frac{1}{10}$
Stomach, length	$4\frac{1}{2}$
,, width	$1\frac{1}{2}$

XXVIII.—*On Additions to the Madeiran Coleoptera.* By T. Vernon Wollaston, M.A., F.L.S.

Fam. **Carabidæ.**

Genus Trechus.

Clairville, Ent. Helv. ii. 23 (1806).

1. *Trechus minyops*, n. sp.

T. angustulo-oblongus, rufo-ferrugineus, nitidus; capite ovali, postice subcrasso, i. e. pone oculos (minutissimos, valde demissos) vix contracto, sulcis frontalibus sat profundis, curvatis; prothorace subquadrato postice vix latiore, angulis anticis subporrectis acutiusculis, posticis rectis, canaliculato, utrinque ad basin profunde impresso; elytris sat profunde subpunctato-striatis, interstitio tertio punctis duobus impresso; antennis rufo-testaceis, brevibus, apicem versus moniliformibus; pedibus testaceis.

Long. corp. lin. $1\frac{1}{3}$.

Habitat in montibus Maderæ, duobus speciminibus ad S. Antonio da Serra a Dom. Moniz detectis.

T. narrowish-oblong, being widest in the middle and about equally (though very slightly) narrowed before and behind, reddish-ferruginous, and shining (but not highly polished). *Head* oval, and with the eyes extremely small, and so completely sunken that they do not project at all beyond the curvature of the head—a fact which causes the neck to seem thick and unconstricted; with the two frontal sulci deep and much curved. *Prothorax* quadrate, though, *if anything*, perhaps a trifle wider behind than before; with the anterior angles slightly porrected and rather acute, but with the posterior ones right angles; distinctly channeled down the disk, and impressed on either side at the base with a deep unpunctured fovea. *Elytra* rather convex and somewhat deeply striated, the striæ being scarcely, or at all events most obscurely, punctured; with two very large and deep impressions on the third interstice of each. *Antennæ* rather short and rufo-testaceous, with the subapical joints rounded and moniliform. *Legs* testaceous.

In the more acute ultimate articulation of its maxillary palpi, which is extremely long and with its terminal half almost aciculated, as well as in its excessively minute eyes (which, being also completely sunken or depressed, give the head a remarkably oval and posteriorly-unconstricted appearance) and the rather short and moniliform subapical joints of its (abbreviated) antennæ, the single specimen from which the above diagnosis has been compiled might almost be regarded as *generically* distinct from the other *Trechi* which have hitherto been detected in these islands. Nevertheless it cannot be a *Trechicus* (to which I am informed by Dr. Schaum the *Trechus fimicola* of the 'Ins. Mad.' should be referred); for it has the flexuose frontal furrows and the ordinary *recurved* first elytral stria (emptying itself, as usual, into the fifth), which do *not* appear to obtain in that group; and I am compelled therefore to cite it as a *Trechus*. But, as the example now before me is unfortunately a female, I am unable to state whether the anterior male feet present anything peculiar in their mode of dilatation, whilst the fact of the specimen being unique prevents me from dissecting it in order to observe the exact structure of its lower lip; so that, until further material is obtained, I would desire to assign it to this genus merely provisionally.

Assuming it, however, to be a true *Trechus*, it may at once be known by its somewhat narrow oblong outline and pale rufo-ferruginous hue, by its extremely diminutive eyes and *square* prothorax, and by its rather short and submoniliform antennæ. In general facies, indeed, it has a good deal in common with the *T. quadricollis* (hitherto unique); but its much smaller bulk and different antennæ and eyes will easily separate it from that insect.

It is to Senhor Moniz that we are indebted for the discovery of the *T. minyops*,—two specimens, one of which he has kindly presented to the collection of the British Museum, having been taken by him at S. Antonio da Serra.

Fam. **Colydiadæ.**

Genus Tarphius.

(Germar) Erichs., Nat. der Ins. Deutschl. iii. 256 (1848).

2. *Tarphius angustulus*, n. sp.

T. angustus, rufo-piceus (vel piceo-ferrugineus), fere calvus (oculo fortissime armato minute et parce fulvo-cinereo pubescens); prothorace elongato, postice gradatim et leviter angustiore, ad latera oblique subrecto, granulis maximis depressis obsito; elytris parallelis, minus sculpturatis, nec nodosis nec carinatis, concoloribus; antennis pedibusque vix clarioribus.

Long. corp. lin. 1.

Habitat in montibus Maderæ australis, in castanetis supra urbem Funchalensem a Dom. Moniz repertus.

T. small and narrow, rufo-piceous or piceo-ferruginous, almost free from scales and setæ, though, under a high magnifying power, sparingly studded with an exceedingly short cinereous or fulvo-cinereous pubescence. *Prothorax* elongate, being widest anteriorly (where it is rather broader than the elytra), but gradually and regularly (but not very greatly) narrowed behind; with the front angles much porrected and acute, and therefore with the emargination deep; broadly flattened at the sides, especially in front, but convex on the disk, and with an impressed transverse line just before the extreme base; beset with excessively large and depressed granules. *Elytra* with the sides quite parallel; very lightly sculptured (particularly behind), and altogether free from both nodules and ridges; also concolorous, there being no indication of paler blotches. *Antennæ* and *legs* of a slightly clearer hue.

This is one of the most distinct of all the *Tarphii* which have yet been detected,—its small size (for it is scarcely, if at all, larger than the *T. Lowei*) and narrow outline, combined with its rufo-ferruginous hue, its elongate prothorax (which is obliquely straight at the sides, and *regularly narrowed* posteriorly), its very lightly sculptured, *parallel, concolorous* elytra, and its almost total freedom (except under a high magnifying power) from pubescence or setæ giving it a character which it is impossible to mistake. In spite of its diminutive bulk and *comparatively* unroughened surface, I am inclined to think that it has perhaps a greater affinity with the *T. parallelus* than with any other species hitherto described.

The *T. angustulus* is also due to the researches of Senhor Moniz, who lately discovered three or four examples of it in the chestnut-woods at the Mount, above Funchal; one of which he has presented to the British Museum collection. This addition to the fauna is extremely interesting, since it raises the species of *Tarphius* which have now been brought to light *in the Madeiran archipelago alone* to no less a number than twenty. So that, with the nine Canarian ones and the *T. gibbulus* from Sicily, there are exactly thirty *Tarphii* now on record!

Fam. **Cryptophagidæ.**

Genus Leucohimatium.

Rosenhaur, Die Thiere Andalus. 179 (1856).

3. *Leucohimatium elongatum.*

L. fusco-ferrugineum, albido pubescens; capite prothoraceque sat parce punctatis, hoc subquadrato postice paulo angustiore, angulis anticis oblique incrassatis, ad latera minutissime crenulato, basi utrinque foveola obscura punctiformi notato; elytris subtiliter striato-punctatis, interstitiis uniseriatim punctulatis.

Long. corp. lin. $1\frac{1}{3}$.

Habitat supra urbem Funchalensem; specimina duo nuper detexit Dom. Anderson.

Paramecosoma elongata, Erichs., Nat. der Ins. Deutschl. iii. 371 (1848).
Leucohimatium angustum, Rosenh., Die Thiere Andal. 179 (1856).

L. narrow, parallel, brownish-ferruginous, and clothed (though not very densely) with a white, robust, decumbent pile. *Head* and *prothorax* punctured: the *latter* subquadrate and a little narrowed posteriorly, with the anterior angles obliquely incrassated, with the sides very minutely crenulated, and with a small punctiform impression on either side behind, at the extreme base. *Elytra* finely striate-punctate; the interstices with a series of very minute punctules down each. *Limbs* scarcely paler than the rest of the surface.

Two examples of this insect, which is found sparingly throughout southern (and even central) Europe, and which I have myself captured in the island of Palma of the Canarian group, were detected, during the spring of the present year, by Mr. F. A. Anderson, who found them in a grassy spot by the side of a small footpath which leads into the S^ta^ Luzia ravine below the church of San Roque. One of these specimens Mr. Anderson has kindly presented to the collection of the British Museum.

Fam. **Lathridiadæ.**

Genus Metophthalmus.

Wollaston, Ins. Mad. 192. tab. iv. f. 4 (1854).

4. *Metophthalmus sculpturatus*, n. sp.

M. subovalis, rufo-ferrugineus; capite prothoraceque inæqualibus, illo in fronte obsolete binodoso necnon utrinque costato; elytris paulo obscurioribus, valde profunde seriatim punctatis, punctis maximis, interstitiis alternis paulo elevatis, irregulariter subundulatis; antennis brevibus pedibusque paulo clarioribus.

Long. corp. lin. $\frac{1}{2}$–$\frac{2}{3}$.

Habitat in montibus Maderæ; sub cortice *Platani* laxo supra urbem Funchalensem Dom. Bewicke sat copiose reperit.

M. oval, rufo-ferruginous, with the elytra a shade darker. *Head* with two very obscure elongate nodules in the centre of its forehead, and with two raised costæ (as in the *M. asperatus*) on either side, arising from the inner and outer margins of the eye (which they consequently enclose) and continued forwards, gradually approximating until they reach the insertion of the antennæ, where they join. *Prothorax* very uneven, as in the *M. asperatus,* but a little less developed than is the case in that insect. *Elytra* very deeply seriate-punctate, the punctures, especially those towards the suture, being enormous, and so closely packed together that the interstices (the alternate ones of which are slightly raised) appear irregular or minutely undulated. *Antennæ* and *legs,* the former of which are short, rufo-testaceous.

In its 10-articulated antennæ this little *Metophthalmus* agrees almost exactly with the *M. asperatus,* except that they are altogether rather shorter—caused by the joints between the minute conical third one and the club being (as in the *M. exiguus*) more abbreviated or moniliform, and the first joint of the clava itself being rather less developed. In the construction of its eyes and feet, and in the singular position of the former, no less than in the serrated margins of its head, prothorax, and elytra, it is identical with that insect. Its main differences lie in its smaller size and more elliptic outline, in its more ferruginous hue, in its less apparent inner frontal costæ (or elongated nodules), and in its very much larger elytral punctures, which are so enormous and closely packed together as to cause the slightly raised alternate interstices to appear less straightened and costate, or more undulated and irregular. From the *M. exiguus* it may immediately be known by (*inter alia*) its larger size and relatively broader outline, and by the darker colour and immensely larger punctures of its elytra.

It is to Mr. Bewicke that we are indebted for this interesting addition to the fauna, several specimens of it having been captured by him from beneath the dead bark of Plane-trees in the grounds of the Palheiro, on the mountains to the eastward of Funchal. Mr. Bewicke has presented me with types; and he has also placed others in the British Museum, as well as in the collection at Oxford.

Fam. Histeridæ.

Genus Eutriptus.

Wollaston, Trans. Ent. Soc. Lond. ser. 3. i. 157 (1862).

The addition of the present genus to our Catalogue, through the recent researches of Mr. Bewicke, is a most important one, as supplying another link of union between Madeira and the Canaries, and that, too, in a most significant manner—through their Euphorbian faunæ. The little insect for the reception of which I lately established the group, I believe to be *universal*, in decayed *Euphorbia*-stems, throughout the Canarian archipelago, though hitherto I happen to have met with it in only five out of the seven islands; and it is interesting therefore to find it, under precisely similar circumstances, at Madeira also. After compiling its generic diagnosis, in my paper above alluded to, I stated that "amongst the forty-four groups of the *Histeridæ* so elaborately enunciated in De Marseul's Monograph, there is certainly nothing which approaches the present one in its most distinctive features. Indeed, its 6-jointed funiculus would of itself suffice to characterize it; for the only known form in which this particular number of joints (or, in fact, *less than seven*) prevails, in that portion of the antennæ, is *Monoplius* (of which hitherto but a single exponent has been detected), from the Cape of Good Hope—an insect widely different from *Eutriptus* in the other details of its structure. Its various peculiarities will be easily gathered from the diagnosis; nevertheless I may just add that its two most anomalous ones (apart from its funiculus) are the formation of its inner maxillary lobe and of its anterior tibia, the former of which is curiously uncinated at its apex (the outer margin being thickened into a narrow rim, which merges into an obtusely curved hook at the tip), whilst the latter has its inner apical angle produced into a long and acute spine, which, being outwardly directed, gives that portion of the leg a very singular appearance."

5. *Eutriptus putricola.*

E. cylindrico-oblongus, subconvexus, aterrimus, politissimus; capite prothoraceque minutissime et obsolete punctulatis; elytro utroque striis duabus obscuris humeralibus obliquis, duabus sublateralibus integris, quatuor levioribus discalibus interruptis remote punctatis plus minus obsoletis et una suturali antice evanescenti notato; antennis testaceis, ad basin pedibusque piceis.

Long. corp. lin. $1-1\frac{1}{4}$.

Habitat Maderam, rarissimus; in ramis Euphorbiarum emortuis ad Portum Novum crescentium a Dom. Bewicke nuperrime repertus.

Eutriptus putricola, Woll., Trans. Ent. Soc. Lond. (3rd series) i. 159, pl. 7. f. 7 (1862).

E. cylindrical-oblong, deep black, and exceedingly shining. *Head* and *prothorax* most minutely and obsoletely punctulated: the *former* with the forehead depressed and the frontal line entire; the *latter* very narrowly margined at the sides, with the *prosternal lines* almost parallel, or very slightly approximating at about their middle point. *Meso-* and *meta-sterna* impunctate; the former deeply excavated anteriorly, and with the line within its front and lateral margins continuous. *Elytra* each with two very obscure oblique humeral striæ; with two sublateral ones, deeper and almost entire; with four much lighter, remotely punctured, and more or less abbreviated ones on the disk; and with a deeper sutural one, evanescent anteriorly at about a third of the distance from the scutellum. *Antennæ* testaceous; their *scape* and the *legs* piceous: the *last* with their *anterior tibiæ* curved and dilated, with three small anguliform teeth along their outer edge, and with their *inner* apical angle produced into an elongate, curved, outwardly directed spine.

Four examples of this insect were captured by Mr. Bewicke from out of the rotten branches of Euphorbias, which he obtained from Porto Novo, a few miles to the eastward of Funchal, during June of the present year. Although locally abundant at the Canaries in similar situations, there is no reason to suspect that it is anything but exceedingly rare in Madeira; for in a letter received lately from Mr. Bewicke, he states,—"I had a man's load (a sackful) of *Euphorbia*-stems from Porto Novo, and although the very first stick I examined produced me four specimens of this new member of the *Histeridæ,* the whole sack contained no more." Two of these Mr. Bewicke sent me for inspection, one of which he has presented to the collection of the British Museum, and the other to the Madeiran cabinet at Oxford.

[To be continued.]

XXIX.—*On the Animal and Affinities of the Genus* Alaba, *with a Review of the known Species, and Descriptions of some new Species.* By Arthur Adams, F.L.S., &c.

This group of Laminarian Mollusca, which seems to represent the pelagian genus *Litiopa,* was first recognized by my brother and myself in our 'Genera of Recent Mollusca.' We then considered it a subgenus of *Cerithiopsis*; but having had an opportunity in Japan of observing the living animal, I find it most nearly resembles *Litiopa*. Dr. P. P. Carpenter, who also perceived the existence of the group, named it *Tuberia*, indicating its relationship with *Litiopa*.

In MM. Eydoux and Souleyet's figure of *Litiopa melanostoma* in the 'Voyage of the Bonite,' the side of the foot is represented as bearing four tentacular filaments, which induced Dr. Gray, in his 'Guide,' to establish the subfamily Litiopinæ in the family *Planaxidæ*. In *Alaba picta*, A. Ad., the animal is semipellucid white, delicately reticulated with red-brown lines. The tentacles are filiform, obtuse at the tips, ringed with red-brown, and flecked with opake white. The right tentacle is considerably longer than the left. The eyes are on flattened lobes at the outer bases of the tentacles. The foot is narrow, auriculate on each side in front, the auricles being linear and recurved. The operculigerous lobe is furnished with four long tentacular filaments, the anterior two of which, when the animal is crawling or swimming, are extended on each side, and the posterior two, a little diverging, are directed backwards. This species lives in two-fathoms-water sandy mud, in which grows a profusion of *Zostera*. It is rather common between Tatiyama and the islet named Takano-Sima, on the west coast of Niphon.

The head, when the animal is in motion, is concealed by the shell, and the eyes are visible through the transparent edge. The creature spins, with great rapidity, a pellucid thread from a viscous secretion emitted from a gland near the end of the tail, and swims, shell downwards, at the surface of the water. When fatigued, it suspends itself, apex downwards, by means of the glutinous thread, which is attached to the surface of the water.

Thus we find that *Alaba picta* agrees in its habits with the account given by Sander Rang of his genus *Litiopa*, from which genus indeed, as Dr. P. P. Carpenter has remarked, *Alaba* differs in the "want of Achatinoid truncation of the base."

I find the species very naturally arrange themselves into three subgeneric groups:—1. *Alaba*, s. str., or the Litiopoid forms; 2. *Diala*, or the Cinguloid forms; and, 3, *Styliferina*, or the Styliferoid forms.

Genus Alaba, H. & A. Ad.

Testa Litiopoidea, ovato-conica seu elongata, subdiaphana; anfractibus plicatis seu varicosis, vertice submamillato. Apertura ovata, labio sæpe vix truncato.

1. *Alaba tervaricosa*, C. B. Ad.

Cingula tervaricosa, C. B. Ad.

Hab. West Indies.

2. *Alaba melanura*, C. B. Ad.

Cingula melanura, C. B. Ad.; *Cing. præusta*, Récluz.

Hab. West Indies.

3. *Alaba puncto-striata*, Gould.

Otia Conch., p. 144.

Hab. Loo-Choo Islands.

4. *Alaba supralirata*, Cpr.

Cat. Mazat. Moll. p. 366.

Hab. Mazatlan.

5. *Alaba violacea*, Cpr.

Cat. Maz. Moll. p. 367.

Hab. Mazatlan.

6. *Alaba terebralis*, Cpr.

Cat. Maz. Moll. p. 367.

Hab. Mazatlan.

7. *Alaba alabastrites*, Cpr.

Cat. Maz. Moll. p. 368.

Hab. Mazatlan.

8. *Alaba conica*, Cpr.

Cat. Maz. Moll. p. 368.

Hab. Mazatlan.

9. *Alaba scalata*, Cpr.

Cat. Maz. Moll. p. 368.

Hab. Mazatlan.

10. *Alaba mutans*, Cpr.

Cat. Maz. Moll. 369.

Hab. Mazatlan.

11. *Alaba picta*, A. Ad.

Diala picta, A. Ad., Annals, 1861.

Hab. Takano-Sima.

12. *Alaba leucosticta*, A. Ad.

Diala leucosticta, A. Ad., Annals, 1861.

Hab. Tabu-Sima.

13. *Alaba cornea*, A. Ad.

Diala cornea, A. Ad., Annals, 1861.

Hab. Awa-Sima; Takano-Sima.

14. *Alaba vibex*, A. Ad.

A. testa ovato-conica, tenui, semipellucida, lutescente, albivaricosa, lineis rufis articulatis concinne picta; anfractibus 6, convexis, transversim sulcatis, varicibus validis, lacteis, irregularibus instructis; apertura ovata; labio arcuato, antice subtruncato; labro margine acuto.

Hab. Sharks' Bay, Australia.

This, for the genus, is a large and showy species, with conspicuous white varices, and with the whorls very prettily marked with interrupted or dotted red-brown lines.

15. *Alaba pulchra*, A. Ad.

A. testa ovato-conica, tenui, semiopaca, sordide alba, maculis, punctis, flammulis longitudinalibus lineisque rufis transversis ornata; anfractibus 7, planis, subimbricatis, ad suturas plicato-nodosis; apertura ovata; labio tenui, arcuato, non truncato; labro simplici, acuto.

Hab. Port Adelaide. T. Angas, Esq.

A handsomely-painted species, with the whorls nodosely plicate at the sutures.

16. *Alaba Blanfordi*, A. Ad.

A. testa acuminato-conica, tenui, cornea, rufo obsolete strigosa; anfractibus 6, transversim sulcatis, longitudinaliter valde plicatis, suturis impressis, anfractu ultimo ad peripheriam subangulato; apertura ovata, antice producta; labio rufo tincto, vix tortuoso.

Hab. Siam. W. T. Blanford, Esq.

A small sulcate species, with plicate whorls.

17. *Alaba monile*, A. Ad.

A. testa elongato-conica, alba, maculis rubris, in serie moniliformi dispositis, in medio anfractuum ornata; anfractibus 6, planis, imbricatis, longitudinaliter nodoso-plicatis; apertura ovata; labio regulariter arcuato; labro margine in medio obsolete angulato.

Hab. Port Lincoln. W. Metcalfe, Esq.

A very pretty white species, ornamented with a necklace-like row of red spots in the middle of the whorls.

18. *Alaba zebrina*, A. Ad.

A. testa ovato-conica, tenui, imperforata, alba, lineis undulatis longitudinalibus rufescentibus ornata; anfractibus $6\frac{1}{2}$, planis, transversim valde et regulariter sulcatis, interdum longitudinaliter obsolete varicosis, suturis impressis, serie macularum instructis; apertura ovata, antice subproducta; labio flexuoso; labro margine simplici, acuto.

Hab. Tsu-Sima.

This species was also obtained by Mr. Cuming in the Philippines. It is very prettily marked with undulating red-brown longitudinal stripes.

19. *Alaba pagodula*, A. Ad.

A. testa elato-conica, tenui, alba, lineis transversis rufis interruptis, in medio anfractuum dispositis, et flammulis longitudinalibus undulatis, ad suturas, ornata; anfractibus planis, imbricatis, in medio nodoso-plicatis, superne et inferne lævibus; apertura ovata, antice producta et subacuminata; labio simplici, arcuato.

Hab. St. Vincent's Gulf. T. Angas, Esq.

This is a very charming species, shaped like a little pagoda, and adorned with red-brown markings. The whorls are encircled in the middle with a series of plicate nodules.

20. *Alaba imbricata*, A. Ad.

A. testa elato-conica, subturrita, semiopaca, alba, hic et illic sparsim rufo tincta; anfractibus 7, planatis, imbricatis, longitudinaliter plicatis, plicis variciformibus, distantibus, transversim sulcatis; apertura subcirculari; labio tenui, arcuato; labro vix effuso, margine subincrassato.

Hab. O-Sima.

A very pretty species, with plicate imbricate whorls.

21. *Alaba felina*, A. Ad.

A. testa ovato-conica, solida, diaphana, flammulis rufescentibus obliquis longitudinalibus picta; anfractibus 5, planis, lævibus; apertura subquadrata; labio rectiusculo; labro intus subincrassato.

Hab. Takano-Sima.

A solid, diaphanous species, with tiger-like, reddish stripes on the whorls.

22. *Alaba lucida*, A. Ad.

A. testa elato-conica, subturrita, solidula, diaphana; anfractibus $6\frac{1}{2}$, planiusculis, subimbricatis, lævissimis, basi spiraliter striata; apertura ovata, antice producta et effusa; labro margine subincrassato.

Hab. Takano-Sima.

A solid, somewhat turreted, pellucid species.

23. *Alaba inflata*, A. Ad.

A. testa ovato-conica, cornea, tenui, subdiaphana, apice violaceo; anfractibus $4\frac{1}{2}$, planiusculis, transversim tenuissime striatis, anfractu ultimo magno, inflato; apertura ovata, antice subangulata; labio arcuato; labro margine tenui.

Hab. O-Sima.

A thin, ventricose, horn-coloured, ovately conical species.

24. *Alaba subangulata*, A. Ad.

A. testa ovato-conica, tenui, viridula, lineis transversis rufescentibus interruptis, et maculis rufescentibus irregularibus, ad suturas, ornata; anfractibus planiusculis, transversim crebre sulcatis, ultimo ad peripheriam subangulato; apertura quadrato-circulari, antice producta et effusa; labio tenui, recto; labro margine, in medio, obtusim angulato.

Hab. Tsu-Sima; 16 fathoms.

A thin species, with subangular periphery, most nearly resembling *A. picta.*

Subgenus Diala, A. Ad.

Testa Cinguloidea, vitrea, subopaca, transversim striata vel sulcata; anfractibus non varicosis, vertice subacuto. Apertura ovata; labio antice non truncato.

1. *Diala varia*, A. Ad.

Annals, 1861.

Hab. Awa-Sima; Takano-Sima; Tanabe.

2. *Diala suturalis*, A. Ad.

Monoptygma suturalis, A. Ad., Sow. Thesaur. Mon. Monopt. pl. 172. figs. 31, 33.

Hab. Philippines; Port Adelaide.

3. *Diala sulcifera*, A. Ad.

D. testa ovato-conica, alba, rufa aut fusca, interdum variegata; anfractibus 5, convexis, transversim sulcatis, sulcis impressis, regularibus, suturis profundis; apertura oblonga; labio arcuato, sæpe rufo tincto; labro margine crenulato.

Hab. O-Sima; Tanabe.

This is a smaller and more ovate species than *D. varia*, with the whorls transversely deeply sulcate. It occurs in the Laminarian zone, in the society of *D. varia.*

4. *Diala rufilabris*, A. Ad.

D. testa elato-conoidali, spira attenuata, lævi, solida, polita, straminea, peritremate aurantiaco; anfractibus $7\frac{1}{2}$, planis, simplicibus, ultimo ad peripheriam obtusim angulato; labio incrassato; labro margine subincrassato.

Hab. Port Lincoln. Coll. Cuming.

A simple, conical, straw-coloured species, with an orange-coloured peritreme.

5. *Diala lauta*, A. Ad.

D. testa elevatim conica, albida, lineis rufis interruptis transversis ornata; anfractibus 7, planis, transversim sulcatis, suturis exaratis, anfractu ultimo ad peripheriam subangulato, basi convexo valde concentrice sulcato; apertura ovata; labio arcuato, simplici.

Hab. Port Adelaide.

This species is not uncommon in shell-sand from Australia.

Subgenus Styliferina, A. Ad.

Testa Styliferoidea, diaphana, turrito-conica; anfractibus lævibus, convexis; vertice mucronato. Apertura subquadrata; labio recto.

I first made known this form of *Alaba* in the 'Annals' for 1860, where it is considered to belong to Styliferidæ; the nucleus, however, shows it to be a subgenus of *Alaba*.

1. *Styliferina orthochila*, A. Ad.

Annals, 1860.

2. *Stylifera goniochila*, A. Ad.

S. testa ovato-turrita, tenui, vitrea, pellucida, maculis lacteis, in serie unica dispositis, in medio anfractuum ornata; anfractibus 9, convexis, suturis marginatis, anfractu ultimo rotundato; apertura subquadrata; labio recto, antice in angulum desinente.

Hab. Mino-Sima; Tanabe; O-Sima.

I have improved my original description, having obtained better specimens.

3. *Styliferina lepida*, A. Ad.

S. testa tenui, lactea, semiopaca, polita, nitida; anfractibus convexis, suturis impressis, anfractu ultimo ad peripheriam rotundato; apertura suborbiculari, antice integra; labio arcuato.

Hab. Yobuko.

A small, polished, white species with an elevated spire.

XXX.—*On an apparently undescribed Spider from Cochin China.* By Dr. Albert Günther.

[Plate VIII. fig. A.]

Cyphagogus Mouhotii. (Plate VIII. fig. A.)

Cephalothorax subovate, covered with fine, short, dense hairs, with a transverse groove between cephalic and thoracic portion, and with a deep impression in the middle of the upper surface of the latter.

Eyes eight, unequal in size, disposed thus ·.::.· ; the four middle occupy a slight protuberance in front of the cephalothorax, whilst the lateral are the smallest and situated on the side of its anterior part.

Falces articulated vertically, rather compressed, with a non-denticulated claw of moderate size at their extremity; the claw is received in a sheath at the lower end of the falces, the edges of the sheath being provided with some horny spines of unequal size. Maxillæ flat; the outer margins of both together form a card-like figure; their lower extremity is hairy; sternal lip between the maxillæ, elongate-elliptical. Sternum ovate, covered with rather coarse hairs. Palpi of moderate length; the terminal joint is rather longer than the two preceding together, and armed with a minute non-pectinated claw.

Legs rather robust, tapering, very unequal in length, the two anterior being nearly equally long, but much longer than the two posterior; the fourth is longer than the third; each is armed with a pair of minute claws.

Abdomen club-shaped, anteriorly produced into a very long, thin, cylindrical process, which is twice bent, so that its basal half is leaning backwards on the back of the abdomen, whilst its terminal half is directed upwards and forwards, terminating in a slight cuneiform swelling; this singular appendage is covered with a leathery, fine hairy skin, like the lower parts of the abdomen. The cephalothorax being united with the abdomen at no great distance from the spinners, the anterior portion of the abdomen, with its appendage, is situated vertically above the thorax. The abdomen is nearly smooth above, and covered with very fine hairs below; it terminates in an obtuse point directed upwards.

Six spinners in a quadrangular group immediately before the vent; the anterior and posterior pair are of moderate size; the third pair is very short, and situated between the posterior spinners.

Two branchial opercula; tracheal opercula absent.

Dimensions.	lines.
Length of cephalothorax	4
„ abdomen to the first bend of the appendage	12
„ appendage from its first bend	10
„ falces	$1\frac{1}{3}$
„ palpus	$4\frac{1}{3}$
„ terminal joint of palpus	$1\frac{2}{3}$
„ first leg	16
„ second leg	$16\frac{1}{3}$
„ third leg	9
„ fourth leg	$10\frac{1}{2}$

Colour brownish yellow; extremities of the legs and of abdominal appendage and sternum blackish brown; upper parts of the abdomen yellow; two black bands round the femur of the first leg.

A single female specimen of this spider was obtained by the late M. Mouhot in the Lao Mountains of Cochin China. Its form is so extraordinary, that we have not hesitated to refer it to a new genus, *Cyphagogus*.

XXXI.—*Some Remarks on the Genus* Trachinus. By Dr. Albert Günther.

[Plate VIII. figs. B, C, D.]

The different species of Weevers (*Trachinus*) have lately been re-examined by Dr. P. v. Bleeker*, who, having paid attention to several characters not mentioned in the works of previous writers, considers them as important enough to split that Linnean genus into three. The characters on which the new divisions are founded are the following:—

1. Armature of the head.
2. More or less oblique direction of the cleft of the mouth.
3. More or less scaly covering of the cheek.
4. Smooth or ciliated edge of the lips.
5. Presence or absence of pterygoid teeth.
6. A single or double lateral line.

Whilst the three former of those characters have been used by other ichthyologists for distinction of the species, M. Bleeker has the merit of having added the three latter: attaching, however, a generic value to them, he distinguishes three genera, characterized as follows:—

1. *Trachinus.*

Caput vertice granulis scabrum. Orbita antice spinis armata. Maxilla superior usque ante oculum adscendens. Squamæ genis sessiles multiseriatæ. Labia simplicia, nec fimbriata nec papillata. Dentes pterygoidei. Oculi obliqui, subverticales. Præoperculum aculeatum. Linea lateralis simplex.

The following species are referred to this division: *T. armatus,* L., *T. araneus,* C. & V., *T. armatus,* Schl., *T.* (?) *cornutus,* Guich.

2. *Pseudotrachinus.*

Caput vertice granulis e centris radiantibus scabrum. Orbita antice spinis armata. Maxilla superior non usque ante oculum adscendens. Spinæ suborbitales sursum spectantes. Squamæ genis sessiles multiseriatæ. Labia simplicia, nec fimbriata nec papillata. Dentes pterygoidei nulli. Oculi obliqui, subverticales. Præoperculum non aculeatum. Linea lateralis simplex.

This division is founded on *T. radiatus,* C. & V., and on *Pseudotrachinus pardalis,* Blkr.

3. *Echiichthys.*

Caput vertice non granosum. Orbita ubique lævis. Maxilla superior usque ante oculum adscendens. Spinæ suborbitales nullæ. Squamæ genis parvæ, deciduæ. Labia papillata vel fimbriata.

* Ann. Scienc. Nat. Paris, 1861, p. 375.

Dentes pterygoidei nulli. Oculi obliqui, subhorizontales. Præoperculum aculeatum. Linea lateralis duplex.

T. vipera, C. & V.

It is not my intention to question for a moment the merits of a division by which, at all events, the determination of those six or seven species is facilitated; but I shall be satisfied with directing attention to the following points which occurred to me during the arrangement of the specimens of *Trachinus* which have been added to the British Museum Collection in the course of the two last years.

1. *Trachinus araneus* was known to me only from the dried skin of a half-grown specimen. The British Museum has lately received a fine large specimen from Cannes (South of France). This species has no pterygoid teeth; the maxillary extends upwards to before the orbit; the cheeks are entirely naked; and the præoperculum is provided with the same feeble spines which are observed in the common Weever (*T. draco*). Therefore this species cannot be referred to *Trachinus*, Blkr., from which it differs in two characters, nor to *Pseudotrachinus*, Blkr.; and unless the diagnoses of those two genera are essentially altered, we shall have to propose a fourth genus for this Weever.

2. The presence of a second (lower) lateral line, attributed to the genus *Echiichthys*, will require further confirmation. Dr. Bleeker says distinctly that it is not a simple "dépression intermusculaire." If we understand by lateral line a canal in the integuments of the body, which is the continuation of the muciferous channels of the head, opening by equidistant pores, I may say that such a second lateral line is not present in *Trachinus vipera*. It appeared to me to be a depressed line, produced by the insertion of a long, thin, flat muscle, the fibres of which descend obliquely forwards to the base of the anal fin; its function is to depress the rays of the anal fin. The line does not extend forward on to the trunk. I could not detect any pores, although I have examined British and Dutch specimens, the latter being sent by Dr. v. Bleeker to the British Museum.

3. In the second volume of the 'Catalogue of Fishes' (p. 234), I have described a Weever from the West Coast of Africa, which differed from the European *T. draco* in the stronger armature of the head, and in the less elongated body. Notwithstanding, I preferred describing it as a variety, seeing that some specimens from the Canary Islands also showed a stronger armature of the head than is usually found in specimens from Northern Europe, although their body is elongate as in the true *T. draco*. Dr. Bleeker has recognized this African Weever in two other specimens in the Leyden Museum, where

they had been named *T. armatus*, Schleg. He does not hesitate to consider it as a species constantly differing from *T. draco* in the ray-like arrangement of the granules on the crown of the head, and in having the interorbital space more concave, the orbital spines stronger, and the bands of pterygoid teeth broader.

Those observations, as regards *T. armatus*, are fully confirmed by an examination of the specimen in the British Museum, which, probably, originates from the same source as those in the Leyden Museum. But if we attach (in this case) specific value to the characters mentioned, I am afraid that the species *T. draco* will share a fate similar to that of the genus *Trachinus*. The following are my observations on specimens *from different localities*:—

a. A specimen from the coast of Guinea, 7 *inches long* (*T. armatus*).—The height of the body is contained $5\frac{1}{2}$ times in the total length. The granules on the crown of the head radiate from centres; interorbital space very narrow and concave; spines before the orbit strong. L. lat. 75. Band of pterygoid teeth 8 mill. long, and $1\frac{2}{3}$ mill. broad. (Pl. VIII. fig. B.)

b. A specimen from the island of Gomera, $9\frac{1}{2}$ *inches long*.—The height of the body is contained $6\frac{1}{2}$ times in the total length. The granules on the crown of the head radiate from centres; interorbital space not very narrow, and moderately concave; spines before the orbit rather strong. L. lat. 85. Band of pterygoid teeth $10\frac{1}{2}$ mill. long, and $1\frac{1}{4}$ mill. broad. (Pl. VIII. fig. C.) (A specimen from Lanzarote possesses the same characters.)

c. A specimen from Cannes, 8 *inches long*.—The height of the body is contained $6\frac{1}{2}$ times in the total length. The granules on the head are not arranged in rays; interorbital space not very narrow, and moderately concave; spines before the orbit rather feeble. L. lat. 85. Band of pterygoid teeth $8\frac{1}{2}$ mill. long, and $1\frac{1}{4}$ mill broad.

d. A specimen from Båhuslän (*Sweden*), 11″ *long*. The height of the body is $\frac{1}{7}$th of the total length. The granules on the head are not arranged in rays; interorbital space not very narrow, and but little concave; spines before the orbit short and obtuse. L. lat. 85. Band of pterygoid teeth $11\frac{1}{2}$ mill. long, and 1 mill. broad. (Pl. VIII. fig. D.)

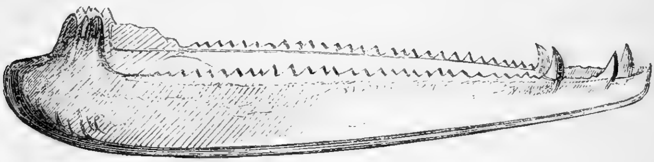
Thus we see that the characters on which *T. armatus* is founded are subject to not inconsiderable variation; but it differs from all the specimens, even from those from the Canary Islands, in having a shorter body and tail. I was in hopes of finding a corresponding decrease in the number of the caudal vertebræ, which at once would have settled the question of its specific distinctness, inasmuch as in those families of fishes which have the tail elongate, and the caudal portion of the vertebral column composed of more than fourteen vertebræ, the number of caudal vertebræ is less in the species with the shorter tail. *Trachinus draco, T. araneus,* and *T. vipera* have respectively 30–31, 29, and 25 caudal vertebræ, according to the length of their tail. *Cottus scorpius* and *C. bubalis,* the different species of *Solea,* &c., are examples of the same kind. But in *T. armatus* the shortness of the body is not accompanied with, or produced by, a smaller number of vertebræ: it has forty-one vertebræ, thirty of which belong to the caudal portion; or, in other words, it completely agrees in this respect with *T. draco.*

XXXII.—*Note on the Discovery of an extremely minute Vertebrate Lower Jaw in Mud dredged at St. Helena.* By Dr. Wallich, F.L.S.

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

Gentlemen,

I beg herewith to enclose a sketch of the jaw of a vertebrate animal, detected by me, a few days ago, in a slide containing a specimen of muddy deposit dredged up at St. Helena, in 1857, in 30 fathoms water, and mounted by me in Canada balsam at the time it was obtained.



The jaw and teeth are fully developed and perfect, there being nothing in the aspect of either to indicate their having formed portions of a creature in a fœtal condition.

The extreme length is $\frac{1}{100}$ inch; so that, assuming the body to have been five times as long as the jaw, we have here evidence of the existence of a vertebrate animal measuring only $\frac{1}{20}$ inch in length—a size considerably below that of many of the organisms usually regarded as microscopic.

I have not had time hitherto to enter into a detailed examination of this most interesting specimen, but shall do myself the pleasure of communicating further particulars regarding it at an early opportunity.

I remain, Gentlemen,
Your most obedient Servant,
G. C. Wallich.

17 Campden Hill Road, Kensington.
Sept. 21, 1862.

BIBLIOGRAPHICAL NOTICE.

The Natural History of the Tineina. By H. T. STAINTON; assisted by Prof. ZELLER, J. W. DOUGLAS, and Prof. FREY. 8vo, Vols. IV. to VII. London, Van Voorst, 1859–1862.

As several years have elapsed since we announced the appearance of the first volume of this important entomological work, and described its general characters, it may perhaps not be amiss to refresh our readers' memories upon these points. Mr. Stainton's object in the 'Natural History of the Tineina' is not only to describe the insects of that group and to unravel their synonymy, neither of which are very easy tasks, but also to furnish a full account of their natural history. With this view the species of each genus are brought together as much as possible, in face of the difficulty of always ascertaining the entire history of the allied species; the appearance of each species in its different states, its habits, and mode of life are described in detail; the times of its making its appearance, both in the larval and in the perfect form, are indicated; its geographical distribution in this country and on the Continent is given; and, finally, its synonymy is fully discussed. In the general remarks on each genus of which the species are noticed, we find the structural characters of the insects in their different stages, followed by a general view of the habits of the species of the genus, their number and distribution. In each genus the author gives a list, often in a tabular form, of all the known species, together with a classified catalogue of the food-plants of all their known larvæ, appending to each plant the names of the species which feed upon it. The generic details are closed by a literary history of the genus, showing the gradual progress of our knowledge of the species and their habits. So much for the general plan of the work, which is executed with a degree of conscientious care and an evident striving after perfection such as are unfortunately rare in the productions of our English entomologists. Its value to the student of the Lepidoptera is greatly increased by the beautiful plates with which it is illustrated: each of these contains figures of the larvæ and perfect insects of three species, accompanied by representations of the leaves of the plants as eaten by the larvæ, and of the cases in which some of them dwell and undergo their transformations. The earlier plates were drawn and lithographed by the late Mr. W. Wing, whose early and lamented death deprived entomologists of one of their most talented artists; the subsequent illustrations have been drawn and engraved with equal accuracy and elegance by Mr. E. W. Robinson, and in the way of entomological figures they leave little or nothing to be desired.

There is one curious feature in the book, to which we adverted at some length on its first appearance, namely, that the text (which, we may observe, is given gratuitously, the work being published at the cost of the plates) is in four languages—English, French, German, and Latin. Without entering into the question whether the usefulness of such a book as this is increased by this multiplication of its tongues, we shall only remark that the present arrangement in four parallel columns on each two pages is decidedly inconvenient, and reiterate the hope, expressed by us in a former notice, that, on the commencement of the second series of ten volumes, Mr. Stainton will adopt the system of printing the part in each language separately. It is certainly an inconvenience in a work of reference to have only half a page of reading on two pages of print.

In his first three volumes Mr. Stainton treated exclusively of leaf-mining species — Moths whose caterpillars live between the two surfaces of leaves, eating the parenchyma and leaving channels or mines, the aspect of which on the surface of the leaf is often very characteristic of the species forming them. In the last-published volume we have mining species again, some belonging to the genus *Nepticula*, already treated of in the first volume, and others to the smaller genus *Bucculatrix*, of which more than half the species are here illustrated and described. The habits of the species of *Bucculatrix* are very similar to those of the *Nepticulæ*, but the larvæ differ in one or two remarkable particulars: the larvæ of *Bucculatrix* possess the six true legs on the thoracic segments, whilst those of *Nepticula* are destitute of these; and while the latter remain within the mine until they are full-grown, and then go down into the ground to undergo their change into the pupa state, the larvæ of *Bucculatrix* quit the mine when nearly mature, and, after moulting, become external feeders. The larva, whilst engaged in its mining operations, is smooth, but its skin becomes rough after quitting the mine; and, in order to undergo its moult comfortably on first venturing into the open air, it spins a flat silken covering, to which Mr. Stainton gives the name of a *cocoonet*, beneath which the larva lies in a doubled position. When full-fed, the larva goes down to the stem of the plant on which it has been feeding, or even to the ground or the leaves of herbage, where it spins a curious ribbed cocoon in some convenient corner, and there undergoes its further changes.

The fourth and fifth volumes are devoted to the history of forty-eight Moths of the extensive genus *Coleophora*, which includes, according to Mr. Stainton, no less than 126 described species, all natives of Europe. The larvæ of these Moths feed upon plants belonging to a great number of natural orders, but chiefly Dicotyledonous, only one being found upon a Coniferous plant (the Larch), and five upon different species of rushes and grasses. The larvæ, while young, mine the leaves of the plants on which they feed, or dwell in the interior of their seeds; but, after the lapse of a short time, they emerge from this concealment, and form a small case, sometimes of silk, but usually of fragments of the leaves of plants, within which they conceal their soft bodies, only protruding the head and anterior segments for the purpose of walking about and feeding. The name of the genus refers to this habit of the larva, of dwelling in a sheath-like case; and many of these habitations are very singular in their appearance. When the case becomes too small, the larva makes itself a new one, generally by mining out the parenchyma of a leaf, and uniting the free edges of the membranes with silk. The change to the pupa state also takes place within the case, and the pupa lies concealed therein until the perfect insect is ready to emerge.

The subject-matter of the sixth volume is furnished by the extensive genus *Depressaria*, which includes eighty described species, mostly natives of Europe. Of these the transformations of fifty-two are known, and the volume under consideration gives the natural history of twenty-four, or nearly half the known species. Their food-plants belong chiefly to the natural orders Umbelliferæ and Compositæ, which nourish no fewer than forty out of the fifty-two species. The larvæ usually feed upon the leaves of plants, the edges of which they turn down so as to form a sort of tubular habitation; but some dwell amongst the umbels of the Umbelliferæ, and often draw together the peduncles of the flowers with silken threads so as greatly to distort the growth of the plant. The perfect insects, which are amongst the largest and least brilliant of our Tineina, are produced at the end of the summer or in the autumn, and most of them hybernate in the perfect state, concealing themselves in the quiet corners of out-houses and sheltered palings, or creeping up amongst the straws of thatch.

In noticing the first volume of this book, we calculated that, for the British Tineina alone, the natural history of all the species could not be given in less than twenty-five volumes, the production of which cannot be looked upon otherwise than as an undertaking requiring a considerable amount of courage. Mr. Stainton, however, goes boldly forward, undeterred even by the rapid increase in the number of known species of the great group to the elucidation of which he has devoted himself with so much zeal, although, if matters go on as they have lately been doing, he may look forward to requiring forty or fifty volumes for the due illustration of his subject. From his "further observations on the genus *Nepticula*," contained in the newly published seventh volume, it appears that this genus, of which only 33 species were known at the time of the publication of the first volume (in 1855), now numbers at least 74 well-established species; and although this is doubtless an extreme case, still the great attention which has of late been paid, both in this country and on the Continent, to the Microlepidoptera, has certainly added many species to other genera. In the face of such a rapid increase still going on, it is almost too much to hope for the continuance of the life and energies of any one man long enough to allow him to bring together the whole mass of progressive observations on the natural history of this interesting group of Moths, in the comprehensive manner displayed in the work before us; but our author may have at least this consolation, that the design of his work is so good and so well carried out, that, let him stop where he will, it must always be a most valuable contribution to entomological literature, and a worthy monument of his zeal for the advancement of his favourite science.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

March 25, 1862.—Dr. J. E. Gray, V.P., in the Chair.

The Secretary announced that Dr. G. Bennett, F.Z.S., had shipped a living Kagu (*Rhinochetus jubatus*) for the Society, from Sydney, on the 16th of January previous, and read the following extracts from a letter just received from that gentleman relating to the habits of this remarkable bird:—

"Of the two Kagus brought from New Caledonia alive, one died on the 4th of January, 1862, and on dissection proved to be a female. It was larger than the one now sent to England alive; and when that one dies (as the plumage and crest are similar, and both appeared to be fully grown, the only distinction being size) it would be interesting to ascertain the sex. The Kagu is a very interesting bird, readily domesticated. It is amusing to see them politely bowing their heads one to the other, elevating their crests at the same time, and then finish by coquetting about. They climb up the wires in front of their place of confinement just as the Red-billed Porphyrios. They often leap, aided by the wings, upon the stumps or low branches of trees; but they invariably roost on the ground, in an erect position, with the head buried between the shoulders or under the wing, and in confinement never seek any elevated position for roosting. In New Caledonia they are usually seen about the sea-coast, by the side of rivers; and although in some parts of the island they are very numerous, yet about the settlement of Port du France they are seldom seen more than from two to four together at the same time. When disturbed they only fly to the height of a few feet, and escape into the thick brushwood. They are eaten by the natives. A lady just returned from New Caledonia informs me that a pair have been kept tame at Port du France for nearly three years, and are well-known roamers of the streets of that settlement. When a dog approaches them, they elevate their crests and flap their wings to drive it away. They are usually to be seen about those places where the men are digging, approaching them fearlessly for the sake of procuring worms or grubs that are turned up from the ground by the hoe or spade. The same lady describes a noise they make in their wild state, when concealed among the reeds or bushes, as resembling that of a young puppy crying for its mother."

The following extract was read from a letter addressed by Colonel Abbott to George O. Wray, Esq., and communicated by the latter gentleman to the Secretary:—

"In March 1838, as near as I can recollect, near the village of Pur-Buddah, distant $1\frac{1}{2}$ mile from the town of Akyab in Arracan, two Sepoys of the Arracan Local Battalion captured under a rock a large female Boa, some 12 feet in length, and abstracted with her a nest of eggs forty-eight in number. Both Snake and eggs were presented to me by a friend, who knew that I was interested in such things. My object now was to secure this prize, and see what would result from the detention. Unfortunately I was taken seriously ill, and neglected to keep notes on the subject, and all I now state is from recollection. The Python was in my possession for upwards of two months and a half, and was constantly coiled around her eggs, refusing food in various forms, living and dead, viz., fowls, rats, and frogs. I then quitted Arracan on sick-leave and came to Calcutta, bringing the Snake and eggs with me, and made them over to Dr. Pearson (since dead) and Dr. Evans. The Snake was in my possession, as I said before, about ten weeks in the province and ten days (more or less) in Calcutta, and nearly a week on the voyage up to Calcutta, as we went to Chittagong: this will bring the eggs and Snake to be known to me three months; and the eggs were still not hatched.

"On visiting the Museum and finding the eggs in the condition I sent them in, curiosity led us to detach an egg from the mass; and looking at it carefully it was supposed to be bad, as it exhibited marks of green mildew and soil, and there was no motion in it. We then determined to open it with a knife, and to our surprise we extracted a fully formed live young one, active and strong, which would, I have no doubt, have lived had it been allowed. I left Calcutta shortly after this, and do not know what became of the Boa and remaining eggs; but, should further information be required, I would suggest that application be made to Mr. Blyth, if still in Calcutta, or to the Curator of the Asiatic Museum of Calcutta."

The following papers were read:—

Characters of Nine New Species of Birds received in collections from Bogota. By P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

I have lately had an opportunity of examining several large collections of bird-skins from Bogota, containing altogether some three or four thousand individuals. The greater number of the species to which these belong are now well known in Europe, from their repeated importation in Bogotan collections; but I have found a few, principally among the less known groups, which appear to have been altogether overlooked or hitherto not collected. I beg leave to submit to the Society the following descriptions of these species.

Fam. Turdidæ.

1. Turdus ephippialis.

Supra cinereus, alis extus, nisi in primariorum parte terminali, et interscapulio rufescente indutis: subtus pallide cinereus: gutture albo, maculis triangularibus fuscis striato: ventre imo et crisso albis: tectricibus subalaribus et remigum parte interna *pallide castaneis: rostro plumbeo: tomiis pallescentibus: pedibus fuscis.*

Long. tota 8·5, alæ 4·7, caudæ 4·2 poll. Angl. et dec.

Hab. In Nov. Granada int.

Mus. P. L. S.

Obs. Affinis *Turdo albiventri* ex Cayenna, et ptilosi fere simili, sed interscapulio et alis extus rufescentibus, et subalaribus castaneis facile dignoscendus.

I may remark that I have now received from the Berlin Museum a Thrush marked *Turdus amaurochalinus*,—a species with which I was not acquainted when I prepared my Synopsis of the American Thrushes, already printed in the Society's 'Proceedings.'* This bird is certainly undistinguishable from what I consider to be *Turdus albiventris* of Spix, of which I have examples from Cayenne, Brazil, Bolivia, and Ecuador. My *Turdus ignobilis* of the highlands of New Granada is barely separable from the same species. On the other hand, there can be no question about the distinctness of the present Bogotan species, looking to its rufous interscapulium and wing-edgings, and dark, almost chestnut-brown under wing-coverts.

Fam. Vireonidæ.

2. Hylophilus ferrugineifrons.

Olivaceus: alis nigricanti-fuscis, extus olivaceis: cauda olivacescenti-fusca: pileo brunnescente tincto, fronte ferruginolento: subtus dilutior, gutture et ventre medio albicantioribus: rostro plumbeo, tomiis pallescentibus, pedibus fuscis.

Long. tota 4·0, alæ 2·1, caudæ 1·5.

Hab. In Nov. Granada int.

Mus. P. L. S.

Obs. Affinis *Hylophilo ochraceicipiti* mihi ex Mexico, sed colore supero olivaceo rostroque robustiore differt. Remex primus, prout semper in hoc genere, spurius, dimidio brevior quam secundus: quartus, quintus et sextus fere æquales et longissimi.

I have tried in vain to reconcile this bird with Lafresnaye's *H. flavipes* (Rev. Zool. 1844, p. 342). It is certainly not his *Hylophilus semibrunneus* (*l. c.* p. 341), as I have seen specimens of the latter in the British Museum.

Fam. Tanagridæ.

3. Chlorospingus oleagineus.

Olivaceus fere unicolor, fronte et regione oculari et corpore subtus flavicanti-olivaceis: alis nigricanti-fuscis, extus brunnescenti-olivaceo limbatis: cauda brunnea unicolore: rostro nigricanti-brunneo: pedibus fuscis.

Long. tota 5·5, alæ 3·25, caudæ 3·5.

Hab. In Nov. Granada int.

Mus. P. L. S.

* See P. Z. S. 1859, p. 321.

Obs. Affinis *C. superciliari* et *C. rubrirostri* et eadem forma, sed colore fere unicolore notabilis.

Fam. Dendrocolaptidæ.

4. Philydor panerythrus.

Murino-rufescens : alis extus et cauda tota rufis, illarum pogoniis interne nigricantibus : subtus læte fulvo-rufus : rostro albicante, hujus basi, cum pedibus, plumbea.

Long. tota 7·5, alæ 3·9, caudæ 3·6.

Hab. In Nov. Granada int.

Mus. P. L. S.

This bird is allied in form to *Philydor rufus* (Vieill.) of Brazil (*P. ruficollis*, Spix, Av. Bras. i. p. 74, pl. 75), though the rectrices are not quite so sharply pointed. It may be distinguished by its more uniformly rufous coloration, and the complete absence of the cinereous head. I have a single Bogotan specimen, the only individual I have met with of this species.

Fam. Tyrannidæ.

5. Leptopogon erythrops.

Olivaceus, pileo cinereo, loris, oculorum ambitu et corpore subtus ad medium pectus fulvide rufis : ventre flavicante : alis nigricanti-fuscis, tectricum apicibus fulvo terminatis ; remigibus omnibus extus olivacescenti-fulvo marginatis : campterio alari, subalaribus et remigum marginibus inferis clare ochracescenti-rufis : cauda ochracescenti-cinerea, marginibus angustis externe olivacescentibus : rostro obscure fusco ; pedibus corylinis.

Long. tota 5·0, alæ 2·7, caudæ 2·4.

Hab. In Nov. Granada int.

Mus. P. L. S.

This is a well-marked species, easily recognizable by its bright-rufous face and breast. In structure it agrees well with *Leptopogon superciliaris*, the type of the section, the bill being rather shorter, but precisely of the same form. The fourth quill is longest, slightly exceeding the third and fifth, which are equal. The first is rather shorter than the eighth, ninth, and tenth.

6. Leptopogon pœcilotis.

Supra olivaceus, pileo plumbescente, loris albescentibus ; plumis auricularibus ad basin flavicantibus, inde distincte nigris : subtus flavo-virens ; alis nigricanti-fuscis, tectricibus omnibus macula terminali ochracea præditis, remigibus olivaceo marginatis : cauda fuscescente, extus olivaceo anguste marginata : rostro superiore nigro, inferiore omnino flavo : pedibus pallide corylinis.

Long. tota 4·5, alæ 2·3, caudæ 2·0.

Hab. In Nov. Granada int.

Mus. P. L. S.

This species is closely allied to *Leptopogon superciliaris* (or at least to the Ecuadorian species which I identify with Tschudi's wretched figure), but is smaller in size, of a brighter and uniform greenish yellow below, and has the lower mandible wholly yellow, and feet pale. In *L. superciliaris* the lower mandible is black, like the upper. I have two similar specimens of Bogotan origin, and a third (imperfect) from Venezuela, which may also belong to the same species, though it wants the conspicuous ochraceous tippings of the wing-coverts.

7. Myiobius bellus.

Obscure olivaceus, pilei subcristati plumis interne rubro-igneis; alis nigris late ochraceo bifasciatis, harum remigibus eodem colore limbatis: cauda fuscescenti-cinerea: subtus flavus; pectore fulvo tincto: rostro superiore nigro, inferiore flavo: pedibus plumbeis.

Long. tota 4·2, alæ 2·3, caudæ 2·0.

Hab. In Nov. Granada int.

Mus. P. L. S.

This species of *Myiobius* is closely allied to the *M. pulcher* of Ecuador (P. Z. S. 1860, p. 464), and must be placed next to that species in the order in which I have arranged the genus (*l. c.*). It is, however, easily distinguishable by its larger size and larger wings, though nearly alike in coloration.

8. Empidochanes pœcilurus.

Fuscescenti-griseus, pileo obscuriore; loris fuscescentibus; alis et cauda nigricanti-fuscis, illarum tectricum apicibus et secundariorum marginibus externis albescentibus: subtus pallide ochraceus, lateraliter cinerascens; subalaribus, remigum et rectricum (nisi duarum mediarum) marginibus internis latis et crisso rufis, fere rubiginosis: rostro et pedibus nigris.

Long. tota 5·5, alæ 2·8, caudæ 2·3.

Hab. In Nov. Granada int.

Mus. P. L. S.

This Tyrant-bird, of which I have a single specimen, is readily distinguishable by its parti-coloured tail. The inner webs of all, except the medial pair, are broadly margined with clear rufous. This colour increases towards the base, and gradually occupies the whole of the vane. The outer tail-feather is also narrowly margined with the same colour. The under wing-coverts and inner margins of the quills are likewise similarly coloured. The fourth primary is rather longer than the third, which slightly exceeds the fifth, and longest; the second is slightly shorter than the third, the first being of about the same length as the eighth and ninth.

This bird has much the general appearance of an *Empidonax*, though abnormal in colouring. I place it for the present as a second species of the allied southern genus *Empidochanes*, of which the type is *Muscicapa oliva*, Bodd. (Pl. Enl. 574. fig. 2). This generic term I propose to use in the place of *Myiophobus* of Cabanis and Heine, as the latter name was previously given by Reichenbach to *Myiobius nævius**, for which and its allies I venture to employ it.

Fam. PSITTACIDÆ.

9. UROCHROMA STICTOPTERA.

Psittaceo-viridis: alis extus nigris, macula in mediis tectricibus roseo-rubra; remigum marginibus externis et secundariis dorso proximis viridibus: caudæ rectricibus intus paululum aurescentibus: rostro pallido: pedibus fuscis.

Long. tota 6·0, alæ 5·0, caudæ 2·5.

Hab. In Nov. Granada int.

Obs. This parrot appears to belong to the group called *Urochroma* by Prince Bonaparte, but is quite different from any known member of that section. The tail is nearly square at its termination, the two medial rectrices being slightly acuminated, the others rounded, but presenting the appearance of being rather worn.

ON TWO NEW SPECIES OF TYRANT-BIRDS FROM ECUADOR. BY P. L. SCLATER, M.A., PH.D., F.R.S., SECRETARY TO THE SOCIETY.

I am indebted to Mr. Gould's kindness for two specimens of Tyrant-birds from a collection recently received by him from the highlands of Ecuador. They are of nearly allied species, but stand best in the two neighbouring sections of *Ochthœca* and *Mecocerculus*. By the latter name I propose to replace *Myiarchus* (Bp., nec Cab.), using it as a generic title for *Fluvicola leucophrys*, Lafr. et D'Orb., and its allies.

1. OCHTHŒCA CITRINIFRONS.

Obscure cinerea, dorso postico rufescente: fronte distincte citrino-flavo: superciliis elongatis, albescentibus; alis caudaque nigricantibus, illarum marginibus externis rufescentibus: subtus omnino pallide cinereus: rostro et pedibus nigris.

Long. tota 4·75, alæ 2·5, caudæ 2·25.

Hab. In rep. Æquator.

Mus. P. L. S.

Obs. Affinis *Ochthœcæ albidiemati*, Lafr., sed fronte citrino facile dignoscenda.

2. MECOCERCULUS GRATIOSUS.

Rufescenti-olivaceus, pileo fusco; fronte distincto et superciliis elongatis aureis: alis fusco-nigris, tectricum utriusque et secundariorum marginibus externis rufescentibus: cauda fusco-nigra: subtus olivaceus, ventre medio flavo: rostro et pedibus nigris.

Long. tota 4·5, alæ 2·5, caudæ 2·2.

Hab. In rep. Æquator.

Mus. P. L. S.

Obs. Affinis *Mecocerculo diademati*, sed rostro breviore, alis paulo brevioribus, et harum tectricibus rufescenti-bifasciatis distinguendus.

* See P. Z. S. 1860, p. 466.

Description of some New Species of Entozoa. By W. Baird, M.D., F.L.S., etc.

1. Ascaris unduloso-striata, Baird.

Head naked, with well-marked, roundish labial lobes. Body of a white colour, with a well-defined line running longitudinally through its whole length ; smooth, but finely wavedly striated longitudinally, instead of transversely. The greatest diameter is at the anterior extremity, the body tapering gradually towards the tail, and terminating in a finely subulate point. In the female this point is long, and gradually becomes very fine; in the male the body, posteriorly to the opening from which issue the male organs or spicula, suddenly contracts and tapers quickly to a very sharp subulate point. The body shows no transverse striæ, the only visible ones being longitudinal and finely waved.

Length of female $5\frac{1}{2}$ lines, male $4\frac{1}{2}$ lines.

Hab. Intestines of the King-Vulture (*Sarcorhamphus papa*). (*Mus. Brit.*)

2. Sclerostoma mucronatum, Baird.

Body semicylindrical, of a brownish colour; thickest in the middle, attenuating towards each extremity, but more so at the anterior extremity. Integument strongly striated, or almost plicated. Head continuous with body. Male ——? Female with the vulva situated about one-third from the posterior extremity, and marked with a strong tubercle. The tail is armed at its extremity with a strong, sharp spine, which is slightly incurved.

Length of female 4 lines ; greatest breadth about $\frac{1}{2}$ line.

Males of this species have not been observed.

Hab. Intestines of the Palluma (*Phrymaturus palluma*) from Chili. (*Mus. Brit.*)

3. Pentastoma teretiusculum, Baird.

Head rounded and truncated. Body cylindrical, of a red colour, considerably more attenuated posteriorly. Tail shortly bilobed. Greatest width of body about 4 or 5 lines below the head; it then gradually attenuates till it reaches the posterior extremity. Integument annulosely ringed; rings about one-third of a line in width.

Length 2 inches 5 lines ; breadth 3 lines.

The only specimen taken is a female.

Hab. Taken from the mouth of an Australian Snake (*Hoplocephalus superbus*) which died lately in the Zoological Society's Gardens, Regent's Park. (*Mus. Brit.*)

For the three above-described species I am indebted to Mr. Edward Gerrard, of the British Museum.

4. Tetrarhynchus minuto-striatus, Baird.

Head of a white colour, solid and smooth. Neck much narrower than head, nearly of the same dimensions throughout its whole length, and minutely and finely striated. Bothria ear-shaped, rather broader at upper than lower part ; open above, adnate below, with callous, raised edges. Proboscides short and club-shaped. Body a minute papilla.

Length of head 2 lines; breadth $1\frac{1}{2}$ line. Length of neck from 1 inch to 13 lines; breadth 1 line.

Hab. Taken from a species of *Brama*, off Madeira. (*Mus. Brit.*)

5. Tetrarhynchus brevis, Baird.

The animal is of a white colour, and is very short and thick. The head is large and broad, and the bothria are ear-shaped, rounded, and very much thickened on the edges. The neck is very short. The proboscides cylindrical and of considerable length.

Length of whole animal 3 lines; head nearly 2 lines; neck 1 line.

Hab. Taken from a species of marine Eel at Madeira. (*Mus. Brit.*)

6. Tetrarhynchus quadripapillosus, Baird.

Head of considerable size; bothria large, rotundate-oval. Neck long, slender, terminating in an enlarged body enclosed in a sheath, which gives off at its lower part four papillæ disposed in such a manner as to interlock with each other and form a terminating conical point.

Length of whole animal about $3\frac{1}{4}$ lines.

Hab. Taken from the liver of *Alepocephalus*, sp., at Madeira. (*Mus. Brit.*)

For these three species of *Tetrarhynchus* I am indebted to J. Yate Johnson, Esq., C. M. Z. S.

7. Bothriocephalus (Tetrabothrium) junceus, Baird.

Bothria four, attached to the head by their face, large and somewhat auriculiform. Head elliptical. Neck slender; first segments very fine, gradually becoming broader, but in no part exceeding half a line in breadth. Apertures of genital organs unilateral.

Length upwards of $4\frac{1}{2}$ inches; breadth of neck $\frac{1}{10}$th of a line; broadest segments about $\frac{1}{2}$ a line.

Hab. Intestines of the King-Vulture (*Sarcorhamphus papa*). (*Mus. Brit.*).

For this species I am indebted to Mr. E. Gerrard.

April 8th, 1862.—Dr. J. E. Gray, V.P., in the Chair.

Mr. Gould exhibited to the Meeting and described two new species of Humming-Birds, which he had recently received from Ecuador; a new *Fregilus* from the Himalayas, which had hitherto been regarded as identical with the European bird of that form; and a species of *Prion*, which appears to constitute an additional member of that peculiar genus of oceanic birds.

The Humming-Birds were named, respectively, *Heliothrix longirostris* and *Aphantochroa hyposticta*; the *Fregilus*, *F. himalayanus*; and the *Prion*, *P. magnirostris*; and were thus described:—

HELIOTHRIX LONGIROSTRIS, Gould.

Male: upper surface and wing-coverts brilliant green; wings dark purplish brown; four middle tail-feathers bluish black, the remainder pure white; lores, line under the eye, and ear-coverts velvety black, terminating in a small tuft of violet-blue feathers; below the black line a stripe or moustache of glittering green; chin, throat, and under surface snow-white; bill black; legs and feet fleshy brown.

Total length $5\frac{1}{4}$ inches; bill $1\frac{1}{16}$; wing $2\frac{7}{8}$; tail $2\frac{1}{4}$.

Hab. Ecuador.

Remark.—I have been for years receiving from Ecuador examples of what I believed to be females of a new species of *Heliothrix*; but now in 1862 I have received an adult male, which convinces me that my opinion was correct, and I have therefore described it under the above appellation. In comparison with the other species of the genus, I find it to be most nearly allied to *H. auritus*, being similarly coloured to that bird; it is, however, of larger size, has a considerably longer bill, and in my specimen, which is doubtless adult, the crown is devoid of the glittering hue seen in *H. auritus*; at the same time, it is somewhat brighter than the back.

APHANTOCHROA HYPOSTICTA, Gould.

All the upper surface, wing-, and tail-coverts deep green; wings purplish brown; tail dull purplish green, deepening into blackish brown at the tip, the two outer feathers on each side very slightly fringed with white at the tip; feathers of the throat, breast, and centre of the abdomen dull white at the base, with a spot of dull green near the tip, giving those parts a spotted appearance; remainder of the under surface dull green; under tail-coverts dull green at the base, deepening into black near the end, and fringed with grey; tarsi and thighs rather thickly clothed with white feathers; bill black, except at the base of the under mandible, which appears to have been flesh-colour.

Total length $4\frac{1}{2}$ inches; bill $1\frac{3}{16}$; wing $2\frac{3}{4}$; tail $1\frac{7}{8}$.

Hab. Ecuador.

Remark.—I have several specimens of this bird, all similarly coloured; and I believe the specimen from which the above description was taken to be fully adult. It differs from *A. cirrhochloris* in its spotted breast, in its shorter tail, and its rather more lengthened and curved bill. I received the examples I possess from Quito, but I believe they were collected near the waters of the Upper Napo.

FREGILUS HIMALAYANUS, Gould.

Plumage of the head and the whole of the body, both above and beneath, deep glossy black; wings and tail black, glossed with purple and green; bill and feet coral-red; nails black.

Hab. The Himalayas.

Remark.—This fine Chough differs so greatly in point of size from the species killed in this country that I have no hesitation in describing it as distinct; and that ornithologists may more clearly perceive the great difference alluded to, I annex an accurate admeasurement of male examples from India and Europe.

Fregilus himalayanus.	Inches.	*Fregilus graculus.*	Inches.
Total length	$15\frac{1}{2}$	Total length	14
Bill	$2\frac{1}{4}$	Bill	$1\frac{7}{8}$
Wing	$12\frac{3}{4}$	Wing	$10\frac{3}{4}$
Tail..............	$6\frac{3}{4}$	Tail..............	$5\frac{3}{4}$
Tarsi	$2\frac{1}{4}$	Tarsi	$1\frac{3}{4}$

I may add that specimens from Italy and from Wales are precisely alike in all their admeasurements.

Prion magnirostris, Gould.

Head, all the upper surface and sides of the chest blue-grey; lesser wing-coverts and the edge of the shoulder brown; the remainder of the wing blue-grey, deepening into slate-grey at the tips of the inner primaries; the outer primaries slaty black, fading into white on the inner edge; scapularies deepening into slate-grey near the end, and tipped with pale grey; tail very light grey, the centre feathers tipped with blackish-brown; chin, throat, centre of the breast, abdomen, and under surface of the wing creamy white; a faint wash of blue on the lower part of the flanks and the under tail-coverts; bill blue, deepening into black on the sides of the nostrils, at the tip and along the side of the lower mandible; irides brown, legs beautiful light blue.

Total length 11 inches; bill, base to tip 2, breadth at base $\frac{15}{16}$; wing 8; tail $4\frac{1}{2}$; tarsi $1\frac{1}{2}$.

Hab. Unknown.

Remark.—As the name I have assigned to it implies, this species differs from every other member of the genus in the extraordinary size of its bill. In form and colouring it is precisely similar to the other *Priones,* all of which are remarkably alike in these respects—not so, however, in their bills, which consequently present the best specific characters.

Remarks on a Specimen of Alepisaurus ferox recently obtained at Madeira. By James Yate Johnson, Corr. Mem. Z.S.

Having lately procured a specimen of this rare and interesting fish (which I have had the pleasure of presenting to the British Museum), I beg leave to lay before the Society the result of my observations upon it when in a fresh state. The remarks I shall make will be for the most part supplementary to Mr. E. T. Bennett's long description of another specimen from this locality, printed in the first volume of the 'Transactions of the Zoological Society*;' but I hope they will be found to have some bearing upon the question of the

* See Trans. Zool. Soc. vol. i. p. 395.

ichthyological position of the genus, which has been placed in no fewer than four families by different naturalists. Mr. Lowe, who founded the genus on the present species, placed it in Cuvier's family of *Tænioïdes*. M. Valenciennes referred the genus to the *Salmonidæ*. Sir John Richardson, in his article on Ichthyology in the 'Encyclopædia Britannica,' assigned it, on page 213, to the *Sphyrænidæ*, and on page 248 to the *Scopelidæ*. Lastly, that able ichthyologist, Dr. Günther, asserts that its natural affinity is decidedly Siluroid (Cat. Acanth. Fishes in Brit. Mus. ii. p. 353). A consideration of Mr. Bennett's description and of the additional points about to be mentioned, some of which appear to have been hitherto overlooked, will lead, I think, to the conclusion that the position assigned to this fish by Dr. Günther is the true one.

The specimen lately obtained is $53\frac{1}{2}$ inches long, the head measuring $7\frac{3}{8}$ inches. The height of the body in front of the pectoral fin is $4\frac{1}{4}$ inches. The branchiostegal membrane is supported by seven rays, which number may probably be taken as the normal one, as it agrees with one of Mr. Lowe's specimens, the other of which had six rays in that membrane. The fish has no barbels, in which negative character it resembles the genus *Batrachocephalus*, a member of the *Siluridæ*. The large eye ($1\frac{1}{8}$ inch in diameter) is surrounded by an adipose skin, which, on the posterior side, intrudes as a transparent veil upon the eye, covering it to the extent of one-third.

The *subopercle* of which Mr. Bennett spoke appears to be the *interopercle*, which has been extraordinarily developed at the expense of the subopercle, the latter being wanting. Both this and the *opercle* (which measures 2 inches across) are remarkable for their paper-like tenuity and the high radiating striatures on their surfaces. The hinder portion of the preopercle forms a strong bony ridge, also striated. The *coracoid* is very broad at its middle, where it is sculptured with radiating striæ like the clavicle. The suprascapular and the narrow scapular are longitudinally striated. The striæ on all the bones are strong.

The remarkably high first dorsal fin has forty-one rays, and the deeply-forked caudal fin nineteen rays, whilst the second dorsal is adipose—in these respects agreeing with Mr. Bennett's description; but the pectoral fin has fourteen in place of fifteen rays, the ventral fin ten in place of nine rays, and the anal fin sixteen in place of seventeen rays. The first ray of the *pectoral* fin in the fish examined by Mr. Bennett was the longest. In this specimen the fifth and sixth rays are the longest (being $7\frac{1}{2}$ inches long), and they are rather more than twice the length of the strongly-serrated first ray, which is superior in length only to the three last. The first *dorsal* fin (the base of which is 32 inches long) arises out of a groove, each margin of which consists of a loose fold of adipose skin. The first ray is jointed above, and is strongly serrate along its free edge, like the first rays of the pectorals and ventrals. The first fifteen or sixteen rays appear to be simple, the others sparingly branched; but the only perfect ray in my specimen is the fourth, and that is

12 inches long. The first ray of the *ventral* fin, though simple and strong below, is jointed above and ends in a weak point. The first two rays of the *anal* fin are short, the succeeding four long, and the remaining rays short. The anterior part of this fin is fleshy, and at the base of this part there is a groove on each side. The length of the base of the whole fin, compared with the total length of the fish, is as 1 to $11\frac{1}{3}$, instead of as 1 to 10 in Mr. Bennett's example. The *caudal* fin measures $7\frac{1}{4}$ inches in length, and the tips of the lobes are 9 inches asunder.

Along the middle of each side on the posterior half of the body there is a low adipose keel of a black colour; and this marks the course, at this part, of the lateral line, which is unarmed throughout. The fish is covered with a thin smooth skin, and is entirely destitute of scales.

As to the *dentition*, there are at each side of the mandible, beginning at the posterior end, ten teeth of moderate size, directed backwards, and flattened, triangular, and pointed. Then come three long-pointed teeth, which decrease in length forwards; then five subulate teeth, having before them two long teeth on one side of the mandible, on the other only one; lastly, at the tip, one acicular tooth. The weak slender premaxillary is set with a single row of small sharp triangular teeth, about eighty-five on each side. The palatine bones are set posteriorly with a row of larger teeth, which, being flat, sharp, and triangular, resemble the teeth of a saw. They are directed backwards, and correspond in size and shape with the opposite teeth of the mandible. At the anterior part of each palatine bone is a row of seven or eight long formidable teeth, the hinder ones being larger; they are flattened, dagger-like, and are directed backwards. Behind these on one side are two long teeth, but only one such tooth on the other. The vomer is toothless.

With reference to the figure accompanying Mr. Bennett's description, it may be remarked that the nostrils are wrongly indicated, being much posterior to the place at which they are represented to be. They are really situated a little nearer the eyes than the snout. The two orifices of each pair, being small and close together, may have been overlooked; and a couple of slight depressions with a bony tubercle, in advance of their true position, have been apparently mistaken for them. Neither does the colouring of the figure well agree with my specimen, which, when fresh from the water, had a dark-bluish-grey back, with sides and belly of a silvery grey, reflecting a brassy lustre in certain directions of the light. The dorsal, pectoral, and caudal fins were a deep black; the ventral and anal fins a silvery grey. The indigo-blue spots in pairs near the lateral line in the figure seem to occupy the places of colourless mucous pores, which were observed in my specimen at irregular intervals near that line.

From this fish were obtained two species of Entozoa, viz. some large specimens of a *Distoma*, and several examples of a Tænioid worm, measuring altogether some feet in length.

MISCELLANEOUS.

Notice of a New Leopard from Japan. By Dr. J. E. Gray, F.R.S. &c.

Mr. Keilish has kindly brought me for examination the skin of a Leopard which he has received from Japan; it is well tanned, and marked on the inside with the red impressions of two Japanese seals.

Leopardus Japanensis.

Fulvous, paler beneath. Back and limbs ornamented with ovate or roundish, unequal-sized black spots; the spots on the shoulders, back, and sides converted into a ring by a single central spot of the same colour as the fur; spot on the back of the legs large, oblong, and transverse. Head with small, regularly disposed black spots; nape with four series of narrow elongated black spots, the outer ones sometimes confluent into lines, and with a series of large black spots on each side of the back of the neck. Tail elongate, spotted, paler, and with four black rings at the tip. *Hab.* Japan.

The skin at first sight seems much like that of a fine-coloured Hunting Leopard; but it is at once distinguished from that animal by the larger size and brown centre of the black spots, and from all the varieties of the Leopard by the linear spots on the nape and the spots on the back not being formed of smaller spots.

The skin is 4 feet 6 inches, and the tail 2 feet 10 inches long.

Notice of a New "Wild Goat" (Capricornus Swinhoei) *from the Island of Formosa.* By Dr. J. E. Gray, F.R.S. &c.

Mr. Swinhoe having kindly shown me some Mammalia from the Island of Formosa, I have the pleasure of sending the description of a new Goat-Antelope.

Capricornus Swinhoei.

Fur harsh and crisp. Brown: a narrow streak down the back of the neck, a spot on the knee, and the front of the four legs below the knee black; the hind legs bay; the sides of the chin pale yellowish; under side of the neck yellow-bay, separated from the upper part of the neck by a ridge of longer hairs. Ears long, brown, pale internally.

Hab. Formosa, on the central ridge of the Snowy Mountains.

This species is very distinct from *Capricornus crispa* of Japan, which has a white face. The skull has a deep and wide concavity in front of the orbits, and a keeled ridge on the cheek. The horns are short and conical.

Death of Fishes in the Sea during the Monsoon.

In a letter to Sir Roderick Murchison, Sir William Denison, the Governor of Madras, observes that, in steaming between Mangalore and Cananore on the west coast of India, he found that for some time after the south-west monsoon the sea was offensive with dead fish, killed by the great mass of fresh water poured into the sea during the season of the monsoon.—*Proc. Geol. Soc.* June 18, 1862.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 59. NOVEMBER 1862.

XXXIII.—*On the Pro-Embryos of the* Charæ. By M. Pringsheim*.

It is generally supposed by the numerous observers of the germination of the *Charæ*, that their spores produce the plants immediately in germination.

This assertion is expressed most distinctly by Bischoff in his monographic treatise on the *Charæ*. After some brief remarks upon the direction of the germinating plant, dependent on the accidental position of the spore, Bischoff says†, "In any case, however, it is clear that in the *Charæ* an immediate development of the germ-plant from the spore takes place, without any trace of a primitive germinal structure, such as occurs in the other Cryptogamia of the higher orders; and even by this the position of these plants upon the boundaries of the two primary divisions of the vegetable kingdom is attested."

Certainly every one who has observed germinating *Charæ* will admit that this assertion is perfectly in accordance with the first and direct impression which germinating *Charæ* produce upon the observer, and has evidently misled all the more recent observers of the germination; for they differ in nothing from Bischoff in their conception of the structure produced from the spore.

Nevertheless this conception is false; and it is certain that the germinating spore does not directly give origin to the young plant, but that in the *Charæ*, as in the higher Cryptogamia, a pro-embryo is first formed in the germination, and upon this the first branches of the plant are subsequently formed by a normal process of gemmation. The proof of this assertion de-

* Translated by W. S. Dallas, F.L.S., from the Monatsbericht der Akad. der Wiss. zu Berlin, April 1862, p. 225.

† G. W. Bischoff, 'Die Cryptogamischen Gewächse,' 1828, p. 10.

pends upon the history of the growth of the shoots of *Charæ*, for the complete representation of which we are indebted to Alex. Braun*. It likewise requires a thorough examination of the formation and structure of the lateral shoots given off from the nodes and leaf-axils of the *Charæ*.

I suppose the general structure of the *Charæ* to be well known; and with regard to the history of the development of their branches I merely call attention here to the fact that every branch and every bud (or branch-rudiment) of the *Charæ*, as in the Cormophyta generally, terminates in a vegetative cone, from which the formation of the whole of the morphological segments (internodes, nodes, and leaves) issues directly or indirectly; and I may add, further, that the vegetative cone of the *Charæ* is formed, not by a complex cellular body, but of a single cell, which is therefore the vegetative cell. I further refer to the fact that the cortication of the joints of the stem and leaves depends upon the neighbouring nodes, the cortical segments descending from the upper nodes coalescing with those ascending from the lower nodes to form a coherent cortical coat.

It is well known that in the *Charæ*, as in leafy plants in general, branches issue from the leaf-axils at the nodes, which equally increase the stock and repeat the growth of the parent branch.

In *Chara fragilis*, to which species the following statements refer, only a single lateral branch usually issues from the younger nodes: this, as Al. Braun has shown, stands in the axil of the oldest leaf of the whorl. It differs from its parent shoot only in that the complete cortication of its first (lowest) joint takes place entirely from the upper node, its basilar node forming no ascending cortical segment.

In older nodes of this plant which have survived the winter, we find, on the contrary, a greater number of shoots rising from one whorl of leaves, and now no longer exclusively from the axil of the oldest leaf.

These later-produced lateral shoots appear at the same time more or less abnormally altered, and a closer examination shows that two kinds of structures, of very different morphological value, occur amongst them.

Some of them are distinguished from the quite normally barked shoot, produced at a much earlier period in the axil of the oldest leaf, by an entire absence or a deficient development of the bark on their lower parts. This alteration usually affects only the lowest joint and the leaves of the first whorl, but here and there also the following joints and whorls.

* "Ueber die Richtungsverhältnisse der Saftströme in den Zellen der Characeen," Monatsber. der Berliner Akad. der Wiss. 1852 & 1853.

To distinguish them from others, I will call these shoots "naked-footed twigs." The manifold phenomena called forth by the various degrees of development of the bark on the lower joints of these naked-footed twigs I pass over here entirely; but, on the contrary, I indicate particularly that even these shoots, in their development, and especially in the formation of their morphological members from the vegetative cell always present at their apex, follow the general law of development of the shoots of *Chara.*

The second kind of twig-like structures, which occur with the naked-footed twigs on the older nodes which have passed through the winter, must strike the observer, even from their external appearance, by the far greater deviation of their lower parts from the normal structure of the shoots of *Charæ.* It is to these structures, under the name of "progerms of the twigs" (*Zweigvorkeime*), that I wish here in the first place to call attention.

Whilst every twig issuing from a node commences with a distinct joint, appearing green from the well-known chlorophyll-rows of the *Charæ,* which bears immediately above it the first normal node furnished with leaves, the progerms of the twigs commence with a perfectly colourless shorter or longer joint, in which the chlorophyll-rows are always wanting. This is followed by an extremely imperfectly developed and always *leafless* node, the place of which is even frequently occupied by a single cell, elongated into the form of a joint. Upon this, again, there follows a more or less elongated but always *naked* joint, which, in its appearance already presents a greater resemblance to the stem-joints of the *Charæ;* and this joint apparently bears the first circle of leaves.

But this also is remarkable for a disproportionate development of the parts, which is never seen on any other whorl of leaves: amongst the leaves apparently belonging to it one is constantly distinguished by its excessive growth, far exceeding any inequalities amongst the leaves of a whorl, that may occur now and then in normal whorls.

It is only from hence that the twig becomes perfectly normal, that is to say, the following joints, nodes, and leaves are exactly like *the first* joints, nodes, and leaves of a normal naked-footed or barked lateral twig; so that it evidently appears as if the true twig originates as a lateral shoot in the axil of the above-mentioned excessively developed leaf of the first whorl.

And this view is in fact fully confirmed by the developmental history, which at the same time furnishes an unexpected explanation of the nature of the excessively developed pseudo-leaf. Thus it shows that this does not belong as a leaf to the first circle of leaves, but that it is the apex of a distinct structure following a peculiar mode of growth, and that it is only under this leaf-like apex, and at a later period, that the first normal bud is produced and developed into a normal barked or naked-footed twig, which is only distinguished from other twigs of *Chara* by its basal node producing a few leaves which remain in a rudimentary state of development.

Now, it is from these little leaves coinciding in a circle with the end of that independent organ to which I give the name of "progerm of the twig" that it appears as if the twig above this whorl was the direct continuation of the joints below it.

The recognition of this gets rid of all the contradictions and abnormal appearances which strike us in the lower joints and the first whorls of these twigs so long as we start from the false assumption that the structure which I indicate as the apex of the progerm of the twig is the excessively developed oldest leaf of the first whorl; for neither the development of this progerminal apex, nor the form of its terminal cell, nor, lastly, the directions of the currents in its cells agree with the normal condition of the parts of a leaf.

The full significance of this progerm of the twig only becomes evident, however, by the comparative examination of the germinating plant.

The considerable deviations from the normal structure of the joints and nodes which are observed in the first joints and nodes of germinating *Charæ* are most simply explained by the same processes of formation which I have shown to occur in the progerms of the twigs.

The germination of the spore also commences with the formation of an *independent* organ following a law of growth *peculiar to itself*—a progerm, from the *leafless* nodes of which the leafy twigs sprout forth.

The progerms formed by the spore resemble in every respect the progerms of the twigs produced on the older nodes of plants which have passed the winter. They reach from the spore to the first whorl of leaves, and terminate here with the same excessively developed structure apparently belonging to the whorl, which has been regarded sometimes, as by the older observers, as the apex of the growing main stem, and sometimes, as by more recent investigators, as the first, disproportionately developed leaf of the first whorl.

It is, however, as already stated, neither the one nor the other, but the apex of a *leafless* provisional structure incapable of further development; and the leaflets in its vicinity, with which it apparently coincides to form a whorl, are, as in the progerms of the twigs, the rudimentary leaves of the basal node of the *first* normal shoot of the *Chara* formed at the base of the progerminal apex.

This proof of the occurrence of the progerm in the *Charæ* fills a sensible gap in the developmental history of those plants. The existence of leafless provisional structures, from which the twigs shoot forth, supports the conception, derived from the history of the formation of the parts, that the twigs of *Chara* are leafy shoots, and places the relationship of the *Charæ* to the Mosses in the clearest light.

To the form of the seminal filaments and of the rudiments of the fruit, in which the *Charæ* so strikingly approach the Mosses, we may now add the similar mode of production of the leafy twigs from buds originating on confervoid leafless progerms; for the progerms of the *Charæ* differ but little in their structure from the confervoid progerms of the Mosses, as is proved by the possible replacement of their few and defectively developed nodes by simple cells elongated into the form of joints. And although the more simple and throughout almost confervoid structure of the plant in the *Charæ*, as also the node-formation of their progerms, by which these externally resemble the leafy twigs, renders the recognition of the progerms and their distinction from the leafy twigs very difficult, still it is never possible to confound the progerms with leafy twigs, and no transition of a progerm into a leafy twig ever occurs; so that the morphological separation of the leafless progerms and the leafy shoots is just as sharply marked in the *Charæ* as in the Mosses.

Lastly, the complete morphological equivalence of the progerms in *Charæ* and Mosses shows itself most decidedly through the progerms of the twigs in the former; for, among all leafy plants, it is only on the stems and leaves of the Mosses that we find organs analogous to the progerms of the twigs of *Charæ*. These are the well-known root-like prothallia which occur on the stems and leaves of many Mosses, and which have been fully described by W. P. Schimper in his anatomical and morphological investigations on the Mosses*.

The *Charæ*, therefore, in their general process of development pass through similar stages to the Mosses.

They are leafy plants, without a main stem or main root, the whole of their twigs, like those of the Mosses, being produced as lateral shoots, either on other leafy twigs or on leafless progerms.

* Compare the structures described by Schimper in his 'Recherches anatomiques et morphologiques sur les Mousses' (Strasburg, 1848), as "radicelles proembryonnaires sur les tiges" (p. 13), "excroissances proembryonnaires sur le limbe et à l'extrémité de la nervure des feuilles" (p. 15), and "radicelles proembryonnaires aux feuilles détachées de la tige" (p. 19).

In the structure of their antheridia and the development of their fruit they certainly present important deviations from the Mosses, which do not permit their complete systematic union with any group of Mosses; but, as in the form of the seminal filaments, so also in the original foundation of the fruit, they agree with the general formative process in the Mosses; for, although the period and the place of impregnation in the *Charæ* are not yet demonstrated, it may nevertheless be asserted with great probability, from well-known and not far-fetched analogies (to which we may now add the formation of the progerms), that in them also it is not the spore-cell which germinates into a prothallium, but a mother-cell preceding this by several generations, that is fertilized. The *Charæ* consequently stand evidently as a peculiar group of the section of Moss-like plants amongst the Cryptogamia.

Moreover, the unexpected occurrence of the progerm in the *Charæ* makes it appear to be a general law (to which, contrary to the earlier views, the *Charæ* are subject as well as Ferns and Mosses) that in all leafy plants the spore never can be directly the vegetative apex of the first leafy axis.

The further development of this preliminary communication will appear, with the necessary bibliographical references and figures, in the next part of my 'Jahrbuch für wissenschaftliche Botanik,' which is already in the press.

XXXIV.—*Description of a new Species of* Hydroporus, *Clairv.* By the Rev. Hamlet Clark, M.A., F.L.S.

Fam. **Dytiscidæ.**

Genus Hydroporus, Clairv.

H. tinctus, n. sp.

H. oblongo-ovalis, subparallelus, sat convexus, post medium paulo latior, ad apicem modice et rotunde productus, crebre punctulatus, leviter pubescens, subopacus, niger, obscure rufo notatus; capite inter oculos undique late et distincte depresso, sparsim punctulato, ad apicem rufo tincto; thorace antice emarginato, lateribus leviter rotundatis, basi sinuata ad medium (scutelli regione) angulata, sparsim et fortiter punctato, antice juxta marginem transverse punctato-striato, ad basin plus minus transverse depresso, ad baseos angulos plus fortiter plerumque foveolato, nigro; elytris thorace latioribus, cum thoracis margine angulum obtusum formantibus, post medium latioribus, leviter punctatis, sparsim pubescentibus, nigris, fascia lata inæquali transversa apud humeros, vitta marginali (post medium in maculam triangularem dilatata) haud apicem attingente, rufis vel rufo-fuscatis, hæ maculæ aliquando obsoletæ sunt, aliquando omnino absunt; corpore subtus nigro; antennis fusco-nigris; pedibus fusco-nigris, tarsorum articulis anteriorum latis.

Magnitudine variat; long. corp. lin. $1\frac{3}{5}$–$1\frac{4}{5}$, lat. $\frac{4}{5}$.

A variable species, both in pattern and size; nevertheless the four examples before me (none absolutely identical with the three others) evidently represent a single species, which is abundantly distinct from all others with which I am acquainted: its elongated form, coupled with the greater breadth of the *post*-medial elytra (especially as contrasted with the thorax), and the distinct angle formed by the line of the margins of the elytra and thorax separate it at once from all species found in Great Britain. In our list the name will stand next to *H. palustris*, Linn.

Four examples of *H. tinctus* were detected among a mass of Turner's captures, by my friend Dr. Power: they were captured certainly in the district of the New Forest.

XXXV.—*A Synopsis of the Species of Alligators.* By Dr. J. E. Gray, F.R.S. &c.

Having had occasion to re-examine the large collection of Alligators in the British Museum for the purpose of naming the more recently received specimens, I am induced to lay before the readers of the 'Annals' an abstract of the result of this examination.

I may observe that Spix, in his work on Brazilian Lizards, gives very good figures of these animals, with the colours well marked; and Natterer, in his 'Beiträge' on South-American Alligators, gives very accurate and detailed figures of the head and the neck-shield of the different species; and he has figured some varieties or species very nearly allied to those here noticed, which I have not seen.

The Alligators (*Alligatoridæ*) may be divided thus:—

I. *The ventral scutella like the dorsal ones, bony, and articulated together, forming a shield. The eyelids with an internal bony plate. The cervical scutella in pairs, forming an elongated shield. Nasal bone short.* Tropical America.

1. Jacare. The orbits united by a bony cross ridge. Eyelids partly fleshy, striated or rugose.

2. Caiman. The orbits not united by a cross ridge. Eyelids entirely bony, smooth.

II. *The ventral scutella thin, the dorsal scutella bony, not articulated together. The eyelids fleshy, smooth. The cervical scutella in pairs, separate. Nasal bone elongate, separating the nostrils.* North America.

3. Alligator. The face broad, depressed.

1. Jacare.

Head moderately high, shelving on the sides. Orbits united by a distinct bony cross ridge. Eyelids striated or rugose, strengthened by a small internal bone. The cervical scutella four or five pairs, forming a shield; the dorsal and ventral scutella bony, articulated together, forming a dorsal and ventral shield; the gular and ventral scutella smooth.

A. *Head elongate; interorbital ridges strong. Dorsal scutella elongate, keeled, keels of vertebral series highest; lumbar scutella in six longitudinal series. Nuchal scutella small, compressed. Eyelids striated, with a rather large internal bone. Back black, yellow-varied.* Melanosuchus.

1. *Jacare nigra* (Black Jacare).

Crocodilus sclerops, Schn. Amph. 162; Cuvier, Arch. Zool. ii. t. 2. f. 3.
Crocodilus Yakare, Daud. Rept. ii. 414.
Alligator Sclerops, Cuvier, Oss. Foss. v. 35, t. 1. f. 7 & 16, t. 2. f. 3.
Caiman niger, Spix, Bras. t. 4 (good).
Champse niger, Natterer, Beitr. t. 21 (good).

Hab. Para; 13 feet long (*Graham*).

I think it better to adopt Spix's name, as *sclerops* has been used for all the species.

B. *Head short; orbits with diverging ribs in front to edge of jaws. Dorsal scutella broad, slightly keeled, equal; the lumbar scutella in four longitudinal series. Nuchal scutella distinct, in two cross series. Eyelids rugose, with a small internal bone. Back olive, brown-banded.* Cynosuchus.

a. *Head short, broad, depressed, with very distinct preorbital ridges to the edge of the jaw. Cervical disk short, broad, formed of four bands of scutella. Sides of jaws pale, with a series of dark spots.*

2. *Jacare latirostris.*

Crocodilus latirostris, Daud. Rept. ii. 417.
Caiman fissipes, Spix, Bras. t. 3 (good).
Champse fissipes, Wagner, Icon. t. 17; Natterer, Beitr. t. 22 (good).
Alligator sclerops, Pr. Max. Abbild. t. .
A. cynocephalus, Dum. & Bibr. Erp. Gén. 86.

Hab. Brazils. Pernambuco (*J. P. G. Smith*).

The nose of the young specimen is as long as the width at the eighth tooth.

b. *Head elongate, longer than the width at the eighth tooth, with none or only indistinct evanescent ridges from the front of the orbit. Cervical disk oblong, elongate, of five series of scutella.*

* *Face depressed, broad; sides of the jaws with a series of large coloured spots, as in the former section.*

3. *Jacare longiscutata.*

Dorsal scutella elongate, longer than broad, uniformly keeled, in ten longitudinal series in the middle of the body; ventral scutella elongate, in fourteen or sixteen longitudinal series. Sides of the jaws pale, with five or six band-like spots; the inner pair of the first and second series of cervical scutella large and equal-sized.

Hab. Tropical America.

This is very like the following; but the head is rather broader, and the dorsal and ventral shields are much larger and more numerous.

It is known from the young of *Jacare nigra* by its olive-colour, the spots on the sides of the jaws, and the presence of the distinct nuchal scutella.

4. *Jacare ocellata.*

Dorsal scutella broad, uniformly keeled, in eight longitudinal series in the middle of the body; ventral scutella in twelve longitudinal series, those of the hinder series smaller, longer, and more numerous; the central pair of cervical scutella in the first series smaller than those that follow.

Hab. Lake of Santa Cruz de la Sierra.

** *Face attenuated, rather high on the sides; sides of the jaws one-coloured, not spotted or banded.*

5. *Jacare punctulata.*

Caiman (Jacaretinga) punctulatus, Spix, Bras. t. 2 (good).
Champsa sclerops, Natterer, Beitr. t. 22 (head, good).
Alligator punctulatus, Dum. & Bibr. Erp. Gén. ii. 91.

Back pale yellow, brown-banded; the sides of the head yellow; upper and lower jaws yellow, one-coloured, or minutely speckled; sides of the neck smooth, with flat scales. Nose rather high and square.

Hab. Brazils (*Spix*); Surinam; Argentine Republic.

Var. Sides of the neck rugose, with prominent keeled scales. Demerara.

Dr. Natterer figures two other species, under the names of *Champsa vallifrons* (t. 23) and *Ch. punctulatus* (t. 24), the latter of which seems to differ from the former in the head being narrower and more tapering. I have seen no specimens agreeing with these figures; but they look very like varieties of the above. At the same time, some of our specimens appear to have more attenuated snouts than others; but when the callipers are applied to the nose and to other parts of the head, the absolute proportions of the parts are very nearly the same.

I may observe that, characteristic as are the figures of Dr. Natterer's paper, none of them exactly agree with our specimens when measured. Perhaps this arises from their having been drawn in perspective.

In some specimens of this *Jacare,* the first and sometimes even the second cervical scutella have two keels, in others only one; but this is no specific distinction, as it is not rare to find species with two keels on one side of the neck, and only one on the other.

2. Caiman.

Head high, flattened on the sides. Orbits without any ridges. The eyelids smooth, strengthened with a large, single, internal bony plate. The dorsal and ventral scutella bony, articulated together, forming a dorsal and ventral shield; the gular and lateral ventral shields keeled, the abdominal ones smooth; the cervical scutella four or five pairs, with sometimes one or a pair interposed between the second and third pairs.

A. *Head shelving on the sides. Nuchal scutella five, in a single cross series; cervical scutella five pairs; dorsal scutella highly keeled, irregular, in six series; the lumbar scutella in two longitudinal series; the gular and two outer lateral series of ventral scutella keeled. The flat upper disk at base of tail broad and strongly crested.* Paleosuchus.

1. *Caiman trigonatus*, Gray, Cat. B. M. 66.

Crocodilus trigonatus, Schn. Amph. 161, ii. t. 1, 2 (skull); Cuvier, Oss. Foss. v. 65.
C. palpebrosus, var. 2, Cuvier, Oss. Foss. v. 40, t. 2. f. 1.
Champse trigonata, Natterer, Beitr. t. 26 (good).

Hab. Tropical America. St. Domingo (*Cuvier*).

Cuvier and Duméril and Bibron have confounded this species with the Black Crocodile from West Africa; and we have even received a skeleton of the latter animal from the Paris Museum, under the name of *Alligator palpebrosus*, var.

B. *Head flat and erect on the sides. Nuchal scutella many, in two cross series; cervical scutella three pairs; dorsal scutella slightly keeled; the lumbar scutella in four longitudinal series; the gular, the ventral, and lateral abdominal scutella keeled. The flat upper disk at the base of the tail elongate.* Aromosuchus.

2. *Caiman palpebrosus*, Gray, Cat. B. M. 67.

Crocodilus sclerops (male), Cuvier, Arch. Zool. ii. 168.
C. palpebrosus, var., Cuvier, Oss. Foss. v. 38, t. 1. f. 6 & 17, t. 2. f. 2.
Champsa palpebrosa, Natterer, Beitr. t. 27 (good).
Caiman (*Jacaretinga*) *moscifer*, Spix, Bras. t. 1.

Brown; tail black, banded.

Hab. Tropical America.

Natterer figures the head of a species, under the name of *C. gibbiceps*; but I do not see in what respect it differs from the above, except that the head is a little higher, which is, perhaps, a sexual distinction.

3. Alligator.

Head depressed, broad, without any preorbital ridges. The eyelids smooth, fleshy. The dorsal scutella not articulated together, in six longitudinal series; the ventral scutella thin; the gular and abdominal shields smooth; nuchal scutella one pair, small; cervical scutella three pairs, hinder smallest.

Alligator Mississippiensis, Gray, Cat. B. M. 61.

Crocodilus Mississippiensis, Daud. Rept. ii. 418.
C. Lucius, Cuvier, Oss. Foss. v. 32, t. 1. f. 8, & 15 t. 2. f. 4.
C. Cuvieri, Leach, Zool. Misc. ii. 102, t. .
Alligator Lucius, Dum. & Bibr. Erp. Gén. iii. 75, t. 25, 26.

Hab. North America. Carolina (*Catesby*).

There are two varieties (?); or, it may be, one sex has the face longer in proportion to the width than the other.

XXXVI.—*On Additions to the Madeiran Coleoptera.* By T. Vernon Wollaston, M.A., F.L.S.

[Continued from p. 293.]

Fam. **Curculionidæ.**

Genus Lixus.

Fabricius, Syst. Eleuth. ii. 498 (1775).

6. *Lixus anguinus* ?, Linn.

L. angusto-elongatus, subcylindricus, subnitidus, pube cinereo-albida demissa minuta parce tectus et linea marginali nivea ornatus; rostro longiusculo, minute inæqualiter punctulato, postice subcarinato; prothorace minutissime punctulato necnon profunde et remote varioloso, in disco linea albidiore utrinque ornato; elytris apice singulatim acuminatis sed vix dehiscentibus, sat profunde striato-punctatis, obsolete albido lineatis.

Long. corp. lin. 6.

Habitat prope urbem Funchalensem, a Dom. Wolff nuper lectus.

Curculio anguinus?, Linn., Syst. Nat. i. ii. 610 (1767).

L. rather smaller and narrower than the *L. Cheiranthi,* less densely clothed with a minute ashy pubescence, but (like that species) ornamented with a broad paler line along its sides; also less opake. *Rostrum* rather longer and slenderer than that of *L. Cheiranthi*; also a little more curved, subcarinated posteriorly, very minutely punctulated, and with rather larger punctures intermixed. *Prothorax* much more deeply and remotely punctured, the punctures (or varioles) being, *on the disk,* enormous and subconfluent; the spaces between them very minutely punctulated; ornamented on either side of its disk with a broad but indistinct paler line. *Elytra* gradually a little narrowed behind, and with the extreme apex of each more produced or acuminated, but scarcely divergent; somewhat deeply striate- (or perhaps rather seriate-) punctate, and apparently ornamented with a few indistinct paler lines. *Legs* robust; the tibial hook rather less developed than in the *L. Cheiranthi*. *Antennæ* picescent at their base.

The single specimen of *Lixus* from which the above description has been compiled was communicated two months ago by Mr. Bewicke, who obtained it from the collection of a German entomologist, Dr. Wolff, by whom it was captured, during the past winter, near Funchal. Being, unfortunately, unique and in a rubbed condition, it is next to impossible to decide for certain whether it be referable positively to the *L. anguinus* of Mediterranean latitudes, though the generality of its characters are so very similar, apparently, to those of that insect, that I think it would scarcely be safe to treat it as distinct. At the same time, however, I cannot but admit that in the almost *undivaricating* apices of its elytra it does not quite accord with types of the *L. anguinus* now before me, but agrees better with the *diagnosis* of the *L. anguiculus* from Southern Europe. Nevertheless I think that its other features, particularly of coloration, will hardly admit of its being identified with the latter.

From the *L. Cheiranthi* (the only *Madeiran* species with which it could possibly be confounded) it is abundantly different, being not merely (judging from the unique example) a little smaller and relatively narrower, but also less densely clothed with minute cinereous pubescence, and moreover less *evenly* so, there being evident traces of paler longitudinal lines, both on its elytra (which are much more produced, separately, at their apices) and on either side of the disk of its pronotum. Its rostrum, too, is a little longer and slenderer, and subcarinated posteriorly; its prothoracic punctures are very much larger and more remote (the central ones particularly being enormous and subconfluent, so as to take the form of varioles); and its tibial hooks are less developed.

In the event of its being an undescribed species (which, however, is scarcely likely), I would propose for it the trivial name of *Wolffii*.

Genus Laparocerus.

Schönherr, Gen. et Spec. Curc. ii. 530 (1834).

7. *Laparocerus undulatus*, n. sp.

L. subgracilis, niger, pube brevi demissa viridi-cinerea parce variegatus sed pilis superadditis fere carens; capite vix sculpturato, oculis ovalibus prominentibus, rostro longiusculo subgracili apicem versus sensim dilatato; prothorace parce et profunde punctato, obsolete carinato, in disco postico leviter bi-impresso; elytris profunde punctato-striatis, obsolete undulato-inæqualibus; antennis ferrugineis, elongatis, gracillimis, articulo secundo tertio sensim longiore.

Mas pedibus robustis; tibiis longissime pilosis, anticis ad apicem valde et subito incurvis, posticis apicem versus facile dilatatis, intus pone medium usque ad apicem late emarginatis, angulo interno angulato-exstante, externo rotundato valde setuloso; tarsis latis.

Fœm. adhuc latet.

Long. corp. lin. $3\frac{1}{2}$.

Habitat in montibus Maderæ, a meipso olim captus.

L. rather narrow, elongate-ovate, black, sparingly variegated with an exceedingly minute, decumbent, greenish-cinereous or opaline pubescence, but almost free from additional erect hairs. *Head* nearly unsculptured, with the rostrum, however, slightly rugulose and also rather long and narrow, though perceptibly widened at its apex; *eyes* oval and prominent. *Prothorax* very deeply and sparingly punctured, most obsoletely keeled, and unequal or bifoveolated on its hinder disk. *Elytra* deeply punctate-striate, and with the interstices rather undulated. *Antennæ* long, slender, and ferruginous; the *scape* nearly straight, very slender at the base and very suddenly thickened at its apex, where it is somewhat darker; *funiculus* with the first joint extremely long, being perceptibly longer than the second.

Male with the *legs* thick and robust: the *tibiæ* with extremely long pile internally, and the *anterior pair* greatly and suddenly incurved at their apex; the *hinder pair* gradually dilated, but scooped-out internally from a little beyond the middle to the inner apical angle, which is anguliform and prominent; the outer angle densely setose and slightly rounded or obtuse (not being prominent): the *tarsi* broad.

Female as yet undetected.

The *excessively slender* scape of this insect, which is suddenly clubbed at its extreme tip (instead of being gradually thickened), will immediately assign it to *Laparocerus* rather than to *Atlantis*; whilst its comparatively elongate, anteriorly subdilated rostrum, narrowish outline, and somewhat undulated interstices point to the *L. clavatus* (which in my 'Ins. Mad.' I had regarded, wrongly, as an *aberrant Atlantis*) as its nearest ally. Specifically, however, it is abundantly distinct from that insect, being not merely larger and of a different colour (its legs being dark instead of testaceous, and its pubescence more or less opal or greenish-cinereous instead of golden-brown), but also having its head and rostrum nearly unsculptured, its eyes a little larger, more oval, and less prominent, its prothorax very much more deeply and sparingly punctured, and more unequal (or biimpressed) on the hinder disk, and with the first joint of its funiculus perceptibly longer than the second. Judging from the single specimen now before me, its sexual characters are likewise different from those of *L. clavatus*; for, although I cannot vouch for the female, the male has its legs considerably more robust, with the tibiæ more pilose and the feet decidedly broader at their base. Its posterior tibiæ, also, are not only wider but broadly scooped-out internally from nearly the middle point to the terminal angle, which last is extremely prominent*.

The unique example (a male) from which the above description has been drawn out I detected lately amongst a quantity of the *Atlantis lamellipes* which I had placed aside in a pill-box, and which were captured by myself several years ago in the lofty elevations of Madeira, principally at the Fanal.

Genus Cænopsis.

Bach, Käfer-Fauna, 268 (1854).

Genus *Trachyphlœo* affinitate proximum et facie habituque generali omnino similis, sed *capite* supra et utrinque dense longitudinaliter striguloso; *rostro* breviore, *scrobe* brevi sursum curvato; *oculis* paulo magis prominulis: *antennis* pone medium scrobis insertis, longioribus, minus incrassatis (sc. *scapo* longiore graciliore versus basin magis flexuoso, *funiculi* articulis inter se laxioribus, 1^{mo} et 2^{do} paulo longioribus, illo minus incrassato): *tibiis* simplicibus (*i. e.* ad apicem externum haud spinosis) et *tarsorum unguiculis* magis approximatis (basi minus distantibus).

This genus (which is identical with *Cataphorticus* of Jacq. Duval) is closely allied to *Trachyphlœus*, with which, indeed, until lately its members have been associated. It differs merely in having the upper surface and sides of its head densely longitudinally strigulose (a peculiarity of sculpture, however, which is, of course, only perceptible when the scales are removed); in its rostrum being shorter, with the lateral scrobs consequently more abbreviated (and likewise more *curved upwards*), and with the eyes a trifle more prominent; in its antennæ (which are implanted rather *behind* the middle of its short scrobs, and therefore nearer to either eye) being rather longer and less incrassated, the funiculus-joints being *laxer inter se*, and the first and second of them more perceptibly elongated (though the former is less evidently thickened than is the case in *Trachyphlœus*); in its

* In some respects it approaches nearer to the *L. morio*; but, apart from numerous other characters, its *much narrower* and apically-subdilated rostrum, in conjunction with its less globose, more uneven, and much more deeply and sparingly punctured prothorax, its more coarsely punctured elytral striæ, and the totally different structure of its hinder male tibiæ, will at once distinguish it from that insect.

tibiæ being simple (or unarmed with additional spines) towards their outer apex; and in its tarsal claws being set more closely together.

8. *Cænopsis Waltoni*, Schönh.

C. ovatus, niger, fusco-cinereo squamosus et setis rigidis longiusculis dense obsitus; capite postice longitudinaliter strigoso, rostro brevi; oculis prominulis; prothorace densissime ruguloso-punctato; elytris profunde striato-punctatis, punctis magnis; antennis pedibusque ferrugineis squamosis, illis versus basin scrobis (mox ante oculos) insertis, his breviusculis, tibiis ad apicem simplicibus (haud spinuloso-terminatis).

Long. corp. lin. $1\frac{1}{2}$.

Habitat Maderam: in montibus supra urbem Funchalensem exemplar unicum sub lapide cepit Dom. Bewicke.

Trachyphlœus Waltoni, Schönh., Gen. et Spec. Curc. vii. 115 (1843).

C. ovate, black, densely clothed with brownish-cinereous scales and studded with long and erect setæ. *Head* closely longitudinally strigulose behind, with the *eyes* rounded and rather prominent, and with the *rostrum* short; the last with the lateral *scrobs* likewise short and curved upwards to the upper margin of the eye, and with the antennæ implanted into it near its base. *Prothorax* very densely punctured, the punctures being rather small and more or less confluent. *Elytra* deeply striate-punctate, the punctures being extremely large. *Antennæ* and *legs* ferruginous, but squamose: the *former* relatively longer and slenderer than those of the *Trachyphlœus scaber*, and with their scape more flexuose at the base; the *latter* rather short, with the tibiæ simple at their extreme apices—not being fringed with, or terminated by, minute spinules.

A single specimen has lately been communicated by Mr. Bewicke (by whom it was captured at the Mount, above Funchal), which appears to me to agree precisely with my British examples of the *C. Waltoni*—possessing the longitudinal frontal strigæ, the abbreviated rostrum, the enormous elytral punctures, and the numerous other features which distinguish that insect; and I think it far from unlikely, therefore, that it may have been imported accidentally into Madeira through the medium of the English residents, who have long been in the habit of bringing boxes of plants, at intervals, from our own country, in order to replenish their gardens with the familiar forms of more northern latitudes. And, indeed, so long as such is the case, it seems impossible to foretell the amount of additions which may and *must* accumulate to the fauna in the course of every few years, though happily it is not difficult, when studied *in situ*, to draw the line of demarcation, in at all events a general way, between that portion of the Coleopterous population which is truly indigenous and that which owes its presence to chance agencies from without. Whether introduced, however, or not (for it is, of course, impossible to decide this point *for certain* on the evidence afforded by a solitary individual), it is clear that the species must be admitted into our Catalogue; for even if it be not originally Madeiran, it has in all probability, at the least, become naturalized in the island. The unique example described above has been presented by Mr. Bewicke to the collection of the British Museum.

In order to draw attention to its distinctions from the *Trachyphlœus scaber*, to which, *primâ facie*, it is of course a good deal allied, I may just repeat that it not only wants the minute spines which fringe the apices of the tibiæ in that insect, but that it is likewise altogether smaller and has its setæ denser and longer; that its rostrum is much more abbreviated and with the lateral *scrobs* consequently shorter (being also *curved upwards*, to the upper margin of the eye, instead of downwards to the *middle* of it); that its eyes are more prominent and its antennæ longer and slenderer, with their scape more flexuose at the base, and implanted *towards the base* of the *scrobs* instead of towards its apex; that its forehead, when denuded of its scales, will be seen to be longitudinally strigulose; that its prothorax is more regularly and closely punctured; and that its elytra have the punctures of their striæ very much larger.

Fam. **Halticidæ.**

Genus Longitarsus.

Latreille, Fam. Nat. des Ins. 405 [script. *Longitarse*] (1825).

9. *Longitarsus*, n. sp.

Habitat Maderam, a Dom. Anderson detectus.

I merely record here the *existence* of a new and insignificant *Longitarsus*, to be added to the list, because my friend M. E. Allard, of Paris, who has paid such great attention to the *Halticidæ*, and to whom we are indebted for the best monograph of the family which has yet been published, is desirous of including it in a supplemental memoir which he is preparing. Although, therefore, I drew out a careful description of it before sending it to Paris, I nevertheless abstain from inserting it in this paper, and will simply call attention to the fact that its discovery is due to Mr. F. A. Anderson, who brushed three or four specimens of it (as I am informed by Mr. Bewicke) from off grass immediately outside the gate which leads into the grounds of the Palheiro, on the mountains to the eastward of Funchal. One of these examples, which has been transmitted to me by Mr. Bewicke, has been presented by Mr. Anderson to the collection of the British Museum.

Although purposely omitting (for the reason above referred to) its diagnosis, I may briefly state that, according to a communication now before me from M. Allard, the species in question is about "the same size and form as the *L. obliteratus*, Rosenh., but is darker and more shining, with the punctation of its prothorax and elytra much finer, and with its antennal joints considerably shorter." M. Allard then adds: "It has equally an analogy with the *L. parvulus*, Gyll.; but this last has its shoulders wider and more prominent, and its punctures a little too subtle and *not* disposed in rows at the base and towards the suture of its elytra."

Fam. **Coccinellidæ.**

Genus Coccinella.

Linnæus, Syst. Nat. edit. 1 [script. *Coccionella*] (1735).

10. *Coccinella Andersoni*, n. sp.

C. rotundato-ovalis, nitida, levissime punctulata; capite rufescenti-lurido, in fronte vix flavescentiore; prothorace antice et ad latera (rotundata) subpellucide marginato, apice truncato (angulis anticis haud porrectis), luride subflavescenti-rufo, ad utrumque latus necnon in maculis duabus basalibus parvis dilute flavo; elytris marginatis, margine circa humeros (valde rotundatos) versus scutellum continuato sed longe ante scutellum abrupte terminato, luride subflavescenti-rufis sed maculis maximis confluentibus dilute flavis marmoratis; antennis pedibusque infuscato-testaceis, illis tarsisque ad apices paulo obscurioribus.

Long. corp. lin. $1\frac{3}{4}$.

Habitat Maderam: ad flores pinorum supra Funchal primus deprehensit Dom. Anderson, cujus in honorem nomen triviale proposui.

C. roundish-oval, shining (but not highly polished), and most lightly and minutely punctulated. *Head* of a dull lurid yellowish red, and a little more diluted (though scarcely spotted) on the forehead. *Prothorax* much rounded at the sides, with its extreme lateral and anterior edges subpellucid, truncated in front (its anterior angles not being at all porrected); of a dull lurid yellowish red, but with each side (except a small, ill-defined, cloudy enclosed spot) broadly lurid yellow, and two obscure nearly confluent patches of the same colour resting on the centre of its extreme base. *Elytra* distinctly margined, the margin being carried forward to about midway between the shoulders (which are much rounded-off) and the scutellum, at which point it terminates abruptly; of the same dull lurid yellowish red as the prothorax, but ornamented with equally dull lurid-yellow, immense, more or less confluent spots, of which two large ones join each other at the extreme base (behind the scutellum), whilst those immediately behind coalesce so as to form an oblique antemedial zigzag fascia, reaching from either shoulder to about the middle of the suture; then follows a longitudinal patch on the outer posterior disk, and then a larger one (near the suture) behind it, both of which merge into a marginal one; after which there is a small rounded spot at the apex itself. *Antennæ* and *legs* brownish-testaceous: the *former* rather slender, with their club (which is a little darker) only slightly enlarged; the *latter* robust, with the outer edge of their tibiæ and the apical joint of their tarsi infuscated.

Referring to this interesting addition to the Madeiran fauna, Mr. Bewicke has transmitted to me the following note:—"Mr. Anderson captured the first, from off a clump of Stone Pine (*Pinus pinea*) to the south of S. Antonio church, about two miles from Funchal. I think this was taken in May. A few days afterwards I obtained four more—two from off the same trees as Mr. Anderson's, and two from off others of the same species about half a mile distant—below S. Martinho. On a subsequent day I met with four more, on trees in the same district; and I have recently found one in Mr. Grimes's garden, on the Saltos road, above Funchal. It is only on trees *in flower* that I have hitherto observed them; but I failed in detecting any *Aphides* on which they might feed."

Fam. **Helopidæ.**

Genus Helops.

Fabricius, Syst. Ent. 257 (1775).

11. *Helops arboricola*, n. sp.

H. subcylindrico-oblongus, ater, subopacus; capite prothoraceque confertissime punctulatis (punctis subconfluentibus), hoc longiusculo, utrinque versus basin plus minus valde sinuato, angulis posticis plus minus acutis; elytris subparallelis, densissime et minute granulatis (granulis versus suturam obsoletis), crenato-striatis, interstitiis tuberculis parvis remotis longitudinaliter obsitis; antennis pedibusque elongatis.

Long. corp. lin. 7.

Habitat in intermediis Maderæ, sub cortice arborum laxo emortuo a Dom. Bewicke captus.

Helops arboricola, Bewicke, in litt.

H. subcylindrical-oblong, black, and subopake. *Head* and *prothorax* most densely punctulated, the punctures being subconfluent and a little coarser on the former than on the latter; the *latter* rather elongate, with the anterior angles somewhat porrected and acute, very finely margined both laterally and behind, and more or less scooped-out (sometimes very deeply so) on either side towards the basal angles, which are consequently more or less prominent or acute. *Elytra* almost parallel at the sides (at any rate in the males), most densely and minutely granulated (the granules, however, being almost obsolete towards the suture), crenate-striated, the interstices with a row of minute tubercles down each, which are obsolete near the suture and in front. *Antennæ* and *legs* long; the *former* (especially towards the extremity) and the *tarsi* of the latter somewhat fuscescent.

The present large *Helops*, the discovery of which is due to Mr. Bewicke, is well distinguished from all the other Madeiran species by its elongate parallel outline (at all events in the male sex); by its most closely punctured head and prothorax, the latter of which is relatively longer, and with the anterior angles more porrected, than is the case in either *H. Vulcanus* or *H. confertus*, and also more scooped-out on either side towards the base, which causes the posterior angles to be more or less prominent or acute; and by its very densely and minutely granulated elytra, the interstices of which have a row of small but well-defined tubercles down each (though both granules and tubercles are nearly obsolete towards the suture, particularly in front).

The *H. arboricola* is altogether narrower and more cylindric than *H. Vulcanus*, and its prothorax is relatively longer and less convex; nevertheless in actual *length* it almost equals that insect. Its habits, however, are quite different; for whilst *H. Vulcanus* is a maritime species, occurring beneath stones and in fissures of exposed rocks towards the coast, *H. arboricola* is found (like *H. confertus*) under the bark of trees in subsylvan spots of intermediate elevations. Under such circumstances a single specimen was captured, first, by Mr. Bewicke, during the spring of 1861, high up in the Ribeira de S. Luzia; and in April of the present year he again met with the species, in another but very similar locality—in the Vasco Gil ravine. Referring to this circumstance, in a letter lately received from him, Mr. Bewicke remarks as follows:—"I took one a short time ago, in a tree, up the Vasco Gil ravine; Senhor Moniz and I subsequently spent a day there and searched the whole vicinity, but found nothing until we came to the original tree, where we obtained three or four more. They were all of them beneath bark, at a considerable height (about 10 or 12 feet) from the ground. The *H. confertus* was very abundant in that tree, as well as in most of the others; and it is perhaps worthy of note that the tree was in a very similar position to the one (in the Rib. de S. Luzia) in which I took the insect last year—namely, in an old river-bed, and at about the same elevation above the sea." One of these latter specimens, from the Vasco Gil ravine, has been presented by Mr. Bewicke to the collection of the British Museum, and another to the Madeiran cabinet at Oxford.

Fam. Staphylinidæ.

Genus PLATYSTHETUS.

Mannerheim, Brachel. 46 (1831).

12. *Platysthetus cornutus.*

P. niger, nitidus; capite subconvexo, punctato; prothorace elytrisque distinctius alutaceis sed levius (sc. levissime) et parcius punctulatis; antennis subgracilibus; tarsis testaceis.

Long. corp. lin. $1\frac{1}{3}$.

Habitat prope urbem Funchalensem, specimen unicum cepit Dom. Anderson.

Oxytelus cornutus, Grav., Col. Micropt. 109 (1802).
Platysthetus cornutus, Erichs., Gen. et Spec. Staph. 782 (1839).

P. black and shining. Head rather convex, or at all events with the forehead not excavated between the antennæ, lightly punctured, and with a fine but abbreviated channel in the centre behind. *Prothorax* and *elytra* more coarsely alutaceous, but with the punctules smaller, finer, and more remote than those on the head, being, in fact, on the latter almost obsolete: the *former* with a deep central channel; the *latter* apparently undiluted in hue, being concolorous with the rest of the surface. *Antennæ* rather slender. *Tibiæ* somewhat piceous; *tarsi* testaceous.

The single specimen from which the above description has been compiled does not appear to differ sufficiently from the common European *P. cornutus* (which I have taken plentifully at the Canaries) to warrant its being treated as distinct. Nevertheless, since it is unfortunately a female one, I am unable to say whether the clypeus of the male sex would afford any character of specific signification. True it is that its elytra are concolorous with the rest of the surface (instead of being more or less testaceous or diluted on the inner disk of each, as is ordinarily the case), but Erichson expressly mentions that (as in examples he had examined from Syria) the elytra are sometimes altogether black. Its other features seem to agree sufficiently well with the corresponding ones of the *P. cornutus,* amongst which its comparatively convex (or unexcavated) forehead, its rather slender antennæ, its alutaceous surface, and the fineness of its punctation may be particularly noticed. The individual described from was taken near Funchal by Mr. F. A. Anderson, who has kindly presented it to the collection of the British Museum.

In my paper on "Additions to the Madeiran Coleoptera" published in the August number of the 'Ann. of Nat. Hist.' for last year, I stated that the species detected in the group up to that date amounted to 646. I have therefore merely to remark that the twelve here enumerated (four of which were first detected by Mr. Bewicke, four by Mr. Anderson, two by Senhor Moniz, one by Dr. Wolff, and one by myself) will raise the number to 658.

The few following notes may be conveniently inserted here:—

1. *Ptinella aptera* (Ann. Nat. Hist. ser. 3. viii. 101).—The little insect (detected in Madeira by Mr. Bewicke) which I cited in my last year's paper of "Additions," under the name of "*Ptinella aptera*, Guérin," appears to be the *ratisbonensis*, Gillm., and not the *aptera*. The mistake arose through the Rev. A. Matthews (who identified the species for me, whilst correcting the nomenclature of the British *Trichopterygidæ*) having had a wrong type communicated from Paris. It appears to him, however (and, I may add, to me also) to be coincident specifically with the English examples with which he originally compared it,—the only difference being that those examples are referable, as he believes, to the *P. ratisbonensis*, instead of to the *aptera*. Its synonymy, therefore, will stand thus:—

Trichopteryx ratisbonensis, Gillm., Sturm's Deutschl. Fauna, xvii. (1845).
Ptinella ratisbonensis, Matthews, Zoologist, 8058 (1862).

2. *Saprinus metallicus* (Ins. Mad. 217).—I find that this insect, which I have taken abundantly from beneath *rejectamenta* on the sea-beach of Porto Santo, is *not* the *metallicus* of Herbst, as I had imagined. From specimens which I sent to De Marseul for comparison, four years ago, and which have but lately been returned, the species appears to be referable to the *apricarius* of Erichson—an insect which is recorded from Spain, Corsica, Sicily, Algeria, and Egypt. Its synonymy will consequently stand thus:—

Saprinus apricarius, Erichs., in Jahrb. 194 (1834).
—— ——, De Mars., Mon. des Hist. 725. 158 (1855).
—— *metallicus*, Woll. [nec Herbst], Ins. Mad. 217 (1854).
—— ——, Id., Cat. Mad. Col. 75 (1857).

3. *Enneadesmus barbatus* (Ann. Nat. Hist. 3 ser. v. 359).—This must be quoted as the *Xylopertha barbata*, since it appears that the *Xylopertha* have, after all, but nine joints to their antennæ, and not ten as has usually been supposed. Consequently Mul-

sant's genus *Enneadesmus*, which was separated from *Xylopertha* solely on account of the former character, has to be suppressed.

4. *Tychius albosquamosus* (Ins. Mad. 345).—Having had occasion lately to re-examine with greater care the unique specimen of this insect which was captured on the Deserta Grande during May of 1850, and to compare it with examples from the Canaries, I believe that it is not a *Tychius* at all, but should be referred to the genus *Smicronyx* of Schönherr. It appears identical with a small Curculionid which I took, four years ago, in the intermediate elevations of Teneriffe, and which must consequently be quoted as the *Smicronyx albosquamosus*. Apart from minuter distinctions, *Smicronyx* may be known from *Tychius* by its more sunken eyes, and by its claws being approximated at their base, whereas in the latter they are not only distant, but are even furnished with a little intermediate appendage. The species are, *on the average*, somewhat smaller and less scaly than the *Tychii*; their prothorax is much more finely, and not so thickly, punctured; their elytral striæ are less decidedly crenulated, being often quite simple; and the spine at the inner apex of their tibiæ is a trifle more developed, whilst even the outer angle also is rather more prominent and spinulose. The unique Desertan example, now in the British Museum, being in exceedingly bad condition, from its having been taken dead and mutilated, it is much to be hoped that fresh specimens may ere long be brought to light, through the indefatigable researches of Mr. Bewicke, whose success amongst the minute Coleoptera of the Madeiran islands has been so remarkable.

5. *Atlantis clavatus* (Ins. Mad. 363).—For the reasons stated above, under the *Laparocerus undulatus*, I believe that this insect will be better referred to *Laparocerus* than to *Atlantis*. It should therefore be cited as the *Laparocerus clavatus*.

6. *Helops*.—According to information which I have received lately from Dr. Schaum, who has had occasion to examine critically certain types of the *Heteromera* in the collection of the late Dr. Germar, the names of no less than three of the Madeiran *Helopes* will, in right of priority, have to be changed, the species having apparently been described by Küster in 1850, *i. e.* four years previous to the publication of my 'Ins. Mad.' Assuming therefore Dr. Schaum's identification to be correct, for the *H. confertus*, Woll., we must read *asper*, Küst.; for the *H. Pluto*, Woll., *gagatinus*, Küst.; and for the *H. cinnamomeus*, Woll., *graniger*, Küst. It appears that "the *asper* was described as a Madeiran insect, but that the other two are stated erroneously to come from Portugal."

XXXVII.—*On a Species of* Limopsis, *now living in the British Seas; with Remarks on the Genus.* By J. Gwyn Jeffreys, F.R.S., F.G.S. &c.*

The only result of any interest which accrued from my dredgings this year in the northern seas of these islands was the discovery of the *Limopsis aurita* of Sassi in a living state. Last year I procured a few small single valves in the same spot; but, as I had experienced so much difficulty in distinguishing fossil from recent shells, I was not quite certain whether these valves might not have come from a submarine pleistocene bed, notwithstanding the freshness of their appearance, and the epidermis being retained on some of them. However, all doubt was removed on the present occasion. A specimen containing the animal was dredged about twenty-two miles off the Island of Unst in Shetland, at a depth of 85 fathoms, in sandy gravel, together with a tolerably large single valve in an equally recent state. My friend Professor Allman was with me at the time, and has very kindly made a drawing of the soft parts, which I have now the pleasure of exhibiting.

As nothing could be seen of the animal, although it was constantly and carefully supplied with sea-water for some time, I had no alternative but to kill it by immersion in boiling water, in order to examine it and the interior of the shell; and the sketch made by Professor Allman and my notes were therefore *post mortem*, and are not so complete or satisfactory as I could wish.

The appearance of the *Limopsis* while living and in its native element was extremely beautiful. The surface of the shell was clothed with long and fine hairs, which projected far beyond the edge of the valves, like a fringe of silken eyelashes. These hairs form part of the epidermis, and are not contractile; and they doubtless serve to protect or warn the feeble mollusk against the insidious attacks of other animals. When the shell becomes dry, the epidermal hairs shrivel up, and to some extent lose their former beauty.

The body is of a milk-white colour. The mantle is open in every part except behind; it has no tubes or folds, and its edges are thickened and furnished with papilliform glands. The gills or branchiæ are disposed as in other members of the same family. The foot is large in proportion to the rest of the body, and is shaped like a tobacconist's knife; it can in all probability form a suboval disk at the central portion, as in *Pectunculus*. The few and imperfect particulars here given serve, however, to show

* Communicated by the Author, having been read at the meeting of the British Association held at Cambridge in 1862.

that the animal of *Limopsis* is closely allied to that of *Pectunculus* in form; and the same remark applies to the shell in each of these genera.

The shell of *Limopsis* differs from that of *Pectunculus* only in the apparatus by which it is closed. In *Pectunculus* the hinge-area or plate at the back of the shell is furnished with a strong ligament which extends from one side to the other, and unites the whole of the hinge; while in *Limopsis* there is no ligament (properly so called), but only a small cartilage which fits into a triangular pit or depression placed just under the beak in each valve. The ligament and cartilage are in either case exterior to and above the hinge-line, but are seated within the beaks. In specimens of *Limopsis* of every age the teeth are continuous; but in *Pectunculus* they are interrupted in the middle, and form two distinct rows which obliquely diverge from the centre. But this last character I do not regard as constant or of much value.

In each of these genera, specimens of the same species vary greatly in being more or less oblique, and in the hinge-margin occasionally projecting at each end to such an extent as to give the shell an appearance of having ears, as is the case in many other genera of the family of *Arcidæ*.

Nucula has also a cartilage with a pit for its reception; but in that genus these processes are *internal*, instead of external as in *Limopsis*, and they are placed *below* instead of above the hinge-line.

Lima bears no affinity to *Limopsis*, having only a single adductor muscle, and a different kind of hinge-fastening.

The history of the genus *Limopsis* is involved in some obscurity, which is partly owing to the rarity of the work in which it was originally described. According to the 'Lethæa geognostica' of Bronn (whose loss is so deeply felt and deplored by geologists), *Limopsis* was proposed as a new genus by Sassi, in the 'Giornale Ligustrico' for 1827; but the British Museum library does not contain any such periodical, and I have not been able to obtain a sight of it in this country. Nyst, in his work on Belgian fossils (1843), stated that he was ignorant of Sassi's publication or its date, although Bronn had given both these particulars twelve years before the above statement was made. Nyst and Galeotti had in 1835 proposed for the same genus the name of *Trigonocœlia*. The late Prof. d'Orbigny, equally disregarding the rule of priority in scientific nomenclature, published, in the 'Paléontologie Française' (1844), another name (*Pectunculina*), which has been lately adopted by Dr. Chenu, who makes *Limopsis* and *Trigonocœlia* subgenera of D'Orbigny's genus, but upon what grounds it is almost impossible to imagine. Dr. J. E. Gray gave another name (*Limnopsis*) to this genus in 1840; but this may have originated in a *lapsus calami.*

The first conchologist who pointed out the difference between *Limopsis* and *Pectunculus,* although he retained both in the old Linnean genus *Arca,* was Brocchi, who, in his 'Conchiologia Fossile Subapennina' (1814, vol. ii. p. 485, tab. 11. f. 9), described the species which I have now noticed as an inhabitant of the British seas. His description and remarks are, as usual, most excellent. This species (*L. aurita*) is not uncommon in the Coralline Crag at Gedgrave; and Mr. Searles Wood suspected that it may have lived on to the Red Crag period, as his cabinet contained a specimen, but much water-worn, from that formation.

It is quite impossible to distinguish, as species, the recent shells dredged in our own northern sea from those found in the Coralline Crag; and I believe other species of *Limopsis* are also derived from Tertiary forms, but that they have not been hitherto identified with them.

The recent species appear to be six in number, viz.:—

1. *multistriata,* Forskål; Red Sea.
2. *Belcheri,* Adams & Reeve. This is perhaps the *Pectunculus granulatus* of Lamarck, an Eocene fossil from Grignon.
3. *munita,* Philippi; from the Sicilian and Calabrian Tertiaries. Probably the same as two recent specimens in the British Museum, the locality of which is unknown: or it may be a variety of the next.
4. *aurita,* Brocchi (*Trigonocœlia sublavigata,* Nyst); Shetland. The single valve of a *Limopsis,* dredged by Mr. M'Andrew on the coast of Norway, and now in the British Museum, appears to belong to a variety of this species, and to differ from the typical form only in the inside of the front margin being notched—a character which is not uncommon in varieties of *Astarte sulcata* and *A. triangularis.* Prof. Sars, in his Catalogue of 1857, regards this last specimen as belonging to *L. munita*; while Danielssen, in his more recent work published in 1859, refers it to the *Pectunculus pygmæus* of Philippi.
5. *cancellata,* Reeve; not uncommon on shells of a variety of *Phorus Indicus,* but apparently fossil.
6. *pellucida,* Jeffreys; dredged off Guernsey. A minute species; but, although quite distinct from the young of any other species, it requires further investigation in regard to its true position.

Although the particulars which I am enabled to give of the animal of *Limopsis* are confessedly meagre, I have been induced to publish them in consequence of nothing being yet known on the subject; and at any rate I hope this notice of another link being supplied in the chain which connects the tertiary with the recent fauna may not be uninteresting to naturalists.

XXXVIII.—*On some new Species of* Scissurellidæ *from the Seas of China and Japan.* By Arthur Adams, F.L.S. &c.

The genus *Scissurella* of D'Orbigny is distinguished from *Anatomus*, H. & A. Adams, in being provided with a foramen instead of a fissure. It is synonymous with *Schismope* of Jeffreys, and *Woodwardia* of Crosse and Fischer. The new species of *Scissurella* and *Anatomus* which I now describe, from the seas of China and Japan, were dredged from deep water and from a bottom of sandy mud and broken shells.

1. *Scissurella carinata*, A. Adams.

S. testa ovata, depressa; spira planiuscula; anfractibus $2\frac{1}{2}$, planis, ultimo supra carinam striis radiantibus (ad suturas validioribus) instructo, infra carinam cingulis elevatis transversis ornato, basi lineis elevatis concentricis, interstitiis cancellatis instructo; apertura obliqua; labio recedente.

Hab. Okosiri; 35 fathoms. Seto-Uchi; 16 fathoms. Gotto; 71 fathoms.

This species and the others I have named *Scissurella* have a foramen instead of a fissure, and would be called by some *Schismope* or *Woodwardia*, both of which names I believe to be synonyms of *Scissurella* proper. *S. carinata* has a flattened spire and three prominent keels on the last whorl below the carinate periphery. It most nearly resembles *S. d'Orbignyi*; but there are three keels besides the fissural carina.

2. *Scissurella modesta*, A. Adams.

S. testa ovata, depressa, stomatelliformi, anguste umbilicata; spira parva vix elata; anfractu ultimo supra carinam concentrice striato, infra carinam longitudinaliter plicato, basi lirulis spiralibus ornato; apertura perobliqua, transversim ovata.

Hab. Tabu-Sima; 25 fathoms.

A small simple white species, without keels, striated above the somewhat rounded periphery, and obsoletely plicate below.

3. *Scissurella miranda*, A. Adams.

S. testa ovata, depressa, late umbilicata; spira planiuscula; anfractu ultimo supra carinam subtilissime concentrice striato, infra carinam plicis obliquis subnodosis longitudinalibus distantibus ornato, basi lineis concentricis instructo; apertura perobliqua, transversim ovata.

Hab. Mino-Sima; 63 fathoms.

In this small but very pretty species the last whorl is nodosely plicate below the fissural keel.

Genus Anatomus, H. & A. Adams.

By common consent, the somewhat mythical *Anatomus* of Denys de Montfort has been ignored. His name *Anatomus*, however, a very significant and good one, may still be used for those species of *Scissurella* in which the margin of the outer lip is fissured. Woodward has unnecessarily suggested the alteration *Anatoma*, for the sake, possibly, of the feminine termination.

1. *Anatomus japonicus*, A. Adams.

A. testa trochiformi; spira conica; anfractibus $3\frac{1}{2}$, convexiusculis, striis elevatis longitudinalibus et transversis confertis concinne decussatis, striis longitudinalibus in basi flexuosis; apertura subcirculari; labio in medio dilatato et reflexo.

Hab. Mino-Sima; 63 fathoms. Seto-Uchi. Gotto. O-Sima.

This is a large and extremely beautiful species, very like *A. crispatus* in sculpture. It also resembles *A. conicus*, D'Orbigny, but it is more depressed, and, instead of being simply striate, it is finely decussate; the base of the shell, moreover, is anteriorly produced and angulated. This species and *Scissurella carinata* are met with in greater abundance than the other members of the group, and both occur in deep water.

2. *Anatomus lamellatus*, A. Adams.

A. testa globoso-conoidea; spira conica; anfractibus $3\frac{1}{2}$, convexiusculis, lamellis radiantibus, subdistantibus, interstitiis lineis elevatis transversis concinne cancellatis, lamellis in basi flexuosis; apertura subcirculari; labio in medio dilatato, angulato, et late reflexo.

Hab. Mino-Sima; 63 fathoms. Gotto; 71 fathoms. O-Sima; 26 fathoms.

In form this species is most like *A. japonicus*; but the upper part of the whorls is adorned with fine curved radiating lamellæ, and the inner lip is broadly reflexed, and partly covers the umbilicus.

3. *Anatomus turbinatus*, A. Adams.

A. testa turbiniformi; umbilico profundo, perspectivo; spira elata; anfractibus $4\frac{1}{2}$, convexiusculis, lamellis confertis radiantibus (in medio angulatis) et lineolis elevatis transversis instructis, basi liris concentricis elevatis ornato.

Hab. Mino-Sima; 63 fathoms.

This species is elevately turbinate, with two conspicuous carinate whorls and a deep perspective umbilicus. The fine lamellæ on the upper part of the whorls are bent or angulated in the middle.

4. *Anatomus concinnus*, A. Adams.

A. testa ovata, depressiuscula; spira parva, vix elata, anguste et profunde umbilicata; anfractibus $2\frac{1}{2}$, convexis, striis elevatis radiantibus et concentricis concinne decussatis; apertura obliqua, suborbiculari.

Hab. Rifunsiri; 35 fathoms.

Under the lens, this little species appears to be intermediate in character between *A. crispatus*, Flem., and *A. reticulatus*, Phil., the decussation not being so fine as in the former, nor so coarse as in the latter.

5. *Anatomus mirificus*, A. Adams.

A. testa ovata, depressa; spira plana, late et profunde umbilicata; anfractibus $2\frac{1}{2}$, planiusculis, lineis elevatis radiantibus et concentricis regulariter et concinne clathratis, regione umbilicali sublævi; apertura perobliqua; labio recedente.

Hab. Lo-shan-kow, Shantung.

In this large and very beautiful species the entire surface of the whorls is regularly and delicately finely clathrate, and the umbilicus is very wide and open.

6. *Anatomus stamineus*, A. Adams.

A. testa ovata, depressa; spira plana; umbilico mediocri; anfractibus $2\frac{1}{2}$, planiusculis, lineis stamineis elevatis radiantibus (infra carinam validioribus) striisque concentricis elevatis late clathratis, regione umbilicali lineis elevatis concentricis instructo; apertura rotundato-ovata; labio recedente.

Hab. Tsu-Sima; 25 fathoms.

This species is widely clathrate, with conspicuous thread-like radiating and concentric lines, the former of which assume on the spire a lamellar character; the umbilicus is moderate.

XXXIX.—*Descriptions of newly discovered Spiders captured in Rio Janeiro by* John Gray, Esq., *and* the Rev. Hamlet Clark. By John Blackwall, F.L.S.

A highly interesting collection of spiders made in Rio Janeiro, chiefly among the Organ Mountains, by John Gray, Esq., and the Rev. Hamlet Clark, early in the year 1857, was, with great liberality, presented to me by those gentlemen, to whom I avail myself of this opportunity to express my obligation. From the specimens it contained, which were preserved in spirit, I have selected the following species for description, under the impression that they will be found new to arachnologists.

Tribe **Octonoculina.**

Family Lycosidæ.

Genus Lycosa, Latr.

Lycosa inornata.

Length of the female $\frac{5}{8}$ths of an inch; length of the cephalothorax $\frac{5}{16}$; breadth $\frac{5}{24}$; breadth of the abdomen $\frac{1}{5}$; length of a posterior leg $\frac{9}{10}$; length of a leg of the third pair $\frac{7}{12}$.

The cephalothorax is large, compressed before, rounded and somewhat depressed on the sides, which are marked with furrows converging towards a narrow longitudinal indentation in the medial line; it is densely clothed with short hairs, and of a dark-brown colour, with broad yellowish-grey margins, and a band of the same hue extending along the middle, whose anterior part is the broadest and comprises a dark-brown line directed backwards from each posterior eye. The four small anterior eyes form a straight transverse row near the frontal margin of the cephalothorax, and the two intermediate ones are larger than the lateral ones. The falces are powerful, conical, vertical, armed with teeth on the inner surface, and of a brown-black colour, with yellow-grey hairs in front. The maxillæ are enlarged at the extremity, which is obliquely truncated on the inner side, and are slightly curved towards the lip; the latter organ is short, and broader in the middle than at the base or apex, which is truncated and hollowed. These parts have a reddish-brown hue, that of their extremities being yellowish brown. The sternum is oval and hairy, with minute prominences on the sides opposite to the legs, and is of a yellowish-brown colour. The legs are robust, provided with hairs and sessile spines, and of a yellow-brown hue; the fourth pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is small and inflected at its base; the metatarsi and tarsi are provided on the under side with hair-like papillæ constituting a climbing apparatus. The palpi resemble the legs in colour, and the digital joint, which is tinged with brown, has a curved pectinated claw at its extremity. The abdomen is oviform, hairy, convex above, and projects over the base of the cephalothorax; the upper part is of a greyish-yellow colour, and has a brownish-black spot on each side of its anterior extremity; a pale-brown band, obscurely bordered with black, extends from the anterior part along the middle, nearly half its length; it has an angular point on each side, and is bifid at its termination; to this band succeed a few small, indistinct, black, angular lines having their vertices directed forwards; the sides are spotted with brown, and the under part has a yellow-grey hue; the sexual organs have a longitudinal septum in the middle, and are of a red-brown colour.

Genus Sphasus, Walck.

Sphasus luteus.

Length of the female $\frac{3}{20}$ths of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{10}$; length of an anterior leg $\frac{3}{8}$; length of a leg of the third pair $\frac{3}{10}$.

The eyes are seated on black spots on the anterior part of the cephalothorax; the four posterior ones form a greatly curved, transverse row, whose convexity is directed backwards, and the other four describe a trapezoid whose shortest side is before; the posterior eyes of the trapezoid are the largest, and the anterior ones much the smallest of the eight. The cephalothorax is short, oval, glossy, convex, particularly in the posterior region, with a very slight indentation in the medial line; it is of a dull-yellow colour, with narrow black lateral margins, and a black line extending from each eye of the anterior pair to the frontal margin, which has a brownish-black spot on each exterior angle; on each side of the posterior part there is a brown spot; and obscure oblique lines of the same hue occur on the sides. The falces are conical and vertical; and the maxillæ, which are straight, are obliquely truncated at the extremity on the outer side. The colour of these parts is dull yellow, each falx having a black longitudinal line in front, which lines appear like a prolongation of those on the frontal margin. The lip is broader at the extremity than at the base, and has a dark-brown hue. The sternum is heart-shaped, of a dull-yellow colour, and has four short black streaks on each side. The legs are slender, provided with long spines, and are of a pale-yellow hue; the metatarsi and tarsi have a tinge of brown; and a fine longitudinal black line occurs on the under side of each femur, being least conspicuous on the femora of the posterior legs; the first pair is the longest, then the fourth, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is small and inflected near its base. The palpi resemble the legs in colour, are devoid of black marks, and have a curved, pectinated claw at their extremity. The abdomen is oviform, convex above, pointed at the spinners, and of a dull-yellow colour, obscurely freckled with yellowish white, a band of a deeper shade extending along the middle of the upper part, which is broadest in the posterior region; the sides are marked with a few brownish-black spots, and oblique confluent lines of the same hue occur on their posterior half; a broad band, composed of brownish-black spots, extends along the middle of the under part, and terminates in an angle at the spinners, which have a pale-brown hue; on the outer side of each branchial operculum there is a short black streak; and the colour of the sexual organs, which are rather prominent, with a small triangular process whose acute vertex is directed forwards, is brownish black.

Family SALTICIDÆ.

Genus SALTICUS, Latr.

Salticus placidus.

Length of the female $\frac{1}{4}$th of an inch; length of the cephalothorax $\frac{1}{8}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{12}$; length of a posterior leg $\frac{5}{24}$; length of a leg of the second pair $\frac{1}{6}$.

The cephalothorax is large, glossy, somewhat quadrilateral, sloping abruptly at the base, and projecting a little beyond the falces in front; it is of a brown-black colour, the cephalic region being the brownest, and has a narrow band of white hairs on the lateral margins. The minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The falces are small, conical, vertical, armed with a few teeth on the inner surface, and are of a red-brown colour. The maxillæ are straight, and enlarged and rounded at the extremity; and the lip is oval. These organs are of a brown hue, the extremity of the former and the apex of the latter having a pale yellow-brown tint. The sternum is oval, and of a brown-black colour. The legs are moderately robust, and provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; the fourth pair is the longest, then the first, and the second pair is the shortest; each tarsus is terminated by two curved, minutely pectinated claws, below which there is a small scopula; they are of a very dark-brown colour, the metatarsi and tarsi of all, and the coxæ and base of the genual joint of the third and fourth pairs, having a yellowish-brown hue. The palpi are short; the humeral joint has a dark-brown hue, that of the cubital, radial, and digital joints being yellowish white. The abdomen is oviform, pointed towards the spinners (which are prominent), convex above, and projects over the base of the cephalothorax; it is sparingly clothed with hairs, and of a brown-black colour; a white band, curved round the anterior extremity, extends along each side more than half its length, and a detached white spot occurs near its termination; near the middle of the upper part there is a transverse white line, and between it and the spinners a small white spot; four indented spots occur on the anterior half, forming a trapezoid whose shortest side is before; there is a large pale-yellow-brown band in the middle of the under part, which tapers to its posterior extremity, but does not extend to the spinners.

This spider was immature.

Salticus radians.

Length of the female $\frac{2}{5}$ths of an inch; length of the cephalothorax $\frac{1}{6}$; breadth $\frac{1}{8}$; breadth of the abdomen $\frac{3}{20}$; length of an anterior leg $\frac{3}{8}$; length of a leg of the second pair $\frac{7}{24}$.

The minute eye of each lateral row is rather nearer to the anterior than to the posterior eye of the same row. The cephalothorax is large, glossy, sparingly clothed with hairs, somewhat quadrilateral, sloping abruptly at the base, and projecting a little beyond the falces in front; it is of a dark-brown colour, with a broad white band, consisting of short hairs, on the posterior half of each lateral margin, and the cephalic region reflects bright tints of green and gold. The falces are short, powerful, conical, divergent at the extremity, armed with a few small teeth on the inner surface, and reflect brilliant hues of gold and green. The maxillæ are straight, and enlarged and rounded at the extremity; the lip and sternum are oval. These parts are of a dark-brown colour, the sternum and the extremity of the maxillæ being the palest. The legs are robust, and provided with hairs and a few spines, the tibiæ of the anterior pair being densely covered with the former on their inferior surface; the first pair is the longest, then the fourth, and the second pair is the shortest; each tarsus is terminated by two curved claws, below which there is a small scopula; they are of a dark-brown hue, faintly tinged with red, the tarsi being the reddest. The palpi resemble the legs in colour, but are rather paler. The abdomen is oviform, pointed towards the spinners (which are prominent), convex above, and projects over the base of the cephalothorax; it is thinly clothed with longish hairs, and of a dark-brown colour, the under part being the palest; the upper part is covered with small adpressed scale-like hairs, which reflect rich tints of green and gold; on each side of the medial line there are three minute, parallel, white spots, disposed longitudinally; four larger ones occur on each side, the posterior one, which is the longest, being directed obliquely towards the spinners; and a few white hairs form a small spot on the coccyx.

This *Salticus* was immature.

Salticus proruptus.

Length of the female $\frac{1}{3}$rd of an inch; length of the cephalothorax $\frac{3}{16}$; breadth $\frac{1}{8}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{7}{20}$; length of a leg of the third pair $\frac{1}{4}$.

The legs are robust, and provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; the first pair is the longest, then the fourth, and the third pair is the shortest; each tarsus is terminated by two curved, minutely pectinated claws, below which there is a small scopula; the colour of the femora is brownish black, and that of the genual joint and tibia of the first and second pairs dark reddish-brown; the genual joint and tibia of the third and fourth pairs have a brownish-red hue; the former is marked with dark reddish brown at its extremity, particularly on the sides and inferior surface, and the latter has a dark reddish-brown annulus at its termination; the metatarsi and tarsi of all the legs have a pale brownish-red colour, and the former have a small reddish-brown annulus at their extremity. The palpi, which are rather long, have a pale brownish-red hue, and are without a claw at their extremity. The cephalothorax is large, glossy, somewhat quadrilateral, sloping abruptly at the base, and projecting a little beyond the falces in front; it is of a very dark brown colour, faintly tinged with red, and the frontal margin is fringed with long yellowish-white hairs. The minute intermediate eye of each lateral row is rather nearer to the anterior than to the posterior eye of the same row. The falces are powerful, conical, and vertical; the maxillæ are straight, and enlarged and rounded at the extremity; the lip is oval, and slightly hollowed at the apex; and the sternum is oval. These parts are of a dark reddish-brown colour, the sternum and the extremity of the maxillæ being much the palest. The abdomen is oviform, pointed towards the spinners (which are prominent), moderately convex above, and projects over the base of the cephalothorax; it is thinly clothed with hairs, and of a dark brown colour, the sides being rather the palest; on each side of the medial line of the upper part there is a series of minute spots, consisting of white hairs, disposed in pairs, those of the penultimate pair, which are much the largest, being of an oblong-oval form, and inclined towards each other.

Salticus delicatus.

Length of the female $\frac{3}{10}$ths of an inch; length of the cephalothorax $\frac{3}{20}$; breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{10}$; length of a leg of the third pair $\frac{1}{3}$; length of a leg of the second pair $\frac{1}{4}$.

The minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The cephalothorax is large, glossy, somewhat quadrilateral, elevated in the cephalic region, and abruptly sloped at the base; it is of a dull yellow colour, faintly tinged with red, the region of the eyes having a reddish-brown hue. The falces are small, conical, and vertical; the maxillæ are straight, and enlarged and rounded at the extremity; the lip is somewhat oval, but truncated and slightly hollowed at the apex. These organs have a red-brown hue, the extremity of the maxillæ being the palest. The legs are robust, provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; the third pair is the longest, then the first, and the second pair is the shortest; each tarsus is terminated by two curved minutely pectinated claws, immediately below which a small scopula is situated; the palpi are short, and without a claw at their extremity; the sternum is oval and glossy. These parts have a dull yellow hue, slightly tinged with red. The abdomen is oviform, somewhat depressed and pointed towards the spinners (which are prominent), convex at the anterior extremity, and projects a little over the base of the cephalothorax; it is sparingly clothed with hairs, and is of a yellowish-white colour, with an obscure, slightly curved, brownish-black band, having its convexity directed forwards, situated near the anterior extremity of the upper part; on each side of the medial line of the posterior half there is a series of brownish-black confluent spots extending to the spinners, the superior pair of which organs has a dark-brown and the inferior pair a red-brown hue; on the under part there are two longitudinal, faint, brownish-black bands which meet near the spinners; and the colour of the sexual organs is dark red-brown.

Salticus cephalicus.

Length of the male $\frac{1}{4}$th of an inch; length of the cephalothorax $\frac{1}{8}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{16}$; length of a leg of the third pair $\frac{3}{10}$; length of a leg of the fourth pair $\frac{1}{4}$.

The cephalothorax is large, glossy, somewhat quadrilateral, very elevated in the cephalic region, and sloped abruptly at the base; it is of a dull yellow colour, tinged with red; the region of the eyes has a reddish-brown hue, and that of the frontal margin, which is broad and nearly vertical, is blackish-brown. The falces are long, prominent, subcylindrical, depressed and indented at the extremity (which has a pointed process on the outer and another on the inner side, near the articulation of the fang), and are of a red-brown colour. The maxillæ are straight, and enlarged at the extremity, which is produced on the outer side; and the lip is oval. These parts have a brownish-yellow colour, tinged with red, the lip being the darkest. The sternum is almost circular, and has a pale yellowish hue. The lateral eyes are seated on black spots, the minute intermediate one of each row being much nearer to the anterior than to the posterior eye of the same row. The legs are moderately robust, provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; the third pair is the longest, then the first, and the fourth pair is the shortest; each tarsus is terminated by two curved claws, immediately below which a small scopula is situated; the base of the femur of the first, second, and third pairs has a dull yellowish colour; the extremity of the joint and the tibia and base of the metatarsus of the same limbs have a red-brown hue, and the hue of the extremity of the metatarsus, with the tarsus, is yellowish-brown; the colour of the posterior legs is pale dull yellow. The palpi are long, slender, and of a yellowish-white hue, the digital joint having a tinge of brown; the cubital and radial joints are long and somewhat clavate, and the latter, which is the shorter, has a large pointed apophysis at its extremity, on the outer side; the digital joint is subcylindrical, convex and hairy externally, compact at the extremity, but has a cavity near the base, on the under side, which comprises the palpal organs; these organs are moderately developed, not very complicated in structure, with a curved, pointed, black spine at their extremity, and are of a reddish-brown colour. The abdomen is oviform, somewhat depressed and pointed towards the spinners (which are prominent), convex at the anterior extremity, and projects a little over the base of the cephalothorax; it is sparingly clothed with hairs, and the upper part, which has a black hue, comprises four minute white spots, disposed in a rectangular figure whose transverse breadth is the greatest, and in the medial line, between these spots and the spinners, there is a larger white spot; these spots consist of short scale-like hairs; the anterior extremity, contiguous to the cephalothorax, the sides, and under part are of a yellowish-white colour, two longitudinal brownish-black bands, which are united near the spinners, occurring on the last; the colour of the superior spinners is dark brown, and that of the inferior pair yellowish-brown.

I have given to this spider the specific name of *cephalicus* provisionally, as it may possibly be the male of *Salticus delicatus*, though it differs from it in many marked particulars.

Salticus properus.

Length of the male $\frac{1}{5}$th of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the second pair $\frac{5}{24}$.

The legs are moderately robust, and provided with hairs and sessile spines; the first pair is the longest, then the fourth, and the second pair is the shortest; each tarsus is terminated by two curved, minutely pectinated claws, immediately below which there is a small scopula; the anterior legs are of a dark brown colour, slightly tinged with red, the metatarsus being the palest, and the tarsus having a reddish-yellow hue; the colour of the second, third, and fourth pairs is dull yellow, the genual joint, tibia, and base of the metatarsus being tinged with red, and the last joint has a small brown annulus at its extremity. The palpi are short, and of a brown colour; the radial joint has a slender pointed apophysis at its extremity, on the outer side; the digital joint is of an oblong-oval form, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, not very complicated in structure, rather prominent at the base, and have a black, curved, filiform spine at their extremity, whose point is directed towards the inner side; these organs are of a brown colour. The cephalothorax is large, glossy, somewhat quadrilateral, sloping abruptly at the base and projecting a little beyond the falces in front; it is of a very dark brown colour, strongly tinged with red in the region of the eyes. The minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The falces are short, conical, and vertical; the maxillæ are straight, and enlarged at the extremity, which is produced on the outer side; the lip is short and oval; and the sternum is oval. These parts are of a dark reddish-brown colour, the falces and lip being the darkest, and the sternum much the palest. The abdomen is oviform, pointed towards the spinners (which are prominent), convex above, projecting over the base of the cephalothorax; it is thinly clothed with hairs, glossy, and the colour of the upper part is brown; a pale, dull yellowish band curves round the anterior extremity, and a broad slightly dentated band of the same hue extends along the middle of the posterior part, and terminates in a yellowish-white spot immediately above the spinners; this band is crossed by several curved, light brown bars, whose convexity is directed forwards, and on each side of it there are two curved yellowish lines, whose convexity is in the same direction; the sides and under part are of a dull yellow colour, a broad, longitudinal, brown band occupying the middle of the latter; and the spinners, which have a dark brown hue, are tipped with yellowish-white.

Salticus scitulus.

Length of the male $\frac{3}{10}$ths of an inch; length of the cephalothorax $\frac{3}{20}$; breadth $\frac{1}{8}$; breadth of the abdomen $\frac{1}{10}$; length of an anterior leg $\frac{3}{8}$; length of a leg of the second pair $\frac{3}{10}$.

The cephalothorax is large, somewhat quadrilateral, sloping gradually at the base, and projecting a little beyond the falces in front; it is densely covered with hairs, and is of a deep black hue, with a broad longitudinal band immediately above each lateral margin, and another extending along the middle, of a yellow-white colour, the anterior extremity of the latter being the palest; there is a small brown-red spot above each eye of the front row, and a larger one below each lateral eye of the same row. The minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The falces are conical, vertical, and have a long sharp tooth on the inner surface; the maxillæ are straight, and enlarged and rounded at the extremity, and the lip is oval. These parts have a dark brown hue, tinged with red, the extremity of the maxillæ being much the palest. The sternum is oval; the legs are robust, and provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; the first pair is the longest, then the fourth, and the second pair is the shortest; each tarsus is terminated by two curved pectinated claws, immediately below which there is a small scopula. These parts have a brownish-yellow hue; the legs are marked with a few obscure, longitudinal, brown lines, and the first pair is the darkest, particularly on the anterior side. The palpi are short, strong, and resemble the legs in colour; the radial joint projects a large pointed apophysis from its extremity, on the outer side; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, rather complex in structure, prominent at the base, and have a curved, pointed, black spine at their extremity, which is directed outwards; they are of a yellowish-brown colour, faintly tinged with red. The abdomen is oviform, pointed towards the spinners (which are prominent), convex above, projecting over the base of the cephalothorax, and is densely covered with hairs; the upper part is of a brownish-black colour, with a broad yellow-white band extending along the middle, which is crossed by a brownish-yellow line at about one-third of its length from the spinners; the sides and under part are of a yellow-white colour; an obscure brownish-black band extends along the former, and in the middle of the latter there is a large dark brown mark, which is bifid at the anterior and broader extremity; a small, triangular, yellow-white spot, whose vertex is directed forwards, occurs near the base of each superior spinner.

Salticus festinus.

Length of the male $\frac{1}{4}$th of an inch; length of the cephalothorax $\frac{1}{8}$; breadth $\frac{1}{11}$; breadth of the abdomen $\frac{1}{12}$; length of an anterior leg $\frac{3}{10}$; length of a leg of the second pair $\frac{1}{5}$.

The legs are robust, and provided with hairs and sessile spines; the first pair is the longest, then the fourth, and the second pair is the shortest; each tarsus is terminated by two curved pectinated claws, immediately below which a small scopula is situated; their colour is brownish-black, with the exception of the tarsi, which have a reddish-brown hue, and a longitudinal line on the upper surface of the femur, a spot near the middle of the tibia, and another at the base of the metatarsus consisting of brilliant white hairs. The palpi are short, strong, and resemble the legs in colour, white hairs occurring on the upper surface of the humeral joint at its extremity, and on the cubital joint; the radial joint is supplied with long black bristles on the under side, and has a pointed apophysis at its extremity on the outer side; the digital joint is subcylindrical, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, not very complicated in structure, protuberant near the base, and are of a dark brown colour. The cephalothorax is large, glossy, somewhat quadrilateral, sloping abruptly at the base, and projecting a little beyond the falces in front; its colour is brownish-black, with a broad band on the posterior half of the lateral margins, a spot in the medial line, at the commencement of the posterior slope, another contiguous to the minute intermediate eye of each lateral row, and a transverse line on the frontal margin consisting of brilliant white hairs. The minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The falces are short, conical, and vertical; the maxillæ are straight, and enlarged and rounded at the extremity; the lip is oval; and the sternum is oval, being rather broader at the posterior than at the anterior part, and is clothed with whitish hairs. These parts have a brown-black hue, the extremity of the maxillæ being the palest. The abdomen is oviform, pointed towards the spinners (which are prominent), convex above, projecting over the base of the cephalothorax, and is densely covered with hairs; the upper part is of an orange-red colour, with four brilliant white spots disposed in a row in the medial line of the posterior half, the two intermediate ones being much the smallest, and the anterior one the largest; a white band, curved round the anterior extremity, extends along each side more than half its length, and a detached white spot occurs near its termination; the sides, spinners, and under part are of a brownish-black colour, the last having a pale yellowish-brown hue in the middle of the anterior part, which is clothed with whitish hairs.

Salticus minax.

Length of the female $\frac{1}{3}$rd of an inch; length of the cephalothorax $\frac{1}{6}$; breadth $\frac{1}{8}$; breadth of the abdomen $\frac{1}{8}$; length of a posterior leg $\frac{3}{8}$; length of a leg of the second pair $\frac{3}{10}$.

The cephalothorax is large, glossy, sparingly clothed with hairs, somewhat quadrilateral, and slopes abruptly at the base; it is of a dull yellow colour, the region of the eyes and a broad longitudinal band on each side, which tapers to its posterior extremity, having a dark red-brown hue; the colour of the narrow lateral margins is dark brown, and the frontal margin is fringed with long yellowish-white hairs. The minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The falces are short, powerful, conical, convex at the base, vertical, and armed with teeth on the inner surface; the maxillæ are straight, and enlarged and rounded at the extremity; and the lip is short and oval. These organs have a red-brown colour, the base of the falces and the extremities of the maxillæ and lip being the palest. The sternum is oval; and the digital joint of the palpi, which is rather long and well supplied with hairs, is without a claw at its extremity. These parts have a pale dull yellowish hue. The legs are robust, and provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; the fourth pair is the longest, then the third, and the second pair is the shortest; each tarsus is terminated by two curved minutely pectinated claws, immediately below which there is a small scopula; they are of a dull yellow colour, obscurely marked with brown; a small dark brown annulus occurs at the extremity of each metatarsus, and the tibiæ of the anterior pair have a dark brown hue, except at the extremity. The abdomen is oviform, pointed towards the spinners (which are prominent), somewhat depressed, and projects over the base of the cephalothorax; it is densely covered with hairs, and is of a yellow-grey colour, a broad band of a paler hue, whose lateral margins are somewhat sinuous and obscurely bordered with black, extending along the middle of the upper part; near the middle of the band there is a black mark in the form of a W, which is succeeded by faint, curved, transverse bars of a yellow-brown colour; they decrease in length as they approach the spinners, and their convexity is directed forwards; the sides are thickly spotted with brown; and on the under part there are three dark brown lines forming three sides of a quadrilateral figure, open in front, whose length considerably exceeds its breadth; the sexual organs are of a yellowish-brown hue, passing into dark brown at the posterior part, and have a longitudinal septum in the middle.

[To be continued.]

XL.—*A Catalogue of the Zoophytes of South Devon and South Cornwall.* By the Rev. Thomas Hincks, B.A.

[Concluded from vol. ix. p. 475.]

Appendix.

Classification.—In the Introduction to this Catalogue I have adopted Prof. Huxley's Systematic Arrangement of the Hydrozoa. I am now convinced, however, that the groups to which he has assigned respectively the names *Hydridæ, Corynidæ,* and *Sertulariadæ* are not entitled to *ordinal* rank, but should merely be regarded as *families.* I therefore propose to classify the Hydroid polypes, with Johnston, under one order, Hydroida, and to distribute them into the following families:—1. *Tubulariadæ* (embracing both the *Tubulariadæ* and the *Corynidæ* of Johnston); 2. *Campanulariadæ*; 3. *Sertulariadæ*; 4. *Hydridæ.*

Addenda.

Class HYDROZOA.

Order **HYDROIDA.** Fam. **Tubulariadæ.**

Eudendrium, Ehrenberg.

1. *E. rameum,* Pallas.

"On *Pinna ingens,* south of the Deadman Point" (*Couch*).

2. *E. capillare,* Alder.

Additional habitat: near Polperro, Cornwall.

The specimens received from this locality bear *female* capsules, which have not hitherto been noticed. They are ranged round the lower portion of the body of the polype, and bear a general resemblance to those of other species of *Eudendrium.*

Mr. Alder, in the Supplement to his Durham and Northumberland Catalogue, refers this species to the genus *Dicoryne.* At present I feel doubtful as to its true position. There is much difficulty in classifying the Tubulariadæ; and the existing genera will require thorough revision.

Fam. **Sertulariadæ.**

SERTULARIA, Linn.

S. filicula, Ellis & Solander.

"On Fuci; rather rare. Talland Sand Bay, Polperro" (*Couch*).

[Very abundant on the Yorkshire coast.]

Fam. **Campanulariadæ.**

CAMPANULARIA, Lamarck.

C. integra, Macgillivray.

Syn. *C. lævis,* Couch, Cornish Fauna, p. 42.

"On stones and shells from deep water, Polperro" (*Couch*).
[Ilfracombe; Filey, Yorkshire.]

Class ACTINOZOA.

Order **ZOANTHARIA**, Milne-Edwards (pars).

Fam. **Ilyanthidæ.**

ILYANTHUS, Forbes.

I. Mitchellii, Gosse.

"Two specimens obtained by a Torquay fisherman near the Start" (*E. W. H. Holdsworth*).

MOLLUSCOIDA.

Class POLYZOA, J. V. Thompson.

Order **INFUNDIBULATA**, Gervais.

Suborder **Cheilostomata**, Busk. Fam. **Membraniporidæ.**

FLUSTRELLA, Gray.

F. hispida, Fabricius.

On sea-weeds between tide-marks, very common.
This species was accidentally omitted.

CORRIGENDA.

Coryne ramosa, Ehrenberg.

This name must be cancelled, and *C. vaginata* substituted for it. I find that the specimens to which I applied it belong to the latter species. I have received a *Coryne* from Talland Sand Bay, near Polperro, which I believe to be undescribed, but I am unable to name it at present.

PLUMULARIA, Lamarck.

I have referred, in the Introduction, to Prof. Forbes's suggestion for a dismemberment of this genus. Mr. Busk has divided it into two very natural groups, for one of which he retains the name *Plumularia,* assigning to the other that of *Halicornaria.* They are distinguished by the position of the nematophores (*tubules* of Johnston)—curious and probably offensive organs, with which one section of the Sertulariadæ is furnished—and by the character of the gonophores.

The following species, included in the Catalogue, belong to *Plumularia* as now restricted :—*cristata, tubulifera, pennatula,* and *myriophyllum.* The rest must be referred to *Halicornaria,* with the exception of *P. falcata,* which should be united with *Sertularia.*

Hoplangia durotrix, Gosse.

This species must be withdrawn from the Catalogue. I find that the specimens which I referred to it are only a form of *Caryophyllia Smithii.*

Caberea Hookeri, Fleming.

Mr. Alder has pointed out to me an error into which I have fallen in my note on this species. I have assumed the *Cellularia Hookeri* of Fleming to be identical with Johnston's species of the same name, and with Busk's *Caberea Hookeri.* This, however, is not the case. Fleming's *C. Hookeri,* which was described from specimens sent from Torquay by Sir W. Hooker, is the *Crisia Boryi* of Audouin—the *Caberea Boryi* of Busk's Catalogue. The species to which Dr. Johnston and Mr. Busk have given the name *Hookeri* is really the *Flustra setacea* of the 'British Animals,' which Fleming had previously described and figured in the Mem. of the Wernerian Soc. (vol. ii. p. 251) as *F. Ellisii.* This point has been satisfactorily established by Mr. Alder. According to the law of priority, therefore, *Caberea Ellisii* should take its place as the name of this species instead of *C. Hookeri.* This form seems to be strictly northern. Now that the synonymy is explained, there is no ground whatever for supposing that it has been met with in Devon.

Lepralia hastata, Hincks.

I have described and figured under this name what I supposed at the time to be a new species. I am now convinced that it is only a peculiar variety of the well-known *L. linearis.* The species must be cancelled, but the form is remarkable enough to be recorded as *L. linearis,* var. *hastata.*

In the Introduction to the Catalogue, it was stated that about

230 species would be enumerated in it. This number has increased to 242, of which 18 are new and 3 have not hitherto been recorded as British; and the wealth of the district is, no doubt, far from being exhausted. Indeed, I learn from my friend Prof. Allman that he has lately discovered several new *Tubulariadæ* in the neighbourhood of Torquay. I shall hope to include these and any subsequent additions in a future Supplement.

The following table shows the number of species under each of the leading divisions:—

Hydrozoa	Hydroida	77	
	Lucernariadæ	2	
		—	79
Actinozoa	Zoantharia	37	
	Alcyonaria	4	
		—	41
Polyzoa	Cheilostomata	87	
	Cyclostomata	14	
	Ctenostomata	17	
	Pedicellinea	3	
	Lophopea	1	
		—	122
			242

XLI.—*On the Unicorn of the Ancients.* By the Rev. W. Haughton, M.A., F.L.S.

Few subjects of zoological interest have from time to time given rise to more discussion than that which relates to the question as to what animal is denoted by the "Unicorn" of the ancients*.

* See for instance the following papers, which the reader interested in this question may consult, but which I have had no opportunity of seeing.

Bacci, And. *Discorso dell' Alicorno.* Fiorenza, 1573.
Bartholinus, Thomas. *De Unicornu observationes novæ.* Patav. 1645.
Bartholinus, Caspar. *De Unicornu ejusque affinibus,* &c. Hafn. 1628.
Bereus, F. C. *Diss. de Monocerote.* Resp. J. H. Homilius. Lips. 1667.
Catelan, Lament. *Histoire de la Licorne.* Monpell. 1624.
—— *Von der Natur, Tugenden, Eigenschaften und Gebrauch des Einhorns; in französ. Sprach beschrieben; von G. Fabro übersetzt.* Frankf. a. M., 1625.
Deusing, Ant. *Diss. de Unicornu.* Groning. 1659.
Documents Nouveaux sur l'existence de la Licorne, in Féruss. Bull. Sc. Nat. iv. 1825, p. 417.
Frenzel, S. F. *Disquis. Naturalis de Unicornu.* Resp. Christ. Vater. Witteberg, 1675.
Laterrade, J. F. *Notice en réfutation de la non-existence de la Licorne,*

Various reports have been given by travellers, that an animal still exists in some parts of the world which bears a marked resemblance to the one-horned animal under consideration; and although scientific men have no hesitation in regarding the Unicorn as a fabulous animal, yet from time to time travellers write home that they are on the track of the veritable creature itself; and I only read the other day that Dr. Baikie, the African traveller, now in charge of the Niger Expedition, is in pursuit of the animal, and thinks that he may be able to discover it in some of the unexplored wastes of Central Africa! He learned from two informants that they had seen the bones of such an animal, and states that they accurately describe the long, straight, black horn, and carefully distinguish between the one-horned Rhinoceros and the supposed Unicorn! Dr. Baikie gives a list of native names by which this unknown animal is called in various African dialects, and is quite disposed to believe that its non-existence is by no means proved*.

What are the chances of our seeing a specimen of the Unicorn brought home to this country, and forming the grand object of attraction to all the world? Why should not a one-horned animal exist such as we see depicted on the royal arms? Father Lobo, in his 'History of Abyssinia,' actually describes the Unicorn as a beautiful *horse*; and Barrow, in his 'Travels in Southern Africa,' gives the figure of a head of a Unicorn which he saw drawn on the sides of a cavern, and appears to entertain no doubt that such an animal exists. No traveller, however, has as yet succeeded in obtaining a specimen; and I venture to affirm very positively that the like result will attend Dr. Baikie's search. But let us take a brief survey of what the ancients have recorded of the Unicorn, or, rather, Unicorns; for there are at least three, if not more, one-horned animals mentioned by them.

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in Bull. Soc. Linn. de Bordeaux, i. 1826; Féruss. Bull. Sc. Nat. x. 1827, p. 396.

Laterrade, J. F. *Sur la Licorne,* in Actes de la Soc. Linn. Bordeaux, v. 1832, p. 115.

—— *On the Unicorn.* Transl. by Jos. Porter, in Silliman's American Journ. xxi. 1832, p. 123.

Reusser, G. *Sur l'existence de la Licorne,* in Millin, Mag. Encycl. iii. 5, 1797, p. 311.

Reitz, K. K. *Neueste Nachricht vom Einhorn,* in Lichtenberg-Voigt's Mag. Bd. x. St. 3, 1797.

Sachs, P. Ldw. *Monocerologia, seu de genuinis Unicornibus Diss.* Raceb. 1676.

Stolbergk, J. Chr. *Exercitatio de Unicornu.* Resp. Chr. Sagittarius. Lips. 1652.

Verster van Wulverhorst, A. H. *Over den Eenhoorn,* in Bijdragen tot de Dierkunde, 1860.

* See the 'Athenæum' for August 16, 1862.

And first of all, there is the Unicorn of the Bible. Pages upon pages have been written on this subject. Some have said it must have been the Antelope (*Oryx leucoryx*) of North Africa, Syria, &c., that the horns, seen in profile, appear as one, and hence the mistake of regarding it as a one-horned animal; others have no hesitation in referring the Unicorn to the one-horned Rhinoceros (*R. unicornis*) of Asia; this is the opinion generally entertained at this day. Now, all attempts to discover a one-horned animal that shall represent the Unicorn of our English Bible are beyond the mark entirely, and for this simple reason: the so-called Unicorn is no Unicorn at all; the Hebrew word (*R'êm*) denotes a two-horned animal, beyond a shadow of a doubt. The "Unicorn" of our English Bible owes its origin to the Septuagint and Vulgate versions *. In the 17th verse of Deut. xxxiii., which contains a portion of Joseph's blessing, it is said, "His horns are like the horns of a *R'êm* †." Our translators, seeing the contradiction involved in the expression "horns of the *Uni*corn," have rendered the Hebrew singular noun as if it were a plural form in the text, though they give the correct translation in the margin. The two horns of the *R'êm* are "the ten thousands of Ephraim and the thousands of Manasseh," and represent the two tribes which sprang from one (viz. Joseph), just as two horns spring from one head. The Unicorn of the Bible therefore may be dismissed at once, as being a very unhappy translation of the Hebrew two-horned *R'êm*, the animal denoted being, there cannot be much doubt, some species of "wild ox," as appears pretty evident from a comparison of the different passages where the word occurs in Holy Scripture. The *R'êm* was two-horned; it is almost always mentioned with bovine animals; it is said to push with its horns; it must have been frequently seen by the ancient Hebrews roaming on the hills of Palestine or in the woods of the Jordan valley, as is evident from the numerous allusions to it. It is true there is no wild ox at present known to exist in Palestine; but this is no reason why, in early times, some mighty species, allied perhaps to the *Urus* which Cæsar saw in the Hercynian Forest, should not have existed in that country. Lions were certainly not uncommon in Palestine and Syria in Biblical times, as is clear from the numerous allusions to them in Holy Writ; and it is interesting to note, as an additional proof, that the late Dr. Roth discovered bones of the Lion in gravel near the Jordan: it is therefore quite probable that

* Μονόκερως in all the passages but one, where the Septuagint has ἁδροί. The Vulgate has *unicornis*, and sometimes *rhinoceros*.

† That the *R'êm* possessed *two* horns was shown in 1737 by Schultens, who, in his Commentary on the Book of Job (xxxix.), draws especial attention to the above passage in Deuteronomy.

future investigations in Palestine may result in the discovery of the bones of *Bos primigenius* or *Bison priscus* or some other once formidable ox. All readers will remember the beautiful description of the *R'êm* in the Book of Job; now let us compare with it the account Cæsar gives of the fierce *Urus*, which in his time frequented the great Hercynian Forest:—"These Uri are scarcely less than elephants in size, but in their nature, colour, and form are bulls. Great is their strength, and great their speed, nor do they spare man or beast when once they have caught sight of him. The hunters are most careful to kill those which they take in pitfalls, while the young men exercise themselves by this sort of hunting, and grow hardened by the toil; those of them who kill most, receive great praise when they exhibit in public the horns as trophies of their success. These Uri, however, even when they are young, cannot be habituated to man and made tractable. The size and shape of their horns are very different from those of our oxen."*

The indomitable nature ascribed to these wild Uri exactly agrees with the description of the *R'êm* as given in chap. xxxix. of the Book of Job; and the apparently implied contrast which is made between the domestic ox and the wild Urus finds an analogue in the above extract from Cæsar. The same remark may be made with respect to the great size and strength of the Scriptural *R'êm* when contrasted with the domestic oxen of Palestine, the ancient inhabitants of which land would naturally draw the same comparison between their domestic cattle and the mighty *R'êm* as Cæsar's legions did between their cattle (*Bos longifrons*) and the great Hercynian wild bulls (*Bos primigenius*), whose bones are now occasionally found, together with those of the elephant, hyæna, &c., in the Tertiary deposits of this country.

It is time, however, to turn our attention to the Unicorns which are mentioned in the writings of the ancient Greeks and Romans.

The earliest record of the existence of a one-horned quadruped is to be found in Ctesias's Treatise on India (Ἰνδικά), of which we possess an abridgement in Photius and a much more complete edition by Bähr. Ctesias lived in the time of Xenophon (circ. B.C. 400), and resided for many years in Persia as physician at the court of King Artaxerxes Mnemon. It was while he was there that he collected materials for the above-named treatise, which consists mainly of a description of the natural history of the north-west part of India: it must be borne in mind that his account of the natural history of that country was derived second-hand, for Ctesias was never himself in India. He must therefore be understood simply to give the Persians' own accounts

* Bell. Gall. vi. cap. 29.

of their various animals, which were doubtless often mixed with fable. Aristotle regarded Ctesias as a man utterly unworthy of credit*—rather a harsh judgment, it is true, but probably not very far from the mark. However, under the name of *ὄνοι ἄγριοι* (wild asses) Ctesias describes his Unicorns. He says, "They are as large as horses, and even larger, with white bodies, red heads, blue eyes, and have each on their foreheads a horn a cubit and a half long, the base of which is white, the upper part red, the middle part black. Drinking-cups are formed of these horns; and those who drink out of them are said to be subject neither to spasm nor epilepsy, nor to the effects of poison. Other asses have no astragalus; but these have one, as well as a gall-bladder. The astragalus I have seen myself: it is beautifully formed, in shape like that of an ox, and very heavy and red throughout. The animal is so swift that no horse can overtake it, and so strong and fierce that it is with difficulty destroyed by arrows and javelins. It begins its running slowly, but gradually increases its speed; it shows great attachment to its young, which it defends against its pursuers, fighting with horn, teeth, and heels. The flesh is so bitter that it is not eaten; but men set a high value on the horns and astragali."

Aristotle † simply mentions this Unicorn under the name of *ὄνος ἰνδικός* (Indian Ass). "We have never seen," he says, "a solidungulous animal with two horns; and there are only a few solidungulous animals with one horn, such as the Indian Ass and the Oryx (*ὄρυξ*). Of all animals with a solid hoof the Indian Ass alone possesses an astragalus."

Pliny's account of the Indian Ass is much the same as Aristotle's. "It is the only solidungulous animal that has an astragalus: the Oryx is one-horned, but it is cloven-footed"‡. Pliny, it will be seen, here differs from Aristotle, who represents the Oryx as solidungulous. Here, then, it is evident we have two Unicorns—the solidungulous Indian Ass with an astragalus, and the Oryx. But it appears there is still another one-horned animal, viz. the Monoceros. "The Orsæan Indians," says the Roman naturalist §, "hunt a very fierce animal, called the Monoceros, which has the body of a horse, the head of a stag, the feet of an elephant, and the tail of a wild boar; it utters a deep lowing noise, and has a single horn, two cubits long, projecting from the middle of its forehead. They say this animal cannot be taken alive."

Ælian ||, who lived long subsequently to any of the above-named writers, mentions the *ὄνοι ἄγριοι* (the description of

* *οὐκ ὢν ἀξιόπιστος*, Hist. An. viii. 27. § 3.

† Hist. Anim. ii. 2. § 8.

‡ N. H. xi. 46. § N. H. viii. 21. || Nat. An. xvi. 20.

which is every word borrowed from Ctesias) and the Monoceros, which he says the natives of the interior of India call *Carcazonon* *: it is the size of a full-grown horse, with a mane and yellow woolly hair, of extreme swiftness, with feet like the elephant and the tail of a wild boar; it has a black horn growing between the eyebrows, which is not smooth, but with natural convolutions, and is very sharp at the point; it emits loud discordant sounds; it lives peaceably with other animals, but quarrels with those of its own kind, the males even destroying the females, excepting at the breeding-season, at which time the animals are gregarious, but at other times they live in solitude in barren tracts. The Monoceros is endued with great strength, and is armed with an invincible horn."

The whole of the accounts of these Unicorns are so evidently deeply tinged with fable † that it is a matter of surprise how any persons should ever have supposed it possible that such animals might still be existing in unexplored countries. Major Latter, however, some years ago, was very sanguine of being able to find a veritable Unicorn in the interior of Tibet: he was informed by a native, that he had frequently seen these animals, which "were fierce and exceedingly wild, and seldom taken alive, but frequently shot;" and that they are frequently to be met with on the borders of the great desert, about a mile from Lassa. From a drawing which accompanied Major Latter's communication, the presumed Unicorn was something like a horse, but with cloven hoofs, a long curved (!) horn growing out of the forehead, and a boar-shaped tail ‡.

Mr. Campbell's § "discovery of the Unicorn in Africa" was nothing more than that of some species of Rhinoceros, which he identifies with the *R'êm* of the Hebrew Scriptures.

* There can be little doubt that the *Rhinoceros unicornis* is the animal which forms the groundwork of nearly all that the ancients have written on one-horned animals. The term which Ælian tells us is used by the natives of India to denote an animal with one horn, is almost identical with that employed by the Arabs and Persians to signify a Rhinoceros. "Vulgatissimum *monocerotis* nomen, nec solum apud Arabes sed et apud Persas, Tartaros atque Indos receptum est *Carcaudan* vel, ut plerumque scribitur, *Carcaddan.*"—Bochart, Hierozoicon, ii. p. 318, ed. Rosenmüller. *Carcaddân* or *Carcadân* is the Arabic name for a Rhinoceros: see Freytag, Lex. Arab. *s. v.*, and Catafagos's Arab. Dict.

† Besides which, it must be remembered that not one of the Greek or Roman writers ever pretended to have seen the animal; the whole foundation rests on the account Ctesias received from the Persians. It is in vain, therefore, to seek for the origin of the story in the supposition that the ancient Greeks and Romans mistook the horns of some antelope seen in profile as if they were only one. The Unicorns, moreover, were supposed to be *Indian* animals, while travellers are hoping to find them in *Africa.*

‡ Asiatic Journal, xi. p. 154.

§ *Ib.* xii. p. 36.

The animal which Mr. Rüppell was told by a native existed in Africa, and which had a long straight horn growing from its forehead (?), was also doubtless a Rhinoceros.

Under the head of "Unicorns in Asia," in the 'Asiatic Journal' (vol. ii. new ser. 1830), a writer revives the opinion of the existence of veritable Unicorns, such as were reported to Major Latter: the animal in question was of the deer kind, having a single horn at the top of the head; it was known by the name of *Seru*. The editor of the 'Asiatic Journal' makes the following wise remark hereupon:—"When we consider that eight years have elapsed since Major Latter's account was given, and that, notwithstanding increased opportunities with Tibet, no fact has since transpired which supplies a confirmation of that account, excepting the obtaining a supposed horn of the supposed Unicorn, we cannot participate in these renewed hopes."

In vol. ii. p. 250 of the same Journal we read:—"Vertoman gives the following account of two Unicorns in Arabia:—In the other part of the temple of Mecca are parks or places enclosed, where are seen two Unicorns, and these are shown to the people for a wonder; the one of them, which is much higher than the other, is not much unlike a colt of two and a half years old; in the forehead grows one horn, straight forward, of the length of 3 cubits. The other is much younger, and like a colt one year old. The horn of this is of the length of four spans. The beast is of the colour of a horse, of a weasel-colour, with a head like a hart, but no long neck, a thin mane hanging only on one side. The legs of both are thin and slender, like a fawn or hind; the hoofs of the four feet are divided in two, much like the feet of a goat; the outer part of the hind feet is very full of hair. They seemed wild and fierce. They are sent to the Sultan of Mecca from the King of Ethiopia!"

There are other reports as to the existence of real Unicorns, such as those of Sparrmann, Lobo, Thenet (who asserted he had hunted Unicorns with the King of Monomotopa), Garcias, and others; but where a veritable animal is meant by the term, that animal is unquestionably some species of Rhinoceros; for all attempts to obtain a specimen of a quadruped with a single horn on its *forehead* have failed, and the accounts of the existence of such animals are very vague, and entirely unsupported by anything approximating to satisfactory evidence.

The one-horned animal of which Ctesias speaks is in all probability the *Rhinoceros unicornis*, exaggerated accounts of which would perhaps have been given him by the Persians, while his own love of the marvellous added the remainder. From Ctesias's *one* single-horned animal, in process of time there came to be at least *three* Unicorns, namely the ὄρυξ, the ὄνος ἄγριος or ἰνδικὸς, and the *μονόκερως*, no living representatives of any of which animals can be supposed to have any existence in nature*. Naturalists are, we believe, agreed upon the point that the so-called Unicorn is a fabulous animal from beginning to end. It has merely been my object in this paper to show how utterly groundless is the foundation on which the whole superstructure rests. We cannot, therefore, participate in the slightest degree in the hope that Dr. Baikie will be more successful than his predecessors.

BIBLIOGRAPHICAL NOTICES.

Naturhistorisk Tidsskrift (Journal of Natural History), founded by Dr. H. Kröyer*; edited by* Prof. T. C. Schjödte *at Copenhagen.* Third Series, 1861. [Kröyer, *Contributions to the History of* Mysidæ; Meinert, *Anatomy of the Larva of* Gastrus Equi; Didrichsen, *Botanical Observations;* Schjödte, *Danish* Harpalini, and *Larvæ of Coleoptera*, &c.]

The 'Naturhistorisk Tidsskrift,' or 'Journal of Natural History,' founded by Dr. Kröyer of Copenhagen, which, from 1837 to 1849, formed one of the principal means of literary communication for Danish naturalists, will be remembered by all those who occupy themselves with the fauna and flora of the North. The editor communicated through this channel a great many of his numerous and valuable contributions to the natural history of Crustacea and Fishes; but in 1849 he was forced by different circumstances to discontinue the journal, six substantial volumes having at that time been published. Travels and declining health afterwards prevented Dr. Kröyer from resuming the publication, which has thus been interrupted for twelve years. At present, however, Professor Schjödte, whose name as an entomologist is also well known in England, has undertaken the task of continuing the journal; and the first part of the third series appeared a twelvemonth ago. That it is an undertaking deserving the attention of English naturalists will appear from a review of the volume before us. It is a matter of course that the majority of the papers will always be in Danish; but the affinity of this language to the English is so great, that any person may easily acquire sufficient Danish for consulting scientific treatises in that language. Besides, the diagnoses and explanations of the plates are given in Latin; this is, at least, the case in the first part of the work, on which we will offer a few remarks.

It is headed by a paper from the pen of Dr. Kröyer, containing descriptions of several species of *Mysidæ* and similar Crustacea. Dr. Kröyer was one of the naturalists who accompanied the great expedition of 'La Recherche' to the Arctic regions, in 1838–1840,

* Pliny (N. H. viii. 21) says that "there are in India oxen with solid hoofs and a single horn." So here we have another kind of Unicorn.

of which the results are embodied in Paul Gaimard's 'Voyages de la Commission du Nord en Scandinavie, Laponie,' &c.; but although several plates have been published containing drawings and analyses of the animals collected, no text has hitherto appeared. This deficiency, the reasons of which Dr. Kröyer promises to explain on a subsequent occasion, he now intends to remedy to some extent; and the treatise before us must in some degree be looked upon as a step in that direction. The descriptions, which in accuracy leave nothing to be desired, are in Danish; but the very full diagnoses, as well as the explanations of the plates, are in Latin. To these we can therefore refer, contenting ourselves with a few general remarks.

In Milne-Edwards's 'Histoire Naturelle des Crustacés' only five species of *Mysidæ* are described, of which three belong to the northern seas—viz. *Mysis spinulosa*, Leach, *M. Chamæleon*, Thompson, and *M. vulgaris*, Thompson. The number of northern species is, however, much greater, as Dr. Kröyer enumerates seven Scandinavian species, amongst which the *M. spinulosa*, Leach, is probably not included. Three of these seven species are exclusively Arctic, viz. *M. oculata*, Fabr., *M. arctica*, Kr., and *M. latitans*, Kr.; the others are found along the shores of Norway, Sweden, and Denmark, from Throndhjem to the Sound. *M. flexuosa*, Müller, besides, penetrates as far into the Baltic as Gotland. *M. inermis*, Rathke, and *M. cornuta*, Kr., reach into the Arctic seas, but not into the Baltic, whilst *M. vulgaris*, Thompson, is principally found in the fjords of Jutland and in the Sound. The *M. oculata* was first described by Fabricius in his 'Fauna Grœnlandica,' and afterwards by Leach, as *M. Fabricii*. It is the commonest species in the Arctic seas, and the principal food of whales and sea-birds at different seasons. To this species tab. 8. fig. 2 *a–r*, in Gaimard's 'Voyages,' &c., has reference. *M. latitans*, Kr., is a new species, found together with the *M. oculata*, which it much resembles. The *M. latitans*, is, however, smaller and more slender. *M. arctica* seems to be a rare and very remarkable form, having the dorsal shield very large, covering all the joints of the cephalothorax, and divided by a remarkable, deep transversal groove into two parts; the frontal rostrum is also unusually distinct, though short. *M. flexuosa*, Müller (Prodromus Zoologiæ Daniæ, 1776), is the species of *Mysis* which has been earliest described with sufficient distinctness to be recognized; and Müller's name must therefore supersede the Thompsonian *M. Chamæleon*. Dr. Kröyer leaves it undecided whether Thompson's *M. Leachii* and Leach's *M. spinulosa* also refer to this species. To *M. flexuosa* belong figs. 1, 2, & 3 on tab. 9 in Gaimard's work. On page 44 in the 'Tidsskrift,' will be found a table (in Latin) for the determination of the species of *Mysis* mentioned in Dr. Kröyer's paper.

The author next describes a new *Cynthia* from the Atlantic, which he proposes to call *inermis*, and which is distinguished from *C. armata*, M.-E., by the shortness of the frontal rostrum, and from *C. Thompsonii*, M.-E., by a number of less conspicuous but not less significant marks. Another species shows sufficient peculiarity of structure to warrant the establishment of a new genus (*Anchialus*, Kr.), distinguishable from *Mysis* principally by the shape of the dorsal shield and by the second pair of foot-jaws terminating in organs of prehension formed by the last three joints: the *only* species is called *typicus*. Then follow the descriptions of *Promysis Galateæ*, Kr., from the Indian Sea, and of *Dymas typus*, Kr., a new genus belonging to Dana's subfamily *Sceletinæ*, and forming an intermediary link between *Mysis* and *Myto*. *Myto Gaimardi*, Kr., was also discovered during the voyage of 'La Recherche,' and described in the second series of the 'Tidsskrift,' vol. i. pp. 470–476; a figure and analyses are found in the 'Voyages,' &c., tab. 7. fig. 1 *a–g*. Dr. Kröyer gives in the present volume (p. 63) a Latin explanation of the said figure. The other new genera and species are illustrated by two plates closely filled with analytical drawings, with a Latin explanation, a table of measurements being also appended. A continuation of these carcinological contributions may be expected in the following parts of the periodical.

The history of the larva of *Gastrus Equi* has been the subject of several treatises by different authors, of which doubtless the most remarkable is one by Schroeder van der Kolk, the celebrated Dutch anatomist. The investigations on which this treatise was founded were partly undertaken before 1830, when some of the drawings were exhibited at a meeting of naturalists in Heidelberg; but the paper was not published till 1845. It was written in French, and appears in the eleventh volume of the 'Nieuwe Verhandelingen der eerste Klasse van het koninklijk-nederlandsche Institut.' Nevertheless this remarkable paper seems to be very little known; and in the most current handbooks there is no mention of it, not even in the author's countryman Van der Hoeven's well-known 'Manual of Zoology.' This oblivion is highly undeserved; and the only circumstance that perhaps in some degree may explain it is that, along with his excellent account of the anatomy of the said larva, Schroeder van der Kolk proposes certain theories concerning the use of the organs he so ably describes which could not but seem suspicious to his contemporaries, and which also in part have turned out to be fallacious. The volume of the Danish 'Tidsskrift' which we are reviewing contains, in a paper by Mr. Meinert, several valuable contributions to our knowledge of this interesting animal, in the shape of a criticism of Schroeder van der Kolk's statements as to the organs of respiration, digestion, and circulation.

The respiratory system consists, as is generally the case with the larvæ of dipterous insects, of a cavity near the posterior end of the animal, from which several tracheæ issue, two being larger than the others, and reaching (one on either side) to the vicinity of the head. In the larva of *Gastrus Equi* the anterior ends of these two long tracheæ are horny, and show a great number of perforations. They are attached to the inner extremity of two short tubes, which correspond to openings in the skin, and through which the tracheæ may be either brought to a level with the general surface of the body or drawn back, and thus protected from injury. Schroeder van der

Kolk has overlooked this remarkable structure, and supposes the tracheæ to end blindly, simply attached by their ends to the inner surface of the skin. According to him, the air in the respiratory organs is renewed through an opening in the middle of a horny plate closing the great aëriferous cavity, at the posterior extremity of the body from behind. Schroeder van der Kolk even assumes the existence of a sphincter around this supposed opening. Mr. Meinert shows that this is a mistake: in the place of the supposed perforation there is merely a pellucid spot, and an impression on the horny plate, caused by the existence in young larvæ of a small gland on this spot, which is obliterated in the adult larvæ. A communication between the air enclosed in the aëriferous chamber and the outer air, through the horny plate closing it from behind, is possible only in so far as it is permitted by the structure of the said plate itself, which consists of a not very close texture of chitinous filaments, externally covered by a firm but thin membrane. When this plate is viewed from behind, it presents six slits of a curved shape, forming concentrical lines, three on each side of the pellucid point in the middle. Each of these slits opens directly into a double row of vesicles containing air. Schroeder van der Kolk supposed these slits to be closed by a very thin membrane, the whole structure representing a kind of trachea-gills; but Mr. Meinert has shown that they are perfectly open, the air being detained in them by their margins being finely denticulated. The number of these slits varies according to the age of the larvæ.

According to Schroeder van der Kolk, the alimentary tube is connected with the adipose tissue in such a manner that the nutritious fluid may directly flow from one into the other. Mr. Meinert shows that the foremost set of connecting tubes, according to Schroeder van der Kolk, are in reality mere ligaments, and that, as regards the second set of such tubes assumed by Schroeder van der Kolk, this anatomist has been misled by the circumstance that the longer pair of the Malpighian vessels, in the larva of *Gastrus Equi*, as well as in many other insects, presents a different structure in their anterior and their posterior parts. Their extreme ends are, as usual, fixed to the posterior parts of the intestine, but do not, as Schroeder van der Kolk thought, open into it; and although the said vessels are fixed to the adipose tissue at that point where their two different structures meet, there is no communication between their cavity and the adipose vesicles. With respect to the dorsal vessel, Schroeder van der Kolk has also fallen into a serious mistake, namely, in considering certain lateral ligaments, which keep the vessel in its place, as a kind of aortas. Although Mr. Meinert has thus divested Schroeder van der Kolk's treatise of much that appeared as its most striking results, there is so much left to admire in it that naturalists will not be justified in disregarding it for the future, as has hitherto been the case.

The aim of Mr. Didrichsen's paper, to which we would next direct attention, is to correct certain mistakes concerning the nature of the thorns in *Berberis*, *Ribes*, and *Parkinsonia*, which seem in a great measure to pervade botanical literature; and also to free the great

Linnæus from the imputation of having but imperfectly distinguished between *spina* and *aculeus*. These errors have arisen from the circumstance that, in his 'Philosophia Botanica,' page 50, *Berberis* is mentioned, together with *Ribes*, *Rubus*, and *Rosa*, as having *aculei*; and on page 110, *Parkinsonia* is instanced, with other leguminous plants, as showing examples of aculei, although the thorns in these plants must be considered as spinæ, according to Linnæus's own definition in page 50. The only mistake of Linnæus is, according to Mr. Didrichsen's view, that *Berberis* has been mentioned (page 50) amongst the examples of aculeus—a circumstance which is easily explained when we remember that, when this part of the 'Philosophia Botanica' was written, Linnæus was slowly recovering from a dangerous illness, as he states himself in the preface, and, while confined to his bed, dictated this immortal work to one of his friends, as fast as the printer could put it in type. Both at an earlier time, in the 'Hortus Cliffortianus' (1737), and afterwards, in the 'Species Plantarum' (ed. 2. p. 472, 1762), he described the thorns of *Berberis* as *spinæ*. Whilst some over-zealous admirers of Linnæus have tried to defend the excusable, but undeniable, error committed in p. 50 in the 'Philosophia Botanica,' others, misguided by a superficial similarity between the thorns of *Berberis* and those of *Ribes*, have maintained that the thorns of *Ribes* had also been erroneously mentioned among the examples of aculei. Others, again, have entirely discarded Linnæus's definitions, and attempted to find some new marks of distinction between *aculeus* and *spina*, derived from their position, the constancy of their occurrence, and their development during the growth of the plant. Mr. Didrichsen fully concurs with those who reserve the name of *spinæ* for such thorns as are only transformations of the ordinary organs or parts of the plants, but describe as *aculei* all thorns which are merely corticular appendages. But at the same time he shows that Linnæus's definition in page 50 of the 'Philosophia Botanica' does in reality come to the same, and is the only practically useful one. He shows that the difficulty which DeCandolle thought to find in reference to the Monocotyledons does not really exist, and that the investigations as to the development of the thorns in *Ribes Grossularia*, by which some German authors pretend to prove these to be spinæ, are altogether unreliable. Nay, Mr. Didrichsen even goes a step further. It is commonly supposed that what are now called morphology or morphological points of view were quite foreign to the mind of Linnæus, and that he only took what we should call a terminological view of questions like the one before us. But Mr. Didrichsen maintains that this was not the case. Linnæus was the founder of botany as a science, and he was well aware that the first thing necessary was to create a fixed terminology; but it needs little explanation to show that for this purpose definitions like those of *spina* and *aculeus* in p. 50 of the 'Philosophia Botanica' were vastly preferable to definitions founded on morphological considerations. Linnæus's description of *Berberis* in the 'Species Plantarum' (ed. 2. p. 470), in which he says, "folia in spinas tripartitas mutata," as well as other passages, show that he knew quite well the morphological difference between *spina* and *aculeus*; and his description of *Ribes Cynobasti* (*ibid.* p. 292), in which these words occur—"aculeus *instar* spinæ sub alis"—shows that he was well aware that the aculeus of the said plant might at a first glance be taken for a spina *on account of its place.* That wide field of research which was opened up by subsequent authors, urging the principles of morphology, was by no means hidden from Linnæus's master-mind; but he left others to do what he could not enter upon himself, if he wished to accomplish the general regeneration of natural history—a purpose so grand in itself that no scientific man has ever grappled with a greater. That the morphological difference between *aculeus* and *spina* was before the mind of Linnæus when he wrote the definitions in page 50 is, in the estimation of Mr. Didrichsen, confirmed by the circumstance that the same matter is treated of once more in a later chapter, but in a different manner. In this second place Linnæus seems really to have taken a purely terminological view of the matter, describing different kinds of thorns only just as they appeared to the eye. Here *aculeus* meant only a small, not very rigid thorn, whatever was its origin; and this fully explains the fact of *Robinia* and *Parkinsonia* being mentioned as instances, although Linnæus elsewhere acknowledged them to have spinæ. That *aculeus* does not mean the same in pages 50 and 110 of the 'Philosophia Botanica,' might have been concluded from the simple fact that he calls his species of *Parkinsonia* "*aculeata*," although he describes it as having spinæ. In naming the species, he took a purely terminological external view; but in describing it, he did not overlook the morphological nature of its thorns. (It is by a mistake that Künth mentions this plant as *P. spinosa*, Linn.)

Prof. Schjödte's paper on the Danish *Harpalini* has a double interest, namely, partly on account of the information afforded on the geographical distribution of certain species, and on the general character of the Danish fauna, and partly on account of the systematical observations by which it is headed. Of *Harpalini*, the Danish fauna numbers no less than forty-six species, and presents the peculiarity that, besides the species occurring in other countries under the same latitudes, not a few species are found in Denmark which are characteristic of far more southern parts of Europe. This is the case with *Anisodactylus signatus* and *nemorivagus; Harpalus distinguendus, fuscipalpis, honestus; Stenolophus melanocephalus* (=*S. Skrimshiranus*), *vespertinus*, and *elegans*. None of these are found either in Norway, Sweden, or North Germany. *Diachromus germanus, Ophonus punctatulus,* and *Stenolophus anglicus* *, reach Denmark through North Germany, but are not found north of the Baltic and the Kattegat. On the other hand, *Bradycellus cognatus* (Greenland, Norway, North of Sweden) is an instance of a very northerly species which is still commonly found in Denmark, but not further to the

* Prof. Schjödte has adopted this name, which dates from 1766 (Voet, i. 67, tab. 35. fig. 18), as the Linnean *Carabus vaporariorum* cannot possibly be this species, and as Voet's name is so much older than Schrank's *C. teutonus*, which some have adopted in this country.

south; whilst *H. ferrugineus* is a species peculiar to the east of Europe, which is still found, though very rarely, in Denmark and at the Rhine, but not in England. In "Möens klint," and the neighbourhood of Silkeborg in Jutland, several species are found which elsewhere are confined to mountains, although the said localities are only 400–600 feet above the surface of the sea: amongst the *Harpalini*, this is the case with *Ophonus azureus* and *Harpalus seriepunctatus*.

The species having all been described before, new descriptions are given only of a few. The characters, however, by which Prof. Schjödte proposes to arrange them into groups are indicated (in Latin); of the genera new and excellent descriptions are given, and a synoptical table at p. 153. The Danish *Harpalini* belong to *Anisodactylus, Diachromus, Ophonus, Harpalus, Bradycellus, Acupalpus, Stenolophus*, and *Balius*, a new genus founded on *Stenolophus conspectus* and a very similar species from Bengal, distinguished by the remarkable shape of the ligula *. Prof. Schjödte further proposes the establishment of a new group within the limits of the *Harpalini*, which he proposes to call *Stenolophini*, and characterizes by the structure of the maxillæ, of which the stipites are prolonged into a remarkable tooth reaching beyond the first joint of the maxillary palpi. In this group Prof. Schjödte comprises a series of small *Harpalini* "spread over the whole earth, and not less so in the scientific systems." Besides *Balius, Stenolophus*, and *Acupalpus*, he mentions *Daptus, Batoscelis*, and *Agonoderus*. Among these, *Daptus* and *Batoscelis* are adapted for a manner of living similar to that of the *Scaritini*; and many entomologists would probably place them near this group on account of their thick heads, broad anterior tibiæ, linear tarsi, &c. Prof. Schjödte, however, urges that these so-called "biological" characters do not indicate a real affinity between all the *Carabi* which exhibit them, but only an analogous mode of life. The structure of every animal is no doubt closely adapted to its habits; and in so far every peculiarity of structure, and the systematic characters derived from it, might, in some sense of the word, be called biological. But it is only to a small extent that we can indicate the connexion between habits of life and structure; and, as our knowledge stands at present, every animal and every group of animals appear to us as exhibiting the general feature of some type quite arbitrarily devised by the Creator, and modified in some respects to serve certain purposes. The true conception of these types, of higher and lower order, is the first condition of a natural system; but in this respect great faults have been committed. One great cause of mistakes is that analogous modifications of the corresponding organs in animals really belonging to different though allied types, but living under analogous external circumstances, have often been erroneously considered as the peculiar characteristics of a type—or, in other words, analogies have been mistaken for affinities. Thus, in the case before

* What is called ligula in *Carabi, Dytisci*, and *Gyrini*, is, strictly speaking, only the fulcrum ligulæ, the true ligula being represented by the "paraglossæ."

us, most *Carabi* adapted for digging in the ground undoubtedly belong to the same natural group—*Scaritini*; but this is not the case with all. Some genera also of other groups are adapted for this manner of living by the shape of their heads, their prothorax, antennæ, and legs, without on that account separating themselves from the group to which they naturally belong. *Daptus* and *Batoscelis* amongst *Stenolophini*, *Ditonus*, *Acinopus*, and others amongst the other *Harpalini*, are in this case. But then the whole set of characters which have reference to this manner of living cannot any longer be considered as the exclusive mark of distinction of any particular group.

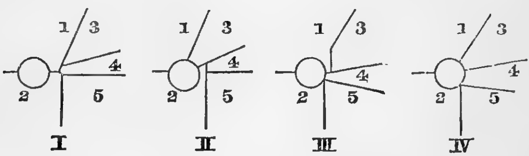
Prof. Schjödte's paper is rich in hints towards a better systematic arrangement of this numerous family than the present one, amongst which we will only mention the peculiar structure of the mouth in *Amblystomus*, *Barysomus*, and *Cyclosomus*, whose paraglossæ, being very broad, unite in front of the ligula.

In connexion with the preceding, a few words may not be out of place with reference to Prof. Schjödte's other contributions to the history of the *Carabi*. Much valuable information on this subject is to be found in his 'Denmark's Eleutherata' *, a work which is much less known than it deserves to be. In the second volume of the second series of the 'Naturhistorisk Tidsskrift,' p. 346, there is an interesting treatise on two new *Carabi* from Guinea,—*Hiletus versutus*, which forms the type of a separate group, and *Ochyropus gigas*, which belongs to *Scaritini*, but is remarkable for its long legs and vigorous feet. To the description of these species the author adds a number of highly interesting remarks on the systematic value of certain structural modifications of the thorax, of the position and shape of the antennæ, as well as of the different modifications to which the neighbouring parts of the head are subject, corresponding to the peculiarities of the antennæ. In the 'Proceedings of the Royal Danish Society' for 1855, he reverts to the subject; and the principal results embodied in these papers may be shortly recapitulated in the following manner.

In all *Carabi* the principal part of the epimera metathoracica is covered by the elytra, and is therefore quite membranaceous; but in very many there is an appendix to the said pieces, which descends towards the haunches, and is visible on the ventral surface. These appendices coalesce more or less with the episterna metathoracica, and appear to a superficial observer as belonging to them; hence *Carabi* presenting this structure have formerly, both by Schjödte and others, been described as having episterna metathoracica appendiculata, although it ought to be epimera metathoracica appendiculata. It is by comparison with other Coleoptera where the epimera are less completely covered than in *Carabi*, that Prof. Schjödte has learned the real nature of these appendices. The existence or want of these pieces is of great systematic value. In the family *Carabini* it

* Denmark's Eleutherata, I. (*Carabi, Dytisci, Gyrini*). Copenhagen, 1840–42. 25 tables, with analytical drawings.

may be advantageously combined with the shape of the tibiæ anteriores. They are wanting in *Cicindelini, Carabini, Elaphrini, Scaritini**, and in the more isolated genera *Siagona* and *Enceladus*. Of these, *Scaritini* distinguish themselves from the others by having a deep incision on the outer edge of the two anterior tibiæ, of which one of the terminal spines of the tibiæ is removed. All the others have either no incision or only a small one, and both terminal spines in their proper place. *Hiletus*, Schjödte, combines this last character with the existence of appendices to the epimera metathoracica, whilst all the other *Carabi* which have not been here mentioned combine the existence of an incision in the two anterior tibiæ, carrying one of the terminal spines, with appendiculated epimera. Another point in the structure of the thorax has perhaps in some respects been observed, though not clearly expressed, by the American entomologist Leconte, namely, the formation of the sockets of the second pair of legs. Five pieces may participate in the formation of each of these sockets: 1, mesosternum; 2, metasternum; 3, episternum mesothoracicum; 4, epimerum mesothoracicum; and 5, episternum metathoracicum, of the corresponding side. There exist four combinations: the sockets are formed (1) by mesosternum and metasternum alone; (2) by mesosternum, metasternum, and episterna mesothoracica; (3) by mesosternum, metasternum, and epimera mesothoracica; (4) by mesosternum, metasternum, episterna, and epimera mesothoracica. In the third and fourth cases a small continuation from the episterna metathoracica sometimes takes part in the formation of the sockets. These four combinations may be represented as in the subjoined diagrams, the numbers indicating the pieces in the order they are mentioned above †.



* In some *Scaritini* the epimera metathoracica present a linear impression near the margin, which may be, and has been, mistaken for a real suture; and the piece thus isolated has been mistaken for the appendices of which we speak.

† Proc. Royal Soc. of Copenhagen, 1855, p. 360. In this place, Prof. Schjödte has communicated various observations, *e. g.* on the new *Niphargus aquilex*, and on *Broscosoma* and *Miscodera*, which he shows are so nearly related that, instead of belonging to different groups of *Carabi*, as some think, they are both true *Harpalini*, and would form only one genus if there were not some difference in the construction of the chin and in the shape of the epimera mesothoracica, which are triangular in *Miscodera* and linear in *Broscosoma*. It is in so far as Leconte has attended to the shape of these pieces that he may be said to have been on the track of Prof. Schjödte's beautiful observation; but he has not penetrated the matter, and Prof. Schjödte avails himself of the opportunity to show how unnatural

For want of sufficient material, Prof. Schjödte has not carried out through all the families the systematical results to which a proper consideration of these characters would lead; he only indicates that the family of *Carabi* may thereby be divided into two natural divisions, and that throughout the order Coleoptera they are valuable as characters of families and groups. There can be no doubt that by this discovery a very important step has been made towards the better arrangement of the Coleoptera.

In the paper on *Hiletus* and *Ochyporus* (in the second series of the 'Tidsskrift,' p. 376), Prof. Schjödte has drawn attention to the differences exhibited by the *Carabi* as to the place of insertion of the antennæ and the corresponding modificatious in the surrounding parts. The following are the principal variations. I. The antennæ may be inserted in the sides of the forehead over the mandibles. The basal joint (scapus) of the antennæ is then generally very long, and a little curved so as not to interfere with the eye when the antennæ are kept quite close to the body, which operation is also facilitated by the socket of the second joint (pedicella) being turned a little backwards. This is the case in *Cicindelini,* and forms a new mark of distinction for this group, which has since also been observed by Leconte. In *Collyris* and *Euprosopus,* each of the cheeks presents a sharp groove under the eye, for the reception of the third joint of the antennæ, which is shaped accordingly. In *Manticora* the basal joint is unusually short, and there is a groove for it closely behind the point of insertion of the antennæ. II. In all other *Carabi* the antennæ are inserted in the cheeks, between the root of the mandibles and the eye, almost every genus exhibiting a peculiar arrangement. In some (as, for instance, in *Anthia*) the cheeks extend so far in all directions that there are no obstructions to the free movements of the antennæ, in which cases therefore no special modifications of the surrounding parts are necessary. In other cases (e. g. *Mormolyce, Helluo, Galerita, Drypta*) the cheeks are so long, and at the same time so much extended to the sides, as to present an anterior surface outside the mandibles, in which the antennæ are inserted. If so, there is sometimes a groove in the mandibles, in order to facilitate the antennæ being turned forward, whilst the opposite movement is often facilitated by a deep groove prolonging the socket backwards. If the cheeks are short without great breadth, similar grooves in the mandibles and in the cheeks, in infinite variation, constantly occur. Finally, in those which are destined for digging under ground (*Scaritini, Acinopus, Broscus,* &c.), or for living under bark (*Silphomorpha*), or other similar modes of existence (*Hiletus*), the cheeks are short, but extend considerably downwards (owing to

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Leconte's classification often becomes because of his blind adherence to the mere differences of shape exhibited by these pieces. Prof. Schjödte further refutes his erroneous statement that *Brachinini* alone have seven abdominal joints, but all other *Carabi* six; the seventh joint is found in all *Carabi,* only in many it is retracted under the sixth (*vide* also Denm. Eleutherata, 361, and Germar, Zeitschrift f. Entomologie, v. 476).

the thickness of the head), the bases of the antennæ are often protected by the prominent corners of the forehead, the antennæ geniculated, and two foveæ antennales provided. Taking all this into consideration, Prof. Schjödte has, in the 'Proceedings of the Royal Society of Copenhagen' (*loc. cit.*), proposed the following distribution of *Carabi*:—

I. Epimera mesothoracica coxas inferius attingentia.

A. *Epimera metathoracica appendice exteriori nulla.*
1. Antennæ frontales.
1. Cicindelini.
2. Antennæ pone mandibulas genis insertæ.
a. Antennæ scrobiculis haud recipiendæ, basi detectæ.
2. Carabini (inclus. Elaphrini cum gen. *Loricera*, Latr., et *Migadops*, Wath.).
b. Antennæ scrobiculis recipiendæ, sæpissime fractæ.
* Antennæ basi detectæ. Tibiæ inermes (mentum concretum; epimera mesothoracica concreta).
3. Siagonini (*Siagona, Enceladus*).
** Antennæ basi lamina frontali supertectæ. Tibiæ anticæ palmatæ.
4. Scaritini.

B. *Epimera metathoracica appendice exteriori instructa.*
a. Antennæ basi lamina frontali supertectæ, scrobiculis recipiendæ. Tibiæ anticæ integræ.
5. Hiletini (type *Hiletus*, Naturh. Tidsskr. *l. c.*).
b. Antennæ basi detectæ, scrobiculis haud recipiendæ. Tibiæ anticæ emarginatæ.
6. Ozænini (types *Ozæna, Myrtropomus, Mormolyce*).

II. Epimera mesothoracica coxas inferius haud attingentia.
Tribus Caraborum ceteræ.

It is to be hoped that Prof. Schjödte will find an opportunity for carrying out in greater detail these new ideas, which certainly seem to promise very useful systematic results.

To return to the volume before us: it should be noticed that it contains four excellent plates illustrating a paper by the editor on the metamorphoses of Coleoptera, with drawings and analyses of the larvæ of *Gyrinus marinus, Hydroïs aterrimus, Hydrophilus caraboïdes, Hydrobius fuscipes, Philhydrus testaceus,* and *Berosus spinosus.* In the following part this treatise will be continued, and we shall then have an opportunity for a few observations on it.

The North-Atlantic Sea-bed; comprising a Diary of the Voyage on board H.M.S. Bulldog, in 1860, *and Observations on the Presence of Animal Life, and the Formation and Nature of Organic Deposits, at great Depths in the Ocean.* By G. C. Wallich, M.D., F.L.S., F.G.S. &c. Part I. 4to. London: Van Voorst, 1862.

In this work Dr. Wallich, who held the office of Naturalist to the Expedition dispatched in 1860 to survey the proposed telegraphic route between this country and America, gives us the results of his investigations into the natural history of the portion of the sea-bed passed over by the 'Bulldog' during her voyage of about four months. The first section of the part now before us contains his journal of the voyage, which comprises much interesting information, especially upon the nature and mode of formation of the icebergs and ice-fields which constitute at once the greatest wonder and the chief danger of those northern seas in which his investigations were carried on. This portion of Dr. Wallich's book we shall, however, pass over, in order to direct the reader's attention more particularly to the remarkable results detailed in the second section, which is devoted to the consideration of the "Bathymetrical Limits of Animal Life in the Ocean."

The interest attaching to this section of Dr. Wallich's work arises from the fact that, in some of his deep-sea soundings, the apparatus employed brought up living animals from those abysses of the ocean which, according to the almost universal opinion of naturalists, were uninhabitable by any creatures, thus at once upsetting all our preconceived notions as to the distribution and limits of animal life in the sea. The first notice of Dr. Wallich's remarkable observations appeared in this Journal in December 1860; in the present work we have a more detailed account of the mode of occurrence of the animals referred to, which can leave no doubt that the existence of animal life at enormous depths is an actual fact.

The most striking of Dr. Wallich's results was obtained in a sounding at a depth of 1260 fathoms: it is to this that his short paper already alluded to refers. The deposit brought up consisted of *Globigerinæ*, many of them in a fresh condition, amongst which were some small Serpuloid tubes, composed chiefly of the shells of small *Globigerinæ* cemented together, from which Dr. Wallich justly concludes that the inhabitants of these tubes live upon the sea-bed among the *Globigerinæ*. But the most astonishing circumstance was the occurrence of numerous living Starfishes of a species (*Ophiocoma granulata*) well known as an inhabitant of our coasts, adhering to the sounding-line under such conditions as to prove that they also must find a suitable dwelling-place in the profound abysses of the ocean. The evidence of this fact is furnished partly by their position on the line, and partly by the contents of the stomach of a specimen opened by Dr. Wallich. To explain the former proof, our author tells us that, after the regular operation of sounding had been performed, the apparatus for bringing up a portion of the bottom was lowered, and, in order to make sure of its reaching and dragging on the bottom, about fifty fathoms of line were paid out in addition to the quantity indicated by the previous sounding. It was only to this fifty fathoms of line, which must have lain along the bottom of the sea, that the Starfishes adhered; and as no fewer than thirteen of them were brought up, it would appear that they must be tolerably plentiful over the sea-bed at the point sounded. The contents of the stomach proved that the *Ophiocomæ* feed upon the *Globigerinæ*, furnishing additional evidence that the two forms were cohabitants of the sea-bottom at this point.

Dr. Wallich refers to other instances in which he obtained living animals, and indications of the existence of other forms, from depths greater than are usually supposed favourable to animal life: the *Globigerinæ*, he states, are obtained from the immense depth of 3000 fathoms, and from no less than 1913 fathoms the small Annelid-tubes above referred to as fabricated of the shells of *Globigerinæ* were brought up. He also cites analogous observations made by various investigators, amongst others by Sir John Ross and Sir James Clark Ross, the former of whom even obtained a Gorgon's-head Star-fish (*Euryale*) adhering to his sounding-line at a depth of 800 fathoms, whilst M. Torell, director of the Swedish expedition to Spitzbergen, is reported to have brought up from 1400 fathoms a "Crustacean of bright colours." Dr. Wallich does not, however, refer to the examples adduced by Dr. A. Milne-Edwards in July 1861, before the Academy of Sciences of Paris (see Annals, Sept. 1861), of the occurrence of several species of Mollusca, Corals, *Serpulæ*, and Polyzoa, found adhering to a submarine cable recovered from depths between 1000 and 1500 fathoms in the Mediterranean.

Having proved experimentally that animals do live at vast depths in the ocean, our author reviews the grounds upon which the opposite opinion, to which he gives the title of *antibiotic*, has been founded. He discusses in detail the various questions connected with the temperature and aëration of the water, and the presence in it of mineral and other substances necessary for the existence of the animal forms which have been found in the deepest recesses of the ocean, and, it appears to us, shows satisfactorily that the views hitherto entertained upon these points are erroneous. The argument derived from total absence of light at these great depths is disposed of by reference to the well-known fact that the lower parts of the deep-sea coral zone of Forbes, which are inhabited by numerous and often brightly coloured animals are situated far below the depth (700 feet) to which the smallest amount of light can penetrate. One main reason which has been urged against the existence of any living thing in the deep sea, namely, the enormous pressure which must prevail towards the bottom, appears to offer no further difficulty. Immense as this pressure must be, amounting to no less than 2640 lbs. on the square inch at a depth of a mile, Dr. Wallich shows that, as every part of the creatures living at the sea-bottom is "completely pervious to fluids, either by its porosity or through endosmotic action, the state of equilibrium remains undisturbed," and thus these animals will be enabled to adapt themselves to all circumstances of pressure.

There is one point, however, in connexion with the residence of animals at great depths, in which Dr. Wallich seems to find some difficulty, namely, the mode in which they can obtain their nourishment. Vegetable substances, in the sea as on land, must be considered to form the basis of the nutrition of animals, either directly or indirectly; but the growth of plants is limited to those zones of the sea-bed to which light can penetrate; and although the remains of vegetable organisms have been brought up in abundance from great depths, their condition seems to prove that their life was passed nearer the surface of the ocean, and that they did not sink to the bottom of the deep waters until after the cessation of their vitality. That the nutrition of the Starfishes and Annelides may be effected at the expense of the *Globigerinæ* and other low forms of animals is shown by the contents of the stomach of one of the Starfishes when brought to the surface; the question then is, in what manner are these lower organisms nourished? In endeavouring to find a solution of this problem, Dr. Wallich puts forward a hypothesis which we cannot think to be at all admissible, namely, that as the organisms in question possess the power of "separating carbonate of lime or silica from waters holding these substances in solution . . . . . they may also apply the elements not needed for that purpose to the nutrition of their soft parts, especially since the remaining elements are those which, when united, constitute the proteine-compound of which their soft parts are invariably composed." In this Dr. Wallich thinks that "no exceptional law is invoked;" but it seems to us that, even if the derivation of mineral elements, such as carbonate of lime and silica, directly from the surrounding water be, as Dr. Wallich considers it, an indisputable fact, it still furnishes us with no analogy to the fixation and combination of the organizable elements into a living body, as the carbonate of lime and silica remain unchanged in their chemical condition; whilst the analogy supposed to exist with plants is still further from the truth. The very difficulty which this hypothesis is proposed to get over arises from the fact, admitted by Dr. Wallich, that plants, which we know to derive their nourishment from inorganic matter, cannot effect the assimilation of the necessary elements without the stimulus of light; and yet we are to assume that animals, none of which, as far as we know, are capable, under the ordinary conditions of plant-life, of availing themselves of the surrounding elements for the nutrition of their bodies, may yet do so under the influence of a total absence of all recognizable stimulus. It appears to us, that in this we have an invocation of a very exceptional law, and one which involves something very like a creation of force. A statement made by Dr. Wallich, a few pages after the promulgation of the above theory, may perhaps serve partly to explain the apparent anomaly. He says, "it is evident that there is an intimate association between the Globigerina-deposits and the Gulf-stream; for wherever we trace the one sweeping across the surface of the ocean, we are almost sure to detect the other resting on the sea-bed; and when we fail to trace the one, we almost as surely fail to detect the other." This connexion between the Gulf-stream and the deposits of *Globigerinæ* is ascribed by Dr. Wallich to the vast quantities of carbonate of lime brought down into it by the great rivers of the American continent. The abundant supply of this salt is considered to be so favourable to the growth of Foraminifera as to cause their abundance along the course of the Gulf-stream. Admitting the force of this argument, may not the influence of the Gulf-stream depend also in part, perhaps chiefly, on the vast numbers of organisms which swarm in its genial waters, and which, sinking to the bottom after death, may furnish the food necessary for the sustenance and multiplication of the inhabitants of the abysses beneath them?

Although constrained to dissent on this point from Dr. Wallich's views, we nevertheless cordially welcome his work as a most important and interesting contribution to our knowledge of the physical geography of the sea. The reader will find in it a most interesting discussion of some of the most important questions connected with the distribution of marine animals; and many of the statements connecting these with the elucidation of facts in geology and physical geography will be found exceedingly valuable. We look forward with much impatience for the appearance of the second part, completing the work (which is announced to be published in December), as it will contain the results of Dr. Wallich's investigations into the structure and life-history of the Rhizopodal Fauna of the deep sea; and from the care with which his researches have been carried on, we have every reason to expect a highly valuable contribution towards the history of those singular creatures. This portion of his subject is barely commenced in the part before us; but, from the few pages here devoted to it, and the lettering of the beautiful plates appended to the work, nearly all of which illustrate the Rhizopoda, it would appear that Dr. Wallich's researches have led him to important systematic results.

On the various Contrivances by which British and Foreign Orchids are Fertilized by Insects, and on the good effects of Intercrossing. By Charles Darwin, M.A., F.R.S. London: John Murray. 12mo. 1862.

Among flowering plants there are few which excite our interest more than the Orchids, whether we consider merely the singularities of their external appearance, or the mysterious amalgamation of their male and female organs in a single central column. The strange and often grotesque forms of the flowers (simulating, as they frequently do, certain members of the animal kingdom), the great beauty of some species, and the remarkable epiphytal habits of others are quite sufficient to attract the attention of both the botanist and the horticulturist to these plants; and when we add to this that the above-mentioned amalgamation of the sexual organs of the flowers, instead of facilitating impregnation, as might have been expected, really seems to place obstacles in the way of the performance of this function, the interest excited by these plants will reach its climax. It is Mr. Darwin's object in the present work to clear up the mystery hanging over the process of impregnation in the Orchids, in order to apply the results thus obtained to the support of certain opinions advanced in his book on the 'Origin of Species.' In the practical part of his task, the explanation of the mode of fertilization, it seems to us that he is completely successful; but whether the arguments deduced therefrom on the general question be equally valid, is another affair.

It has long been supposed by some botanists, amongst whom Mr. Darwin cites Sprengel and Robert Brown, that in the fertilization of Orchids insects play a not unimportant part; but, as remarked by our author, from their assuming the pollen to be applied to the impregnation of the same flower, they have missed discovering the true process. According to Mr. Darwin, the pollen of one flower is almost invariably employed to fertilize the seeds of another; and the contrivances by which this end is attained in different Orchids appear to us to be amongst the most remarkable presented by the vegetable kingdom. We may select one of the simplest forms of the process, namely that exhibited by *Orchis mascula,* as this will furnish a clue to the phenomena presented throughout the group.

In this plant the top of the column is occupied by the single anther, containing two pollinia or masses of pollen-grains, which are produced beneath into small slender stalks, each terminating in a viscid disk which is received into the back of the rostellum. The latter, which is the homologue of one of the stigmata, projects from the front of the column in such a manner as partially to fill up the orifice leading into the nectary, and on each side of it are the true stigmatic surfaces of the remaining two stigmata. The viscid disks of the pollinia are surrounded by a fluid which keeps them constantly moist, being protected from atmospheric influences by the rostellum. The action of this complex apparatus is explained, as follows, by Mr. Darwin:—

"Let us suppose," he says, "an insect to alight on the labellum, which forms a good landing-place, and to push its head into the chamber at the back of which lies the stigma, in order to reach with its proboscis the end of the nectary. . . . . Owing to the pouch-formed rostellum projecting into the gangway of the nectary, it is scarcely possible that any object can be pushed into it without the rostellum being touched. The exterior membrane of the rostellum then ruptures in the proper lines, and the lip or pouch is most easily depressed. When this is effected, one or both of the viscid balls will almost infallibly touch the intruding body. So viscid are these balls that whatever they touch they firmly stick to. Moreover the viscid matter has the peculiar chemical property of setting, like a cement, hard and dry in a few minutes' time. As the anther-cells are open in front, when the insect withdraws its head, one pollinium, or both, will be withdrawn, firmly cemented to the object, projecting up like horns. The firmness of the attachment of the cement is very necessary, as we shall immediately see; for if the pollinia were to fall sideways or backwards, they could never fertilize the flower. From the position in which the two pollinia lie in their cells, they diverge a little when attached to any object. Now let us suppose our insect to fly to another flower: . . . . by looking at the diagram, it will be evident that the firmly attached pollinium will be simply pushed against or into its old position, namely into its anther-cell. How, then, can the flower be fertilized? This is effected by a beautiful contrivance: though the viscid surface remains immoveably affixed, the apparently insignificant and minute disk of membrane to which the caudicle adheres is endowed with a remarkable power of contraction, which causes the pollinium to sweep through about 90 degrees, always in one direction, viz. towards the apex of the proboscis, in the course, on an average, of thirty seconds. Now, after this movement and interval of time (which would allow the insect to fly to another flower), it will be seen that if the pencil [or proboscis] be inserted into the nectary, the thick end of the pollinium will exactly strike the stigmatic surface."

That things go on in the way just described was demonstrated experimentally by Mr. Darwin by the simple expedient of thrusting the point of a pencil or some similar object into the orifice of the nectary, when one or both of the pollinia are certain to be removed, and the subsequent change of position for enabling the pollen to reach the viscid stigmatic surfaces of another flower may easily be observed. The occurrence of the same phenomena by the intervention of moths and other sucking insects is proved by the frequent occurrence of pollinia adhering to their proboscides. Mr. Darwin gives a list of twenty-three species of Lepidoptera on which pollinia of *Orchis pyramidalis* have been met with; he figures the head of a specimen of *Acontia luctuosa* with seven pairs of pollinia attached to its proboscis, and mentions one of a *Caradrina* which bore no fewer than eleven pairs of these pollen-masses.

As the general principle on which the fertilization of Orchids depends is nearly the same throughout, although the different means by which its effectuation is ensured present many beautiful and wonderful contrivances, the extract above given may suffice for our present purpose; the reader will, however, find the details given by Mr. Darwin on all points connected with the impregnation of these plants most interesting. We may, however, trespass a little further upon his time in order to advert to one case which appears to us particularly remarkable.

In *Catasetum*, one species of which is now known to be the male form belonging to a female plant placed by botanists in quite a different genus, the two pollinia are affixed to a common, broad and strong pedicle bearing at its lower end a single disk coated with viscid matter. The latter, however, is so turned into the interior of the column that no insect can by any possibility get at it, and indeed there seems to be nothing to induce even the most inquisitive insect to push his proboscis into the vicinity of the disk. How, then, is it to be set free? Mr. Darwin describes a pair of long, stiff and tapering organs, which he calls antennæ, projecting from the sides of the column close to the insertion of the pedicle of the pollinia; these hang down over the pouch-like labellum, in such a position that an insect moving about upon the latter can hardly fail to touch them. The slight irritation thus caused appears to produce some singular effect upon the tissues about the base of the pollinia: the membranes retaining the common pedicle in its position are ruptured; the heavy viscid disk is set free, and is drawn forth by the sudden extension of the previously curved pedicle, which straightens itself with such force as to jerk the pollinia out of their cells and project the whole organ to a distance often of two or three feet, the disk with its viscid coat being always carried foremost, ready to adhere to any object.

Mr. Darwin sums up, as follows, the phenomena presented by the genus including *Catasetum*, *Monachanthus*, and *Myanthus* of botanists. He says, "We see a flower patiently waiting with its antennæ stretched forth in a well-adapted position, ready to give notice whenever an insect puts its head into the cavity of the labellum. The female *Monachanthus*, not having pollinia to eject, is destitute of antennæ. In the male and hermaphrodite forms, namely *Catasetum tridentatum* and *Myanthus*, the pollinia lie doubled up like a spring, ready to be instantaneously shot forth when the antennæ are touched; the disk end is always projected foremost, and is coated with viscid matter, which quickly sets hard, and firmly affixes the hinged pedicel to the insect's body. The insect flies from flower to flower, till at last it visits a female or hermaphrodite plant; it then inserts one of the masses of pollen into the stigmatic cavity. When the insect flies away, the elastic caudicle, made weak enough to yield to the viscidity of the stigmatic surface, breaks, and leaves behind the pollen-mass; then the pollen-tubes slowly protrude, penetrate the stigmatic canal, and the act of fertilization is completed. Who would have been bold enough," he adds, "to have surmised that the propagation of a species should have depended on so complex, so apparently artificial, and yet so admirable an arrangement?"

The consequence deduced by Mr. Darwin from the facts above referred to is stated by him in the following words:—"Considering how precious the pollen of Orchids evidently is, and what care has been bestowed on its organization and on the accessory parts,—considering that the anther always stands close behind or above the stigma, self-fertilization would have been an incomparably safer process than the transportal of the pollen from flower to flower. It is an astonishing fact that self-fertilization should not have been an habitual occurrence. It apparently demonstrates to us that there must be something injurious in the process. Nature thus tells us, in the most emphatic manner, that she abhors perpetual self-fertilization."

To this conclusion we may be permitted to demur. Even amongst Orchids, according to Mr. Darwin, some species, the most striking of which is the Bee-Orchis (*Ophrys apifera*), are organized for self-fertilization; and we do not see why the mere fact of the close juxtaposition of the sexual organs, coupled with the necessity for the impregnation of one flower by the pollen of another (admitting this to the fullest extent), should have more weight in proving that "Nature abhors self-fertilization" than the perfectly well-known fact that, whilst the majority of plants bear hermaphrodite flowers, others are monœcious and diœcious. It seems to us that, curious and interesting as are the phenomena revealed to us by Mr. Darwin, they are far from giving any support to the theory that self-impregnation is abhorrent to Nature, especially as there are many plants and animals in which, as far as we are aware, "perpetual self-fertilization" must prevail.

Apart from this theory and that of "natural selection," which we cannot think is much advanced by the present volume, we must welcome this work of Mr. Darwin's as a most important and interesting addition to botanical literature. It contains the details of a vast number of curious phenomena, observed most carefully, and furnishes a most lucid exposition of the homologies of the singular flowers of which it treats. The illustrations also are excellent.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

May 13, 1862.—John Gould, Esq., F.R.S., in the Chair.

NOTICE OF A NEW SPECIES OF DOLPHIN (DELPHINUS CATALANIA), DISCOVERED IN NORTH AUSTRALIA BY MR. JOHN MACGILLIVRAY. BY DR. J. E. GRAY, F.R.S., ETC.

Mr. John Macgillivray has sent to Mr. Cuming, who has transferred them to the British Museum Collection, two skulls of a species of Dolphin or Bottlenose, which he regards as probably new.

These skulls were accompanied by the following notes :—

" DELPHINUS, n. s.

" *The larger of the two* skulls belonged to an individual killed off Cape Melville (within the Great Barrier Reefs), north-east coast of Australia, Sept. 5, 1860. It was a *female*, 7½ feet in length; and from it were taken two fœtuses, each 10 inches in length. The adult was of a very light lead-colour above and on the sides, gradually passing into the dirty leaden white of the lower parts, which were covered (as also the flippers) with longitudinally elongated blotches of dark lead-colour.

" *The smaller of the two* skulls represents another Porpoise of the same species, harpooned off Cape Flattery, on the north-east coast of Australia, Oct. 9, 1860. It was considerably smaller than the first one, being only 6¾ feet in length. It was a *female*. The colour was *exactly* lead-colour, fading into whitish on the lower parts between the anus and the snout. The sides were marked with small oblong spots of the same colour as the back. Measurements when recent :—

" Total length, snout to centre of tail, 6 feet 9 inches.

" Snout to base of dorsal, 3 feet; length of anterior border of dorsal 13 inches; height of dorsal 8 inches; width of dorsal 12 inches; from posterior border of dorsal to tip of tail, 2 feet 8 inches.

" Swimming-paws (midway between snout and dorsal) 13 inches long, and 5½ inches broad; from their base to end of snout, 13 inches.

" Tail 22 inches across from tip to tip.

" Anus 2 feet 2 inches in front of tail (centre of tip).

" Eye ¾ths of an inch in diameter, situated 1½ inch behind angle of mouth, and 12 inches from tip of upper jaw.

" Lower jaw projecting 1 inch beyond the upper.

" This Porpoise was occasionally seen, in small droves of from three to six, along the north-east coast of Australia, within the reefs. Two other species also were seen, but we could not fasten."

The two skulls slightly differ in shape and size.

No. 1 is 17 inches long; the beak to the notch is 10 inches, and the upper tooth-bone $8\frac{1}{2}$ inches long; the front lower teeth are worn away and truncated, like the teeth of the common *Delphinus tursio*, which was described as *D. brunatus* by Montague. There are twenty-seven teeth on each side in the upper, and twenty-five teeth on each side in the lower jaw.

No. 2 is 17 inches long; the beak $9\frac{1}{2}$, and the upper tooth-bone 8 inches long. The teeth twenty-four above (perhaps one on each side is deficient, as the end of the jaw is very tender), twenty-three or twenty-four below. The front lower teeth are slightly truncated; but this skull chiefly differs from No. 1 in being rather more convex and rather narrower, especially in the hinder part, from the middle of its length.

I have compared these skulls with those of the different species of Bottlenoses (*Tursio*) in the British Museum; and they are perfectly distinct from any of them. The species may be called *Delphinus Catalania*. It is smaller in size, and has a much smaller brain-cavity than *D. Cymodoce* (Gray, Zool. Erebus & Terror, t. 19) and *D. Metis* (Gray, Zool. Erebus & Terror, t. 18); and the beak is not so tapering as in these species, and the teeth are rather more numerous.

It is equally distinct from *Delphinus Eurynome* (Gray, Zool. Erebus & Terror, t. 17), believed to be from the North Sea.

It is not easy to point out the distinction of these species in words; but there cannot be a doubt about them when they are compared together.

I may here observe that *Delphinus Eutropia* (Gray, Proc. Zool. Soc. 1849, 1; Zool. Erebus & Terror, t. 34 ined.), which, in the 'Catalogue of Cetacea' in the British Museum, I have placed in the first section of *Tursia*, with *D. tursio* and the species above named, should be formed into a section of itself, characterized by having a very broad muzzle shelving on the sides, and the skull shelving down over the orbits, and thirty-four or thirty-five slender teeth on each side of each jaw. This section may be called Eutropia.

Notice of a Wingless Bird, or Moho, and a Raven found in the Island of Hawaii by Mr. W. H. Pease. By Dr. J. E. Gray, F.R.S., etc.

In a note lately received from Mr. W. H. Pease, dated Honolulu, Nov. 20, 1861, he observes, "I noticed in a late number of the 'Annals of Natural History' a description of a species of bird living in our islands (which was figured many years since in Dixon's 'Voyage'), by Mr. Gould; he refers it to the genus '*Moho*.'

"Please inform him that there is a *wingless bird* of small size living in the island of Hawaii, which the natives call 'Moho,' which is now nearly extinct, having been killed off by the wild cats and dogs within late years; I have seen but a single specimen. There is also living there a species of Raven."

Some Remarks on Aquila Desmursii (J. Verreaux). By J. H. Gurney, M.P., F.Z.S.*

M. Jules Verreaux, who first recognized this Eagle as a distinct species, communicated his description of it to Dr. Hartlaub, by whom the species was made known to ornithologists in his admirable work on the Ornithology of West Africa.

My present object is to put on record some information as to this interesting bird, with which M. Jules Verreaux has been so good as to supply me, and also to give some indications of the changes of plumage to which this species appears liable, and which I have had the opportunity of examining in several examples which now form part of the collection of the Norwich Museum.

It may, however, be well to premise a few general remarks with reference to the geographical distribution of this Eagle, and to some of the peculiarities by which it is distinguished.

Aquila Desmursii has hitherto only been found in Tropical Africa, north of the Equator,—specimens having been obtained at Bissao on the western coast, and also in Nubia and Abyssinia, and on the banks of the White Nile.

It is a small species, intermediate in size between *Aquila pennata* and *Aquila nævia*. From the former it is readily distinguishable by the greater length of all its measurements; from the latter (as also from *Aquila nævioïdes*) it may, on the contrary, be distinguished by its less size and, as Dr. Hartlaub well remarks, "by the more delicately shaped bill, and by the greater length of the tail" as compared with that of the wings.

Another well-marked distinction, to which Dr. Hartlaub does not allude, is to be found in the presence in *Aquila Desmursii* of a well-defined, though small, occipital crest, consisting of from eight to nine pointed feathers, the longest of which are fully an inch and a half in length.

The colouring of this Eagle, described in Dr. Hartlaub's work, is that which characterizes what I believe to be the adult bird after it has newly moulted and has acquired its fresh plumage. In this dress the general colouring of *Aquila Desmursii* closely resembles that of the adult of *Aquila nævioïdes* under similar conditions, being of a rufous brown, varying in intensity in different portions of the same feather.

Other specimens of *Aquila Desmursii* exhibit a plumage of an extremely dark and almost uniform chocolate-colour. These individuals I believe to be immature birds, in which the feathers have been also newly acquired. In this stage they bear a considerable general resemblance in point of colouring to the immature specimens of *Aquila pennata*, though I have never met with an immature *Aquila pennata* quite so dark as some specimens I have seen of *Aquila Desmursii*. In *Aquila Desmursii*, as also in *Aquila nævioïdes*,

* This paper will also be published in the Society's 'Transactions,' accompanied by a plate.

both adult and immature birds appear liable to have their plumage exceedingly bleached by the action of the tropical sun; but it is remarkable that the feathers composing the occipital crest in *Aquila Desmursii* appear to retain their original tint, notwithstanding the partial loss of colour from the above cause in the portions of the plumage immediately adjacent. It should also be remarked that, in some immature specimens, nearly the whole under surface is of a very pale whitish brown—a variation from the ordinary darker colouring which cannot be accounted for by the effect of sun and weather only.

In conclusion, I will add the remarks on this species communicated to me by M. Jules Verreaux, which are as follows:—"According to the notes of the collectors, the irides of the adult birds are of a chestnut-brown tinged with yellow; whilst in the young birds the yellow tint is absent, and the brown is deeper, with but little tinge of chestnut. The natives (at Bissao) give the name of 'Socolas' to this species only, it being well known to them as a very courageous bird, attacking even the small Gazelles (*Cephalophorus Maxwelli*) which inhabit the same localities, and also preying on various birds, and especially the *Francolinus bicalcaratus.*"

Descriptions of seven New Species of Phyllopodous Crustaceans, belonging to the Genera Estheria and Limnetis. By W. Baird, M.D., F.L.S.

1. Estheria Jonesi, Baird.

Carapace of a comparatively hard, horny structure, and of a dark-brown colour. Valves ventricose, rounded, ovate. Umbones prominent, nearly central, but a little nearer the anterior extremity; involute and representing exactly those of a bivalve shell. Dorsal margin short; ventral rounded. Anterior extremity swollen, rounded, shorter than posterior extremity, which is somewhat compressed and rounded. Ribs numerous and narrow. Those of the upper half of carapace, from the umbo downwards, strongly developed, the edges being raised and strongly beaded; the interstices hollow, and more sparsely dotted with rather small irregular-sized punctations. Ribs of lower half of carapace, as far as the ventral margin, much smaller than those of upper half, narrower, and much more numerous; they are punctate also; but the interstices are so very narrow that no sculpture can be seen. Internally the surface is quite smooth, and of a dark-purple colour.

Length of carapace, 6 lines; breadth at umbo, nearly 5 lines.

Hab. Brackish water, Island of Cuba (*Dr. Dunker*). Communicated by T. R. Jones, Esq. (*Mus. Brit.*)

2. Estheria Dunkeri, Baird.

Carapace-valves broadly ovate and somewhat elongate. Umbones prominent, and placed at some distance (rather more than a third) from anterior extremity. Dorsal margin short, rather sloping. Ventral margin nearly straight, or only slightly rounded. Anterior extremity swollen, very convex, and rounded. Posterior extremity elongate, more compressed, and not so rounded. The carapace is of a uniform yellow horn-colour, thin, and translucent. Ribs numerous, elevated, rather narrow, about twenty-seven in number, with the interstices marked with shallow pits and extremely fine punctations.

This species approaches somewhat to *E. brasiliensis*, but differs in the position of the umbones, those of *E. Dunkeri* being further from the anterior extremity. The relative size of anterior and posterior extremities differs also, the former in *E. brasiliensis* being much broader than in the present species. It is a larger species also than *E. brasiliensis.*

Length of carapace, 7 lines; breadth at umbo, 4 lines.

Hab. Zimapan, Mexico; in fresh water (*Dr. Dunker*). Communicated by T. R. Jones, Esq. (*Mus. Brit.*)

3. Estheria Lofti, Baird.

Carapace of a very light amber-colour, oval, rather swollen. Umbones very prominent, elongate, placed near the anterior extremity. Dorsal margin slightly sloping. Ventral margin rounded. Anterior extremity swollen, rounded, and broader than the posterior, which is rather narrow, and somewhat compressed. Ribs of carapace few, broad; interstices marked with coarse-looking, raised, flexuous lines.

This species resembles in form the *E. tetracera* as represented by Krynicki, and found by him near Moscow and at Charkow, Russia.

Length of carapace, rather more than 4 lines; breadth at umbo, 3 lines.

Hab. Stagnant water on the banks of the Tigris, near Bagdad. Collected, along with *E. dahalacensis*, by the late W. R. Loftus, Esq., in May 1855. (*Mus. Brit.*)

4. Estheria Rubidgei, Baird.

Carapace-valves ovate. Dorsal margin long, straight. Umbones small, placed near the anterior extremity. Ventral margin slightly rounded. Anterior extremity rounded. Posterior extremity emarginate at upper part, giving it somewhat the appearance of the shell of an *Avicula*. Anterior extremity rather the larger. Ribs of carapace not numerous, and wide apart, the surface in the interspaces marked with coarse and flexuously disposed raised lines.

This species partakes of the characters of straight-dorsal-margined species, *E. dahalacensis* and *E. Macgillivrayi*. From the last species it differs in size, form of posterior extremity, and markings of interspaces between the ribs, as well as their comparative size and number, those of the present species being fewer and wider apart.

Length of carapace, about $3\frac{1}{4}$ lines; breadth at umbo, 2 lines.

Hab. A dried-up "vley" near Port Elizabeth, Cape Colony. Collected by Dr. Rubidge, and communicated to Henry Woodward, Esq., by W. S. M. D'Urban, Esq. (*Mus. Brit.*)

5. Estheria Macgillivrayi, Baird.

Carapace-valves ovate. Dorsal margin long, straight. Umbones small, placed about 1 line from the anterior extremity. Ventral margin rounded. Anterior extremity rounded, as well as posterior, both being of nearly equal size. Ribs of carapace numerous, narrow, and finely punctate in the interstices.

In general outline this species resembles very much *E. dahalacensis*; but the ribs are narrower, more numerous, and the surface of the interstices is much more finely punctate.

Length of carapace, about 5 lines; breadth at umbo, 3 lines.

Hab. Brackish lake, Green Point, Cape of Good Hope (*J. Macgillivray*). (*Mus. Brit.*)

6. Estheria Caldwelli, Baird.

Carapace-valves swollen, ovate, of a pale horn-colour. Umbones large, prominent, and ferruginous-coloured, placed at about one-third distance from the anterior extremity. Dorsal margin short, and nearly straight. Anterior extremity rounded, short, a little broader than posterior extremity, which is long and rounded. Ventral margin rounded. Ribs of carapace numerous, rather narrow. Interstices roughly and strongly punctate.

Length of carapace, nearly 4 lines; breadth at umbo, rather more than 2 lines.

Hab. Lake Winnipeg, N. America (*W. Caldwell, Esq.*). (*Mus. Brit.*)

7. Limnetis Gouldii, Baird.

Carapace nearly quite globular, ventricose, and of a light horn-colour. Surface of valves smooth, not ribbed, and covered entirely with numerous very small hollow punctations exactly resembling those on the top of a thimble. The point to which the adductor muscles are attached is very marked, being slightly prominent and very smooth and shining; and the branchial canals on the surface of the valves are strongly exhibited.

This species resembles very much *L. Wahlbergii* of Lovén, from Port Natal. In addition, however, to the total difference of habitat, this species differs from the one described by Lovén in size, being double the dimensions of it. The animal, too, differs in some particulars; but as all the specimens I have examined are males, and the one figured by Lovén is a female, I do not know how far these differences may be merely sexual.

Diameter of carapace, about $1\frac{1}{2}$ line.

Hab. Fresh water at St. Ann's, twenty miles from Montreal, Canada. Collected by Charles Gould, Esq., June 1857. (*Mus. Brit.*)

Note on Furina textilis. By Gerard Krefft, Acting Curator Austr. Mus.

During my rambles in the neighbourhood of Sydney I have found a number of small Snakes, varying in length from 8 to 12″, and answering to the description given by Duméril and Bibron of *Furina textilis*. None of the specimens obtained have exceeded 16″ in length; and I have been naturally anxious to procure the young of this species. During two years I was unsuccessful, and I began to think at last that this Snake was only the immature form of some other species, which supposition became a belief when some months ago I found an egg containing as large a specimen of *Furina textilis* as I had ever met with before. On further investigation I found that the distinct bands and black spots of this Snake faded with the growth of the individual, and apparently vanished altogether in old specimens. As the egg and young in my possession are of a size generally produced by Snakes from 3 to 4 feet in length, and as I have a series of specimens in which the disappearance of the bands and markings may be clearly traced, I do not hesitate to assert that *Pseudonaia textilis* is only a young Snake. Inviting the scrutiny of more able naturalists than myself to this fact, I beg to refer at the same time to my collection forwarded to the International Exhibition, specimens Nos. 66 and 40, which I believe to be identical.

I have since forwarded a full-grown adult Snake of this species to Dr. Günther, which I have stuffed, as in the dry specimens the remains of the rings on the body may be better observed than when preserved in spirits. I have been unable to find any description in Duméril and Bibron of the large *Furina* of which I suppose the *F. textilis* to be the young; and, not being in possession of the British Museum Catalogue, I do not know whether this Snake has been described at all.

Note on the Deer of Formosa. By P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

In some remarks on the Japanese Deer received by the Society in 1860, which I made before the meeting of this Society in the month of November of that year*, I gave some reasons for considering *Cervus sika* of the 'Fauna Japonica,' *Cervus pseudaxis* of the French naturalists, and Dr. Gray's *Rusa japonica* as probably synonyms of the same species. In a communication made to the Society in the following year, Dr. Gray ultimately admits that his *Rusa japonica* is probably the same as *Cervus sika*, "though it differs so much from the figure and description of that animal in the 'Fauna Japonica';"† and I believe there is now little doubt upon this point. Mr. Westerman, the Director of the Gardens of the Zoological Society of Amsterdam, to whom we parted with a pair of these Japanese Deer in 1861, has informed me that he was previously well acquainted with the species, and that it is certainly identical with the type of *Cervus sika* in the Leyden Museum. Since the arrival of the first example of this Deer (the pair presented to the Society by Mr. Wilks, July 21, 1860), we have received several others. In September 1861, a female arrived from our Corresponding Member, Mr. Blyth of Calcutta, being one of the examples he has commented upon in the 'Journal of the Asiatic Society of Bengal' (xxx. p. 90); and in June of the same year we purchased a pair of these animals, the male of which was subsequently parted with to Mr. Westerman. On the 31st of August,

* Ann. & Mag. ser. 3. vol. vii. p. 142. † Ibid. vol. viii. p. 341.

1861, the female presented by Mr. Wilks produced a male calf; and there seems every probability of this Deer doing well in this country.

With regard, however, to the Formosan Deer (*Cervus taëvanus* or *taiouanus*), I was certainly wrong in supposing it to be the same as the Japanese *Cervus sika*. Knowing nothing about it, except from Mr. Blyth's description, I supposed that he who created the species was to be trusted when he destroyed it. I therefore put faith in what Mr. Blyth wrote in a letter to me (dated July 4th, 1860), that he was then "satisfied" that the Formosan and Japanese Deer were of "one and the same species." It appears, however, from what Mr. Swinhoe says (see P. Z. S. 1861, p. 235), that all the living Deer sent to Mr. Blyth were of the Japanese species, and that Mr. Blyth never had the Formosan species alive*. Mr. Blyth's comparison, therefore, was made between animals of the same species.

All doubt, however, as to the perfect distinctness of the Formosan Deer from the Japanese *Cervus sika* is removed since we have received the fine male of the *Cervus taëvanus*, presented to us by our Corresponding Member, Mr. Swinhoe, in December last. It will be evident to any one who inspects this animal and compares it with the adjoining specimen of *Cervus sika*, that, though probably nearly allied to the latter and belonging to the same group of Deer, it is quite distinct specifically. Its larger size and the deep-red colouring of the posterior part of the neck are quite sufficient to distinguish it. With the true form of the horns in *Cervus taëvanus* we are not yet acquainted, owing to our specimen having broken and worn down his horns while in confinement.

But we have to thank Mr. Swinhoe (who is now Vice-Consul in Formosa) for another and most valuable addition to our series of Deer. On April 28th, a specimen of what I suppose Mr. Swinhoe to mean by the "Roe-Deer"† of Formosa arrived, and is now doing well in our Menagerie. It turns out to be a species of the *Rusine* group of Deer, quite distinct from any of the four species of this

* Mr. Blyth says, "Mr. Sclater is wrong in identifying the Japanese and Formosan species" (Journ. As. Soc. Beng. 1861, p. 192, *note*); but he neglects to add that my mistake arose from the incorrect information with which he himself had furnished me.

† Mr. Swinhoe writes to me, "Four if not five Deer are on their way to you. The buck (*C. taëvanus*) left me in high condition; and a lovely animal he was. The doe of the same species sent was with young; and I have some apprehensions about her. The two buck Roe-Deer will, I think, delight the Society, as they must surely be new species. I did not know of their existence till my visit to Taiwanfoo. They are known to the Chinese here as Cheeangs, and are procured by them from the aborigines of the inner hills. The *C. taëvanus*, which is procured from the same savages, is distinguished as the Lok or Stag; and the *Cervulus* as the Kiung. I have seen nothing as yet of the Bear or the Mountain Sheep, said to be found in Formosa; but since my arrival here I have sent a fine pair of Monkeys to my friend in Hong Kong for transmission to the Gardens. They may turn out novelties, and I have no doubt you would like more; so I will try and procure a few more. The Tortoises from Southern Formosa I take to be peculiar, and I have accordingly forwarded you a few; I have also preserved some in spirits." [These Tortoises have arrived, and turn out to be *Emys Bennettii*, Gray.—P. L. S.]

section* we at present possess, and in all probability of a species hitherto unknown, and for which I propose the temporary designation *Cervus Swinhoïi*. It would appear, therefore, that there are four distinct species of Deer inhabiting the coasts of China and Japan, concerning which we require much more information :—

1. *Cervus sika*, Temm. & Sieb. (*Rusa japonica*, Gray), from Japan.

2. *Cervus pseudaxis*, Eyd. & Soul. (Gray, P. Z. S. 1861, p. 236, pl. xxvii.), from Northern China.

3. *Cervus taëvanus*, Blyth (Journ. A. S. B. xxix. p. 90), from Formosa.

4. *Cervus Swinhoïi*, sp. nov., from Formosa.

Our single male specimen of Swinhoe's Deer stands about 2 feet 8 inches in height, and presents the general appearance of a small Deer of the Sambur group (*Rusa*). The head, neck, and fore legs are greyish black, growing more rufescent on the back, and passing on the rump and hind quarters into a deep chestnut. The tail is rather long and very bushy, and composed of grizzly-blackish hairs. The inside of the thighs and belly beneath are fawn-colour, passing on the inside of the legs into pale ochraceous. The animal appears to be in about its second year. The present horns have been injured whilst growing, and are much broken.

On a New Bird from the Isle of Madagascar. By Dr. G. Hartlaub, For. Memb.

Tylas†, n. g. (*Pycnonotinæ*).

Char. Gen.—*Rostrum satis robustum et elongatum, rectiusculum, emarginatum, dimidio apicali compressum, basin versus dilatatum; culmine carinato, subarcuato; naribus apertis, ovalibus; vibrissis rictalibus nonnullis conspicuis, mollibus. Alæ longiusculæ, caudæ dimidium superantes; remige prima subspuria, quarta et quinta longissimis, subæqualibus, tertia breviore, secunda multo breviore. Cauda longa, æqualis. Tarsi breviusculi; pedibus parvis; digitis gracilibus, debilibus, interno vix breviore; unguibus debilibus.*

Tylas Eduardi, sp. nov. *Supra subolivascenti-plumbea; capite toto nigro, nitore chalybeo; cauda dorso concolore; scapis rectricum supra nitide nigris, subtus albis; corpore subtus cum subalaribus et subcaudalibus ochraceo; capitis nigredine circumscripte albido circumdata; rostro nigro; pedibus fuscis.*

Long. tot. circa 8″; rostr. a fr. 9‴, a rict. $11\frac{1}{2}$‴; al. 4″ 5‴; caud. a bas. 3″ 4‴; tars. $9\frac{2}{3}$‴; dig. med. c. ung. 9‴.

We have named this interesting new form after its discoverer, Mr. Edward Newton, a gentleman who has recently visited Mada-

* *Cervus Duvaucelii* et *C. Aristotelis*, ex Ind. cont.; *C. rusa*, ex Malacca; *C. moluccensis*, ex ins. Molucc.

† τυλὰς, "avis quædam ignota turdina."

gascar, and whose zealous efforts have very materially forwarded our knowledge of the ornithology of the East-African Archipelago.

The genus *Tylas* is nearly allied to *Hypsipetes*, but differs in the beak being decidedly stronger, broader, and more inflated; in the longer wings, which in *Hypsipetes* do not reach to the middle of the tail; in the tail being proportionally shorter; and in the rictal bristles being much more developed. The under tail-coverts are very long. The iris is yellow—a colour not found hitherto in the genus *Hypsipetes*. The whole system of coloration is different from that of the latter genus.

MISCELLANEOUS.

Notice of a new Species of Cynopterus *from Morty Island.* By Dr. J. E. Gray, F.R.S.

The British Museum has lately received from Mr. A. R. Wallace two interesting specimens of a fruit-eating Bat from Morty Island, collected in 1861, which appears not yet to have been registered in the Catalogues. I therefore subjoin a short specific description of it. It is easily known from all the other species by the extraordinary length of its tail; indeed, it seems to form a section or subgenus apart, that may be called *Uronycteris*.

Cynopterus (Uronycteris) albiventer.

Tail elongate and free, produced beyond the narrow interfemoral membrane. Nostrils much produced, tubular, and far apart. Brown above, with greyer base to the hairs. Face and throat only slightly hairy, grey; side of the neck and breast yellow-brown; side of the body brown; chest and middle of the belly white; the wing brown.

Hab. Morty Island.

The length of the fore-arm 2 inches; length of tail (dry) nearly $\frac{3}{4}$ inch.

The wing-bone on the upper surface of the wings of both specimens is marked with some irregular white spots; these may be only accidentally or even artificially produced in the process of preservation, or by carriage, as the spots on the two sides of the same wing are unlike, and those of the two specimens dissimilar.

On the Larvæ of Hypoderma. By F. Brauer.

In August 1860, the author communicated to the Zoological and Botanical Society of Vienna some observations on the change of skin in the larvæ of *Hypoderma*. He now calls attention to the agreement of his observations with those published by Leuckart on the larvæ of the *Muscidæ*, which is especially important, as the investigations were quite independent of each other.

In the *Œstridæ* change of skin was said to take place by Neuman and Joly; but neither of these authors had witnessed this phenomenon, the occurrence of which they were led to suppose by observing the difference between young and adult larvæ of *Gastrus*.

The investigation of the cause of this change increases the interest attaching to the observations. In a larva living in the same way from its exclusion from the egg to its change to the pupa state, such a cause can hardly be discovered; but it is otherwise with the larvæ of the *Œstridæ*, which must wander to the place where they can attain maturity. In this respect the *Œstridæ* are divisible into two groups, the egg-laying and larviparous forms. To the former belong *Gastrus* and *Hypoderma*; to the latter, *Cephalomyia* and *Cephenomyia*. In the former genera, the larva has to get into the stomach or under the skin, as the eggs are deposited by the imago upon hairs. In *Cephalomyia* and *Cephenomyia* the female injects the maggots into the nose of the animal on which they are parasitic. The greatest difference between the young and adult larvæ occurs in those which have the greatest migration to perform,—consequently in the larvæ of *Gastrus* and *Hypoderma*.

The author's observations were made on numerous larvæ of *Hypoderma Diana*, n. sp., from the skin of the Roe.

First stage (duration unknown, but probably very long, as the fly appears only for a few days in May, and the larvæ are found in this stage in the following February. The end of January and beginning of February may be regarded as the period of transition to the second stage).—In this stage the larva grows to a length of $6\frac{1}{2}$ lines, but remains nearly cylindrical and scarcely 1 line in diameter. Anterior extremity rounded off; posterior extremity like the anterior, or the last three segments attenuated into a tail, at the pleasure of the larva. Buccal organs very small. Buccal orifice funnel-shaped; above it projects a straight spike, which rests upon a transverse chitinous piece concealed in the œsophagus, from which on each side a chitinous arch proceeds backwards and terminates in a shovel-like plate, as in almost all larvæ of flies. The shovel-like plates are on each side of the œsophagus, and their faces are vertical.

Close to the first-mentioned spike are two hooks (one on each side); these are bent at right angles, and their free ends are directed outwards and downwards. They can be moved so as to form a single point with the median spike; if then their points are bent outwards and backwards, it is clear that the larva will push itself forward, and readily bore into any object opposed to it. The anterior stigmata are pretty large; they are on the sides of the upper part of the second segment; they are round, and bordered on the inner margin by a semilunar chitinous band. Posterior stigmata forming two small, irregular, porous, chitinous plates. Round the stigmata the last segment bears numerous small, round chitinous plates, which give it a punctured appearance. The larva has eleven segments, and appears naked; there are some microscopic spines only in the funnel-shaped pit of the mouth and on the margin of the lower lip.

Second stage (duration very short, at the utmost one month. This form appears from the end of January to the middle of February, usually together with the first and third forms).—Larva at first shorter than in the first stage, but broader. It grows from 5 to 7 lines long, and is easily recognized by the black spots on the lower surface, which consist of dense groups of black spines. Above, the larva is quite naked, with the exception of the first three segments. Mouth forming a V-shaped pit; its margins bordered laterally and below by rough, thick chitinous bands, which are firmly united below, and internally spread out into the above-mentioned chitinous plates and numerous filaments embracing the œsophagus. Spike and hooks wanting. No anterior stigmata observed. Posterior stigmata reni-from, forming a very coarsely cellular plate on each side. Form of the larva very changeable; the posterior end is very often much attenuated, like a tail.

Third stage (duration from February to April).—Mouth a funnel-shaped pit with membranous margins; in the pit a small horny ring, immediately followed by the œsophagus, which directly afterwards passes over a chitinous frame from which the chitinous shovel-like plates issue. Above the buccal pit there are two horny rings, as rudimentary antennæ. Anterior stigmata very small, on the hinder margin of the first segment. Posterior stigmata reniform, nearly smooth, flat, radiately furrowed.

From this it follows that the young larvæ can bore their way into the skin, and subsequently undergo a retrograde metamorphosis of their buccal organs. The author remarks upon the fact that thus organs of so much importance as the parts of the mouth may lose their significance in a systematic point of view. A more detailed account of his observations is promised in a forthcoming monograph of the *Œstridæ.—Wiegmann's Archiv,* 1862, p. 210.

The King Crab (Limulus Polyphemus) *found on the English Coast.* By Dr. J. E. Gray, F.R.S. &c.

The King Crab has lately been frequently imported into Liverpool, and is shown alive at the Free Museum of that town, and also in the Zoological Gardens in the Regent's Park.

Mr. Walker, the Arctic traveller, lately took a living specimen with him to Paris, with the idea of presenting it to the Jardin des Plantes; but he failed in doing so through the absence of the Professors to whom he had an introduction. Being tired of the charge of the animal, and of providing it with fresh sea-water, &c., he threw it overboard, between Boulogne and Dover, on his way back.

The animal must have been washed ashore at Dover; for I have had more than one account of its having been found on that coast, and one kind correspondent offered to secure it for the British Museum at the price of five pounds.

It is as well that this should be recorded; for otherwise it may at some future day, when the circumstance of its having been thrown into the water is forgotten, be placed in the fauna as a rare or occasional visitor, instead of being artificially introduced.

Notice of a new Species of Bosh-Buck (Cephalophus bicolor) *from Natal.* By Dr. J. E. Gray, F.R.S. &c.

Mr. W. Fosbrook has kindly presented to the British Museum a beautiful small species of Bush-Bock, which was captured by John Dunn, Esq., in the Umgozy Forest, between the river Umbelaus and Umblatore, in the country of the Amazula. The natives have no name for it, as far as Mr. Dunn could learn. It is a most peculiarly marked species, and of very small size; when it died, the mammæ were found dilated with milk, showing that it was of adult age. The hunters mistook it for a young animal, and fed it with milk, on which it died.

Cephalophus bicolor.

Brown; the rump, the whole of the hind legs, the chin, throat, chest, belly, inner side of the fore legs, a broad ring over the front hoofs, and a large spot occupying the front of the face and forehead pure white. The ears blackish, white within. The sides of the forehead darkish brown. The crumen on the side of the face linear, well marked. Horns none in the female sex.

Hab. Natal.

The smallest species of the genus, not weighing more than 3 lbs. It is most like *C. Whitfieldii,* of the Gambia; but the brown is of a different shade, and there is no white, which is so prominent in the Natal animal.

On the Natural and Artificial Production of Cork in the Cork-oak. By M. Casimir de Candolle.

This paper is interesting as being the first botanical publication of the inheritor of this honoured name in the third generation of botanists, and as an account of the formation and structure of cork in the Cork-oak, both in the natural state and especially under the operation which has to be practised in order to the production of cork of any commercial value. The operation consists in the removal from the trunk of the natural corky layer of the bark down to the subjacent cellular envelope or green layer, which is done in Algeria (where young DeCandolle's observations were made) during the summer or autumn. Shortly after this operation, a new corky stratum begins to form in the green layer, at a variable distance from its denuded surface. This grows by annual layers upon its internal face, just as the original and worthless corky layer did; but this is much finer and much more elastic, and is the commercial article. When this valuable cork has attained sufficient thickness (ordinarily after seven or eight years), it also is removed, with the same result as before; *i. e.* still another new corky stratum is formed below; and so successive crops may be taken off the trunk every seventh or eighth year for a long while, or even indefinitely.—Abstract in Silliman's *Journal* for Sept. 1862 from the *Mém. de la Soc. de Phys. et d'Hist. Nat. de Genève,* vol. xvi. 1860.

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XLII.—*On the Phenomena of Motion in the Pseudopodia of the* Rhizopoda, *and especially on the so-called Granular Movement and the supposed Coalescence of the Pseudopodia.* By Prof. REICHERT*.

[IN the introductory portion of this paper, Prof. Reichert endeavours to controvert what he calls the "sarcode-theory," under which he sees a revival of the old notion of a living primordial slime capable of being produced in some mysterious manner independently of preexisting organisms. As we cannot see that the idea of the nature of "sarcode" generally entertained involves any such opinions as to its origin, this part of the author's paper has been omitted, and the translation commences with his discussion of the motile phenomena presented by the pseudopodia.]

Whilst Ehrenberg, in his investigations of living Polythalamia from the North Sea, declares himself expressly against the coalescence of the filaments emitted by them†, Schultze, in his work 'Ueber den Organismus der Polythalamien' (Leipzig, 1854), places himself entirely on Dujardin's side; and to this view the cell-membrane could not but fall a sacrifice afterwards. According to him, the body of the Polythalamia consists of a formless substance, comparable, as to its consistence, with fluid wax, containing globules imbedded in it here and there. The phenomena of motion in the pseudopodia are described by this author essentially in accordance with Dujardin, but rather more accurately, both with regard to their branching and coalescence and in respect of the so-called granular movement in and upon them. Of the granular movement Schultze speaks as follows:—

* Monatsbericht der Akademie der Wissenschaften zu Berlin, 1862, p. 406. Translated by W. S. Dallas, F.L.S.

† Abhandl. der Akad. der Wiss. zu Berlin, 1839, p. 106.

"A distinction of membrane and contents does not exist in the filaments (p. 17); observation is against an interior channeled structure in which the larger globules are moved; but the regular flowing to and fro of the contractile substance effects the movement of the granules, and the latter, again, inform us of the movements of contraction. The small granules moreover move with the substance flowing out of the general mass of the body *into* the filaments themselves; the larger ones, on the contrary, appear as corpuscles moving *on* the filaments. The coalescence of two or more filaments, the passage of the granules from one into the others united with it, must also remove all doubts raised as to the nature of the substance of the body of the Polythalamia being such as was assumed by Dujardin."

Soon afterwards a parallel was set up between the supposed granular movements in the pseudopodia of the Polythalamia and the currents in the cells of plants, by Unger and Cohn, and thus the bridge was made by which the theory of the protoplasmic mass was enabled to make good its entry into science.

According to J. Müller, the granular movement in the Polythalamia exactly resembles those in the extended filaments of the Thalassicollæ, Polycystina, and Acanthometræ*. In his description of the phenomena of motion in the filaments of the *Sphærozoa* (p. 7) there is an observation on elongated swellings passing along these filaments like granules, to which I must hereafter refer particularly.

During my residence at Trieste last year, my most ardent desire to become more exactly acquainted, from personal observation, with the phenomena of motion in the pseudopodia of the Polythalamia, which have led to such different views upon the organization of animals, was fulfilled. The sea-mud with the living Polythalamia was procured from the basins which have been shut off in the neighbourhood of Zaole for the manufacture of sea-salt. In this there were a species of *Miliola* and one of *Rotalia* which I did not more particularly determine. The animals were examined under magnifying powers of 300, 500, and 700 diameters.

The first impression made upon me by the phenomena of motion in the pseudopodia was of such a nature as fully to support the descriptions of Dujardin and Max Schultze: it was as if one had to do with a fluid substance readily changing its configuration and course with a constant flow and return of particles. But any one observing the astonishing spectacle, which appears so wonderful from its opposition to evident facts in the organization of animals, without reposing a blind con-

* Abhandl. der Akad. der Wiss. zu Berlin, 1858, p. 2.

fidence in the correctness of the dogmas of the theory of primordial slime, sarcode, or protoplasm, must admit, after some consideration, that the picture of a fluid and flowing mass may also very easily be produced in separated and not fluid, but solid or semisolid (*festweichen*) masses whenever two conditions are fulfilled :—1, when the surface of such bodies brings an alternate, more or less regular play of elevations before us in such a manner that we are led to conceive a motion like that of waves in water ; and 2, when bodies really separate, but not distinguishable as such at their mutual points of contact, are constantly changing their relative position, and under these circumstances present themselves as a mass varying at pleasure in form and limits, and possessing properties appertaining to fluid substances. From the point of view which I am convinced is to be maintained, if not alone, still especially, in regard to organisms, the impression made by the phenomena of motion in the pseudopodia becomes essentially different; the lustre of the dogmas respecting the sarcode-theory is very soon lost, and the heresy then becomes clear and unmistakeable.

In order, however, to avoid being misled by the deceptive image, it is necessary in this, as in other cases, to take up the microscopic analysis of the individual filaments, and at first to disregard as much as possible their proteus-like complicated mass. According to my observations upon *the nature of the individual filaments*, the following statements may be made :—

The pseudopodia, which, when fully extended, measure six or eight times the greatest diameter of the body, form at their free extremities (where they may with the greatest certainty be found simple and single), extraordinarily fine filaments, even under the highest powers of the microscope. To give some notion of their fineness the observation will suffice, that a perceptible thickening scarcely appears when two or three filaments come together and apparently fuse into one, or when the magnifying power of the instrument is raised from 450 to 700 diameters. For the same reason nothing definite can be said as to whether they are, as they appear to be, perfectly cylindrical or more or less flattened. They appear to be everywhere of uniform thickness. Apparent or real local thickenings occur in consequence of movements of contraction, to which I must revert hereafter; I must likewise defer the discussion of the question whether, besides decidedly simple filaments, branched ones occur, issuing from the former by movements of contraction. The individual extended filaments consist of an apparently colourless, transparent, hyaline substance, which at the extreme ends, where they may most readily be observed singly, possesses an index of refraction differing very little from that of the surrounding fluid (sea-water); it is only with the greatest effort and the most favourable light that the extreme ends of the filaments can be traced. Where many pseudopodia lie together, the outlines become sharper and at the same time darker, and, in the animals examined by me, a yellowish coloration makes its appearance. If we leave out of consideration the apparent granules occurring in the so-called granular movement, no globules or corpuscles of measurable size were detected at any time or in any place in or on the pseudopodia. Thicker bundles, engaged either in expansion or contraction, have usually a finely granulated appearance. It cannot, however, be ascertained by direct observation whether this is produced by fine wrinklings and inequalities of the surface, or by fine granules imbedded in the apparently hyaline mass. In the lamellæ and structures like swimming membranes formed by the apparent coalescence of the filaments, a granular habitus is also not unfrequently visible. These granules, however, belong either to the so-called granular movement, or it still remains uncertain whether we have to do with a true granule or with a portion of the filament only altered in its form, and resembling a granule. As the granular marking is always lost immediately when the filaments lie quietly in the extended state, or the granular plates and lamellæ again break up into quiescent extended filaments, it must be inferred that the granular marking is only apparent, and produced by alterations of form in the hyaline filaments.

As regards the important question of the state of cohesion and consistence of the substance of the pseudopodia, direct experiments for the solution of this cannot be instituted. We are therefore compelled to draw conclusions upon the above-mentioned physical property from the behaviour of the filaments during active and passive movements, and during their approximation and separation. Here, in the first place, the fact must be proved that, however the filaments may change their form, bend, twist, apparently coalesce, and again separate, their *original form is finally preserved under all civcumstances,* and undergoes no change. From this it follows that their substance cannot be fluid. Moreover, if we will not blindly trust in the dogmas of the various primordial-slime theories, adopt the erroneous theory of the so-called granular movement, and accept the apparent coalescence of the filaments as a real one without further examination, we shall be compelled, in the presence of the facts adduced, to declare the comparison with fluid wax or with a mucus of similar consistence to be quite untenable. But, from the behaviour of the filaments during changes of their form by active and passive movements, it may with certainty be inferred that their substance must be extraordinarily soft and flexible. I may here indicate especially that the quiescent filaments allow themselves to be readily curved into any form by others which are moving, and then remain in this form until they are brought out of it by their own movements or those of other filaments.

During the mutual displacements of the filaments, and the mutual approximation thereby often produced, another remarkable property shows itself,—namely, their ready adhesion to each other. In consequence of this ready adhesion, it happens that the filaments very commonly issue from the shell in larger or smaller bundles, and only subsequently separate. It is also frequently observed that a filament which has, in consequence of its own movement, got under others and then become quiescent, clings to other moving filaments during their passage, and is carried forward passively with them, not unfrequently like an anastomosis between them.

Phenomena of active Movement in the individual Pseudopodia of the Polythalamia.

To the phenomena of active movement in the pseudopodia of the Polythalamia I refer—

1. The issuing of the filaments from the shell, their extension and retraction.

   If the filamentous pseudopodia, which are originally morphologically simple, could actually become converted into branched forms, and the latter again revert to the original form, this change of form must also have belonged to the category of active movements; but these changes of form, as I shall afterwards prove, are either only apparent or not capable of being established with certainty.
2. A tortuous or vermiform movement, usually somewhat sluggish, of the more or less extended filament, either throughout its whole length or in some section of it.
3. The phenomenon described under the name of "granular movement."
4. A mutual displacement of the filaments, often occurring imperceptibly, by their closer approximation or removal to a greater distance, or also by their separation from a bundle in the general radiary complex, under circumstances which do not allow the detection of the active movements of other filaments as co-operating causes. To the changes in the arrangement and form of the total radiary complex of filaments I would not refer more particularly. In these changes, both active movements of the filaments and passive ones caused by their ready adhesion to each other, participate; and it is often quite impossible to calculate exactly the part taken by each kind of

movement. Nevertheless other observers, especially J. Müller, have indicated the imperceptible mutual displacement of the filaments as a phenomenon of active movement; and the fact must be admitted that such displacements of the filaments do occur, in which neither the other active movements of the filaments themselves nor any causes of motion in the surrounding fluid are perceptible. It is exceedingly probable that the causes lie in active movements which occur concealed within the shell at the base of the filaments.

It will be sufficient to indicate preliminarily that the phenomena of movement referred to, and indeed, as will immediately appear, also the so-called granular movement, are only to be regarded as the visible effects of those changes in the substance of the filaments which are produced by the so-called contractility. Of these changes in the material no trace can be detected by the microscope either here, under apparently very favourable circumstances, or in any other contractile substances; we find ourselves rather only in a position to infer the existence of those invisible movements which occur in the contractile substance itself from the effects produced by them (which become an expression visible to us) in the change of form of contractile structures or in changes of the relative positions of the organs participating in them. The supporters of the sarcode-theory have certainly gone a step further by the manner in which they conceived the granular movement. To them the apparent granule is a portion of body-substance containing globules, which flows out of the shell into the extended filament, and again flows back, thus elongating and shortening the filament, or causing the appearance of lamellæ and islands in the radiary complex of filaments by the local accumulation of sarcode. In sarcode, therefore, we should succeed in seeing what has hitherto been denied to us in other contractile structures. Contraction would thus consist in a movement of the mass of the contractile substance, in a transfer of it from one place to another far distant, and the changes of form in contractile structures occur as a consequence of this. In this way it becomes intelligible how the notion could arise of identifying the currents of fluid in cells with the currents of contraction in the pseudopodia. As it may be demonstrated that the granular movement is not produced by the flowing to and fro of portions of the body-substance of the Polythalamia containing globules, I am saved the trouble of entering more particularly into the further consequences of this conception of the contractile movements of the supposed fluid sarcode and its application to other contractile structures.

The so-called Granular Movement.

With regard to the appearances hitherto known under which the granular movement occurs, I must here give the following indications. Dujardin speaks only of an ebb and flow of body-substance containing globules, in consequence of which the filaments appear uneven and granular. Max Schultze, however, represents the ebbing and flowing mass as advancing partly in, but especially on, the filaments as an apparent granule which contains the larger globules. J. Müller indicates that an internal granular movement, like that in the rays of *Actinophrys*, does not occur in the pseudopodia—that here the granular movement rather resembles a granule advancing on the surface of the filament; and he adds the observation that mucous globules and foreign bodies are also moved to and fro by the granules. In his memoir (p. 7) we also find the following remarkable passage:—"Not unfrequently the filaments are seen to be thickened or swelled here and there, and this elongated swelling (little knot) is seen to advance upon the rays like the granules, which may be referred either to a progressive contraction or to elongation and shortening, but is perhaps connected with the granular current." These words are only thrown out doubtfully, and are not again referred to on other occasions when the movements of the pseudopodia are spoken of; nevertheless they contain an observation which, by further investigation of the phenomena, must have led J. Müller to the same conception of the granular movement as that which I have arrived at by my investigations.

The animal in which I first observed the granular movements exhibited them only on particular filaments, and there were even moments in which the visible extended pseudopodia were quite quiescent. The granular movement appeared to be, as described by Max Schultze and J. Müller, an apparent grain or granule moving to and fro on the surface of the filament. I must add, however, that the movement of the granule was not uniform, but that it appeared to jump forward over the surface, or, at least, showed a tremulous movement. But it struck me as very remarkable that, notwithstanding numerous supposed affluxes of granules, and although it is common enough to see that the quiescent granule at the extremity of the filaments does not return, not a single perceptible quiescent globule could be detected in the entire field of vision, either in the surrounding fluid or in or on the substance of the rays themselves. And yet the sarcode-substance flowing out of the body to the rays should contain globules, and the larger globules should not only effect the protrusion of the flowing mass above the level of the filament, but also cause the optical expression of the granular movement. Therefore body-substance with globules could not have flowed to the rays: the fallacy was evident.

The question now was to trace accurately the apparent grain, the true form of which could not be judged of during motion, at the moment of its formation and disappearance. For this there are plenty of opportunities. The shell certainly prevents the observation of many granules; we cannot say how the apparent granules are produced and lose themselves there; but we cannot assert that they there flow out of or into the substance of the body of the animal. With some attention, however, it is very soon discovered that both the centripetal and centrifugal movement of the granule may commence and terminate at any part of the extended filaments outside the shell. Here the following observations may be made during the appearance of the granule, which has hitherto been considered only in motion. On any spot of the hyaline extended filament, there appears suddenly an apparent thickening of fusiform outline, of somewhat yellowish colour and dark contour; the apices of the spindle lose themselves quite imperceptibly in the neighbouring parts of the filament which have remained unaltered. Soon afterwards it appears as if the spindle became shorter, but thicker and darker in the middle, where it projects more beyond the level of the filament; finally, the extremities of the apparently fusiform thickening disappear from the view, and the elevated central part jumps along upon the surface of the filament in the likeness of a granule. On the cessation of the movement, the granule disappears in exactly the same manner, but in a reversed order.

Any one who has traced the gradual production and cessation of the granular movement will assuredly give up the notion of a truly flowing substance in the pseudopodia—a notion which has been derived from an erroneous transference of the phenomena of contraction visible in the *Amœbæ* to the pseudopodia of the Polythalamia. In these we have evidently extended contractile organs of the Polythalamion, in which no cavity and no true granule, either in or upon it, is to be detected; and the phenomena described in connexion with the granular movement therefore require that the latter, as already hinted at by J. Müller, should be interpreted as a phenomenon of contraction. Our knowledge of visible phenomena of contraction is limited, as already mentioned, to the changes of form occurring in the contractile organs in consequence of invisible movements in the contractile substance itself; and even in this respect the scanty observations upon their structure and texture still leave much to be desired. In the present case, only the contraction-wave which occurs and advances upon the filiform contractile organ, in the form either of a local thickening or of a local curvature and loop-formation, can be referred to.

The first question is, whether the described microscopic appearances suit with the assumption that the contraction-wave is caused by local thickening of the filament suddenly occurring at any point and then advancing further: the apparent granule in the so-called granular movement would then have to be regarded as the thickened point. From a deficiency of observations, nothing can be said as to whether the apparent fusiform thickening of the filament must necessarily precede the formation of a knot-like or grain-like swelling and agrees with the preliminary assumption in regard to the contraction-wave. But it may be affirmed that an advancing knot-like thickening of the filament could not produce the microscopic appearance actually seen—as if a granule advanced by jerks upon the surface. Nor could the microscopical picture be produced even if the local swelling of the filament on all sides were of considerable elevation, forming, as in the case of *Astasia flavicans* observed by Ehrenberg, a circular disk, through the central point of which the unchanged portion of the filament seemed to pass; for, during the progress of such a swelling, the microscopic appearance would be as if a ring were drawn along the filament. There is only one case in which, in my opinion, the contraction-wave in the form of an advancing local thickening could correspond with the microscopic appearances described: the thickening must occur on one side, and in the form of a clubbed process or appendage of the pseudopodium; the club-shaped end would then, as it advanced along the pseudopodium, be especially visible and indeed as an apparent grain, seeming to move along on the surface of the filament. No such contraction-form has, however, hitherto been observed; and its assumption seems to me rather bold.

On the contrary, the granular movement seems to be easily intelligible, and at the same time in perfect accordance with other contraction-forms, both in its occurrence and disappearance and in its progress, if we imagine that the contraction-wave is formed by a loop advancing along the filament, produced in consequence of contractile movements of the substance invisible to us. With this supposition the microscopic appearances during the production and, in reversed order, during the cessation of the granular movement especially correspond; the loop, when just rising, will be seen at first as an elongated swelling, afterwards becoming thicker in the middle, and projecting beyond the level of the filament. The elevated loop will also, in consequence of the refraction of the vertex of the curve, present exactly the appearance of a granule, or roundish or oval corpuscle, lying upon the filament, as is very frequently the case in transverse folds of smooth muscular fibres. Thus it is clear that the loop, when in motion, must appear as a granule progressing on the surface of the filament, and, lastly, that it must present the microscopic image of a jerking granule, as it may be presupposed that the loop, in its continual new formation and disappearance, will not always retain the same elevation, and this will cause the appearance of a vacillation of the vertex of the curve or of the apparent granule.

On the apparent Amalgamation and Coalescence of the Pseudopodia.

Of the phenomena which, it was supposed, justified the conclusion that two pseudopodia of the Polythalamia coalesced on touching, the granular movement has already been discussed and its validity disproved. The other evidence adduced may be referred, 1st, to the absence of visible lines of separation during the immediate contact of two actually or apparently simple pseudopodia; and 2nd, to the variability of the configuration of the entire extended radiating complex of filaments under appearances which it was supposed were only possible by an actual coalescence of the filaments. This must be seen, says Dujardin, to remove all doubt that we have to do with a fluid substance, with a true coalescence of the contractile organs.

In order to estimate correctly the value of this evidence and obtain an unprejudiced notion of the changes of form in the whole system of filaments, the behaviour of two (in most cases only apparently) simple pseudopodia must be studied under different circumstances. Two such filaments lying beside each other longitudinally, or crossing each from any cause, exhibit no line of separation at their point of contact: this is what is directly observed. Does it follow from this that the parts in contact have coalesced? Certainly not. Every microscopist is aware that under certain circumstances two decidedly solid parts, such as cells or fibres, may lie together so that the line of separation is not perceived. Some time since, I observed innumerable *Amœbæ* enclosed in an egg-membrane of *Tichogonia*. Some of them, when flattened, came close together, and at this moment all visible line of separation was wanting; afterwards their bodies became cylindrical, and then a line of separation made its appearance at their point of contact. Is it at all remarkable that the line of separation between two contiguous pseudopodia is not seen, when their outlines are so faintly marked, and they possess an index of refraction differing so little from that of water?

The following observations may be made upon two filaments applied to each other entirely or partially in the direction of their length. The united filaments, except when very thick bundles come together, do not appear thicker than the separate ones; if one of the filaments be shorter than the other, the point at which it terminates is not perceived. From this it follows, as already observed, that we can never say with certainty that any filament is simple. Further, the united filaments, in consequence of active movement in one or both of them, may separate again partly or entirely. By this means an orifice may occur in the united filaments, which closes again in a state of repose; or only the apex of one filament separates from the other, and the united, apparently simple, filament then possesses a branch, and appears branched. My attention having been attracted to this, I could not but ask myself the question, whether the ramifications are not throughout only apparent. From my investigations, this question must be answered in the affirmative. I have met with no case of ramification which could not have been explained in the most natural manner by the protrusion of the extremities of filaments from an apparently simple pseudopodium; nay, the usually sudden shooting forth of such branches is not in favour of their production being effected by movements of contraction.

In two filaments crossing each other at an acute angle, an appearance is observable upon which, as a proof of the coalescence of the pseudopodia, great stress has been laid, especially by Dujardin; the angle is very frequently seen to be occupied by a web-like structure. When the angle is very acute, and the appearance not much diffused, the suspicion that there is some optical illusion cannot be altogether got rid of; in other cases it is seen quite distinctly that the angle formed by the two filaments is occupied by a hyaline or generally finely granular substance. The comparison with a swimming membrane is, however, not quite suitable; for no filament is to be distinguished on the margins or in the region of the apparently membranous structure. From the microscopic appearance, it might equally well be said to be a triangular plate from the angles of which filaments issue.

I will not deny that such a web-like structure may be produced by the overflow of the mass of two fluid filaments approaching each other at an acute angle. But in the present case, taking into consideration our previous knowledge of the morphological conditions of the organization of animals, in order to show that they make their appearance by such a mode of production it must first of all be proved that the filaments consist of a fluid substance; or, if the web-like plate itself is to serve as evidence of the fluid consistence of the pseudopodia, it would have to be shown that their production can be imagined only by truly fluid substances, and not by means of semisolid filaments of the nature described by me.

In vain we seek, in the works of Dujardin, Max Schultze, and other adherents of the sarcode-theory, for any such scientific treatment of the problem before them. The granular movement is at once explained as the optical expression of the ebbing and flowing body-substance; there is no hesitation about inferring from the uniting of the filaments into bundles, without lines of separation, that they coalesce; and when once the notion of the slimy consistence of the sarcode was entertained, the formation of the apparently membranous plates only furnished a fresh proof of the preconceived opinion. The confusion of the observers is so great that it never seems to have been thought worth while to notice the behaviour of the apparently membranous plates during their disappearance, or the movements of the pseudopodia, and thus to raise the question whether the appearances here seen could be brought into accordance with the view set up. Thus, the plate supposed to be fluid and formed by a fresh accession of body-substance disappears without a trace of residuum on the separation of the united filaments; nay, further, the two crossed filaments are seen to be pushed continually to and fro, still retaining their original form, with as much facility as if there existed no such membrane, *i. e.* a spot in their course at which the filamentous structure ceases and in its place a fluid plate is introduced.

On the other hand, in the apparently membranous plates, phenomena are observed from which, according to the above statements regarding the granular movement, we must necessarily infer the presence of filaments in the plates, and consequently the composition of the latter out of filaments. It is well known that the granular movement is perceptible in the apparently membranous plates. The apparent granules are seen to pass from the proximal end of the filament in more or less curved lines through the plates to the peripheral end of the same filament, or *vice versâ*; the granule is also seen to run in a straight or curved line from one filament to the other. And it is further observed that, during the separation of the two contiguous filaments from the webs which as it were distort them, filaments quite distinctly separate and become free. I remember one case in which a filament even separated from the free margin of the membrane, subsequently presented itself as a branch of one of the filaments, and finally became perfectly free as a third filament. Hence we may, or rather must, conceive that the apparently membranous webs and plates are produced in this way: in the pseudopodia, or rather bundles of pseudopodia, which approach each other and cross at an acute angle, some of the filaments are moved out of their place, and pushed together into the angle so as to form an apparent plate. The extraordinary flexibility of these filaments, and their great tendency to adhere to each other, are properties which evidently assist in the formation of such membranes and plates.

It is evident that the conditions for the displacement of the simple filaments contained in two approximated pseudopodia so as apparently to form membranous plates are not limited to the crossing of such pseudopodia under an acute angle: two bundles of pseudopodia merely touching each other with the vertices of their curves, and then again separating a little, will also give rise to the appearance of seemingly membranous plates; and a case has even occurred to me in which an apparently membranous bridge-like union was formed at the spot where the separation of two pseudopodia issuing from one bundle had not quite been completed.

After these explanations, I believe there will not be the least difficulty in the comprehension of the multifarious changes of form in the whole radiary complex of pseudopodia, in which, by local contraction in any section, however small, of each filament, innumerable moving particles may be represented. When the animal extends its pseudopodia, the more simple radiate arrangement predominates; soon afterwards the apparent ramifications commence, and become constantly more numerous. The branches, after issuing or being set free, easily reach neighbouring filaments, apply themselves to these, and then appear as anastomoses. By the multiplication of such apparent anastomoses, those reticulated figures are produced which are known under the name of the sarcode-net. At the same time, when the conditions are favourable, numerous membrane-like structures and bridge-like unions between the filaments become visible. These are more widely stretched the more numerous the filaments or the thicker the bundles which touch each other at the part implicated, and, by the imperceptible displacement of the finer filaments contained in them, furnish a more abundant material for the formation of the apparently membranous plates. The causes of the alterations of form in the general radiary system of the pseudopodia are to be sought chiefly in their movements, either active or passive—*i. e.* produced by the ready adhesion of the filaments to each other; by these are effected the displacements of the innumerable particles in the general radiary system, which are often imperceptible, and limited to the very smallest space. Favourable conditions for the multiplicity of forms, and for their ready and often imperceptible change, are also furnished by the extraordinary number of the filaments and their ready flexibility.

Finally, the appearance produced by these readily moveable and extraordinarily flexible parts in the protean system of filaments, as if a moving fluid substance assumed any form, or spread and poured itself into any shape, is an illusion which is set up especially by the circumstance that individual minute parts which are readily displaceable throughout can never be distinguished at their points of contact.

XLIII.—*Description of a singular Shell from Southern India, allied to* Tanalia; *with Remarks on a Travancore* Batissa, *and on the Himalayan Form* Tricula. By W. H. Benson, Esq.

Tanalia(?) *Stomatodon*, Bens., n. sp.

T. testa ovato-globosa, solida, læviuscula (juniorum polita), striis spiralibus obsoletis induta, olivaceo-nigrescente; spira brevi erosa, sutura impressa; anfractibus 3 superstitibus, superioribus convexiusculis, ultimo convexo; apertura ovato-acuta, albida, intus demum angustiore, sinuata; peristomate integro, margine dextro basalique acuto, columellari late calloso, infra latiore, subito intus truncato, dente prominente crasso munito.

Axis 14, lat. 12 mill.

Habitat in aquis dulcibus montium prope Cottyam, regionis Travancoriæ. Invenit D. Kohlhoff.

This very interesting shell was sent to me by Capt. Charles Annesley Benson, at whose request the discoverer had kindly searched the Travancore Hills behind Trevandrum for land and freshwater shells. Among the former was a specimen of *Helix Basileus*, Bens., larger than the type-specimen described in the Annals of Natural History for February 1861.

Tanalia (?) Stomatodon.

The form now made known is a very distinct species of the Paludomoid type; and should it prove to be a *Tanalia*, as surmised by Mr. H. F. Blanford, who has carefully studied the family, it will stand as the first of the genus which has occurred out of Ceylon. Unfortunately, all the specimens were deficient in the operculum, which, when examined, may possibly authorize its transfer to a new genus, in which case the specific name may fairly be employed to designate it. In my remarks on *Clea Annesleyi*, from Quilon, in the Ann. Nat. Hist. for October 1860, I observed that, notwithstanding the basal emargination, *Clea*, with reference to its unguiculate operculum, would probably be found to have nearer relations with the Cingalese genus *Tanalia* than with *Melania* and its congeners. *Stomatodon* seems partly to supply one of the absent links, inasmuch as its operculum must necessarily be provided with a basal projection, while its construction is also likely to be unguiculate. There is some resemblance in this shell to *Neritina*, for which genus a specimen might, on a cursory glance, be taken. The upper part of the columellar callosity exhibits in some specimens a blackish-brown tint, and a patch of the same colour may occasionally be observed at the base, in the interior of the aperture, the throat of which is tinged with violet and purple and presents a minutely corrugate surface.

Since the publication of *Corbicula Quilonica*, Bens., in the Ann. Nat. Hist. for October 1860, where it was described from young specimens, I have received from Capt. C. A. Benson a single large and solid example, found at the same place. It belongs to Gray's *Batissa*, a genus intermediate between *Corbicula* and *Cyrena*. The shortness of the serrulate lateral teeth was recorded in the Latin characters, and alluded to, as well as their comparative brevity on the anterior side, in the subsequent remarks as worthy of notice. The continent of India had not previously furnished any examples of *Batissa*, of which some fine species inhabit the Eastern Archipelago.

The following are the dimensions of the adult shell:—

Long. 21, lat. 34, diam. 15 mill.

In the original description of the young, the breadth was by mistake stated as 10 instead of 8 mill., and the length as 8 mill. instead of 10.

I am informed that the conchological writer, M. Brot, has, in his Catalogue of Melaniadæ (a copy of which has not yet come under my inspection), referred my minute Melaniadous *Tricula*, from the Himalaya, to the genus *Paludina*. M. Brot can scarcely have examined the subspiral operculum of the shell, or consulted the original description published in M'Clelland's 'Calcutta Journal of Natural History' for 1842; otherwise he would not have overlooked the differences presented by such an operculum from the concentric laminations of that of *Paludina*, the animal of which differs altogether from that of the mountain form, which nearly approaches that of *Melania*; while the shell of *Tricula* bears the same relation to *Melania* as that observable in the Egyptian and Syrian *Paludomus bulimoides*, Olivier, when compared with the more Eastern forms of the genus. *Tricula* occurred at an altitude of 4000 feet. It may now possibly inhabit the plains, as I placed living specimens in a pond at Moradabad.

I add an extract from the paper in the Calcutta Journal:—

"Subgenus Tricula.

"Testæ spira elongatiuscula; apertura obliqua, ovata, integra, superne angulata; peristomate continuo, subreflexo; anfractu ultimo subumbilicato.

"Animal *Melaniæ* simile, proboscide elongata, antice emarginata; tentaculis filiformibus duobus oculos postice prope basin gerentibus; pede mediocri ovato, antice subquadrato. Operculo corneo subspirali.

"*T. montana.*

"*T.* testa olivacea, ovato-conica; anfractibus sex, rotundatis, suturis impressis; apertura intus albida; peristomate nigrescente; apice obtuso, plerumque decollato.

"Hab. in rivo, apud lacum Kemaonensem Bhimtâl dictum.

"This little shell I first found adhering to the prone surface of a leaf of *Potamogeton,* in a clear and weedy stream running through a marsh at the head of Bheemtâl and supplying that lake; and subsequently Dr. Bacon and myself found it abundantly on the stems of a water Iris which we drew up by the roots from the bed of the stream for examination."

I further remarked that it exhibited a tendency towards *Paludina* in form and in the continuity and incrassation of the peristome.

Cheltenham, Nov. 12, 1862.

XLIV.—*On the Unicorn of the Ancients.* By the Rev. W. Houghton, M.A., F.L.S.

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

Gentlemen,

I hasten to correct a serious error which I committed in my paper "On the Unicorn of the Ancients," published in the last Number of your Magazine. I there stated (p. 369) that "the animal which Mr. Rüppell was told by a native existed in Africa, and which had a long straight horn growing from its forehead (?), was doubtless a Rhinoceros." I grounded this somewhat hasty conclusion on a short paragraph that appeared in the twentieth volume of the 'Asiatic Journal' (July 1825), published the year before Rüppell's 'Atlas zu der Reise im nördlichen Africa.' I have since referred to this work, in which, at pt. i. p. 29, Mr. Rüppell has made some observations on the Unicorn, which, under the name of *Nillekma,* is known to the natives of Kordofan. "The accounts which I obtained," this traveller remarks (p. 30), "from persons of the greatest respectability concerning the *Nillekma* all perfectly agreed,—to wit, the animal's hide was of a reddish colour, its size that of a pony, its form slender like the Antelope's; the male had a long straight horn upon its brow, which was wanting in the female. Some added that it has cloven hoofs, others said the hoof was entire. It inhabits, according to report, the desert lying south of Kordofan, and is remarkably swift."

From this it is quite clear that this supposed animal is something very different from any species of Rhinoceros. I ought, therefore, perhaps to modify my assertion when I boldly denied the existence of any such animal, seeing that so distinguished a naturalist as Edward Rüppell was inclined to believe in it. But even if future investigations should result in the discovery of such an animal as that described above (which, to say the least, is in the highest degree improbable), it is certain that it can have nothing to do with the two-horned *R'êm* of the Bible, nor, as it seems to me, with any of the one-horned animals mentioned in the writings of the ancient Greeks and Romans. The authority for the existence of the animal rests entirely upon the assertions of natives, whose veracity is not often to be depended upon. I remember being told by a traveller in Palestine that it is perfectly useless to attempt to obtain reliable information from the Arabs of that country. They will tell a traveller almost anything that comes into their heads, no matter how improbable it may be,—though in the question at issue it is but fair to state that Mr. Rüppell was perfectly satisfied with the accuracy of the information he had received from his native servant on questions relating to animals.

With regard to the zoological objection to the possibility of the existence of an animal with a single horn on the middle of the forehead (viz. that no horn can grow upon a suture), Mr. Rüppell replies by instancing the case of the Giraffe, the male of which, he states, is possessed of a third horn, placed on the very centre of the frontal suture. This fact, though denied by Prof. Owen, was maintained by Cuvier, and has lately been insisted upon by Dr. Cobbold.

I remain, Gentlemen,
Very truly yours,
W. Houghton.

Preston Rectory, Nov. 3, 1862.

XLV.—*On the Animal and Float of* Ianthina.

By Arthur Adams, F.L.S. &c.

In the North Atlantic Ocean, about four hundred miles from the Azores, I obtained a considerable number of lively Ianthinas; and I believe there are one or two points of interest in the history of this beautiful Mollusk which deserve mention, as they seem to have escaped the notice of previous observers. I will first of all consider the animal, and then the float by means of which it is supported at the surface of the water.

The animal is entirely blind. I sought in vain for eyes, both at the base and apex of the longer, external, pointed tentacle, and likewise at the truncated apex of the inner and shorter tentacular process. No trace of eyes was visible, although an accidental dark round spot of pigment may have been mistaken for those organs.

The head is proboscidiform, and the muzzle is contractile only. The muzzle is susceptible of considerable inflation; and the apices of the large horny mandibles and the rounded extremity of the tongue, armed with its formidable array of sharp, curved, slender teeth, are observed protruding from the extremity when the animal is engaged in exploring for food,

Although doubtless the chief food of the *Ianthina* consists of *Physaliæ, Porpitæ*, and *Velellæ*, which are usually seen floating in its society, on the surface, in calm weather, yet an occasional Barnacle does not seem to come amiss to the blind Snail of the ocean. From the stomachs of several I extracted fragments of the tufted feet of *Lepas*, and in one which I examined the *Lepas*-remains occupied the entire length of the œsophagus.

On each side of the broad short tongue, or lingual membrane, are two large horny jaws, which, when removed, present an elongate-quadrate form. They are convex externally, very thin, and quite pellucid; the inner free edge is straight and slightly thickened, the outer attached edge is membranaceous and convex. The anterior lower angle is the pointed apex of the jaw, from which proceed radiating striæ and grooves, curving upwards and outwards at the anterior upper angle, and becoming nearly straight as they approach the straight inner margin.

The mantle, on the left side, has a distinct siphonal fold corresponding with the angle formed by the union of the inner and outer lips of the shell. The bar-like gills are placed far back under the arched cavity of the shell, in a diagonal direction, and in none of my specimens do they exhibit the appearance of an extruded tuft, as represented in some figures of the animal.

The sides of the foot are furnished with a lateral membrane (without fringes, furbelows, or filaments) which, in lively individuals, is reflexed on the right side on the penultimate whorl of the shell. Anteriorly, this membrane terminates in a simple angular lobe, and posteriorly forms a truncate vertical margin. The foot is narrow, elongated, rounded in front, tapering behind, and not circular and contracted as shown in some figures taken from animals in spirits. The under surface of the foot, like the under surface of the shell, is of a deeper violet-colour than the upper portions; for these are the parts exposed to the light, the under surface both of animal and shell becoming the upper in the usual position of the living animal. The animal always floats shell downwards, with the vesicular buoy above it directed backwards. The anterior part of the foot is mobile, free, rounded, and dilated, and the sides are usually folded inwards, forming a shallow cup, which embraces the smooth anterior rounded end of the float. When the animal wishes to bring its head to the surface of the water, this part of the foot is made to glide over the back of the float. Thus the animal can raise and lower itself at pleasure by means of its own float.

The violet liquid which is ejected in considerable quantities when the animal is irritated is at first equably diffused, but shortly sinks to the bottom in the form of a deposit, leaving the water pellucid. The bag or reservoir containing the colouring-fluid is visible through the skin on the back of the neck, and the fluid is poured direct into the branchial cavity, and makes its escape from under the free edge of the mantle. My dyeing operations with this purple fluid were not crowned with success, the beautiful colour fading gradually away, leaving "magenta" and "mauve" yet possessors of the field.

The float is attached to the under surface of the caudal end of the foot, where what appear to be the muciparous follicles give it a striated appearance. In this species, which is *I. violacea*, the float is quite colourless; but in *I. exigua* it is of a faint pinkish tinge, and in that of *I. globosa* it is frequently of a pale delicate lilac. In *Recluzia Bensoni*, A. Ad., which has a pale yellow shell, the float is of a light straw-colour.

None of the floats of my specimens had ova affixed to them; but the surface of many of the shells was studded with the young of *Lepades*, which appeared to me to have been described as a genus of Entomostracans, under the name of *Evadne*. When the animal is weakly or dead, the float readily becomes detached, for there is no organic connexion between it and the foot. The mucous film of which it is composed appears to be of the same nature as that glutinous fluid emitted by *Litiopa* and *Alaba*, but which, in these genera, instead of forming vesicles containing air, is spun out into filmy threads, which, however, are sufficiently buoyant to support the animals. The vesicles are probably formed in the same manner as the frothy spume of the little green Homopterous larva which is seen on bushes in the spring, and which, in Hampshire, usually goes by the name of "Cuckoo-spit." When a portion is cut off, the float is enlarged at the end next the foot of the animal, and is not regenerated at the excised part.

The float is often seen lacerated by the teeth of fishes; and hundreds of detached floats are observed in the water. With a pair of sharp-pointed scissors I made incisions into the floats, and allowed the air to escape, when the animals gradually descended, and remained helpless at the bottom of the vessel: the floats were not regenerated or renewed during the period the animals remained alive. Crepitating portions, when separated, continue buoyant until the vesicles of which they are composed gradually collapse from the escape of the air with which they are distended; and the floats, when pounded in a mortar, are readily reduced to a mucus.

XLVI.—*On the Animal and Affinities of* Scaliola, *a Genus of Mollusca from Japan.* By Arthur Adams, F.L.S. &c.

In the 'Annals' for 1860 (vol. vi. p. 120), I gave, under the name of *Scaliola*, a short description of what I then believed to be a new subgenus of *Scala*. Since then, however, I have discovered the Mollusk in a living state, and have ascertained, from an examination of the animal, that it is furnished with a rostriform head, as in Rissoidæ, and not with a retractile proboscis as in Scalidæ. In all the species I have met with in Japan, its curious habit of agglutinating grains of sand to the surface of the shell is observable. In this peculiarity the genus resembles *Onustus* and *Xenophora*; a species of *Helicina* likewise exhibits the same remarkable feature. In the original specimens from which I took my first description the foreign particles were worn off.

Genus Scaliola, A. Adams.

An. capite proboscidiformi. Rostrum elongatum, cylindricum, annulatum. Tentacula filiformia. Oculi prominentes, nigri, ad basin externam tentaculorum positi. Pes brevis, ovatus, postice subacuminatus.

Operculum corneum, ovatum, subspirale; nucleo subterminali.

Testa turrita, umbilicata seu rimata; anfractibus agglutinantibus, arenaceis. Apertura plus minusve circularis, peritremate continuo; margine recto, acuto.

The species the animal of which I observed was *S. bella*, A. Ad. It occurred in considerable numbers at Takano-Sima, a small island near Tatiyama, on the coast of Niphon, in from two to three fathoms, on a bottom of sandy mud. The rostrum is long, large, annulate, bifid at the end, and of a pale yellow colour. The tentacles are small and filiform, with large black eyes at their outer bases. The head is elongated, with a dark median linear mark on the upper surface. The foot is short, ovate, semipellucid, with an opake white blotch on the side near the operculum.

1. *Scaliola bella*, A. Adams.

S. testa pyramidato-turrita, late umbilicata, alba; anfractibus arenaceis, convexis, suturis canaliculatis; anfractu ultimo soluto; apertura circulari.

Hab. Takano-Sima; $2\frac{1}{2}$ fathoms. Tabu-Sima; 25 fathoms.

2. *Scaliola arenosa,* A. Adams.

S. testa turrita, rimata; anfractibus convexis, arenosis, suturis profundis; anfractu ultimo ad peritrema contiguo; apertura vix circulari.

Hab. O-Sima; Tanabe; Simoda.

3. *Scaliola glareosa,* A. Adams.

S. testa graciliori, turrita, imperforata, alba; anfractibus convexis, arenosis, suturis impressis; anfractu ultimo ad peritrema consolidato; apertura ovata.

Hab. Tsu-Sima; Takano-Sima.

4. *Scaliola gracilis,* A. Adams.

S. testa turrita, gracili, alba, subarenosa; anfractibus convexis, subnudis, suturis profundis; anfractu ultimo vix soluto; apertura subcirculari.

Hab. Gotto; 71 fathoms.

XLVII.—*Descriptions of newly discovered Spiders captured in Rio Janeiro by* John Gray, Esq., *and* the Rev. Hamlet Clark. By John Blackwall, F.L.S.

[Continued from p. 360.]

Family Thomisidæ.

Genus Thomisus, Walck.

Thomisus gibbosus.

Length of the female $\frac{7}{24}$ths of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{11}{24}$; length of a leg of the third pair $\frac{1}{4}$.

The eyes are disposed on the anterior part of the cephalothorax in two transverse curved rows, forming a crescent; the two anterior intermediate ones are the smallest; the eyes of each lateral pair are seated on tubercles, and the anterior ones are the largest of the eight. The cephalothorax is short, broad, convex, slightly compressed before, rounded on the sides, abruptly sloped at the base and in front, where it is truncated; it is sparingly clothed with hairs, and has a yellowish-brown hue, with dark reddish-brown spots; the frontal margin, a transverse line between the two rows of eyes, and another situated behind the posterior row, which is slightly angular with its vertex directed backwards, have a yellowish-white tint; and a large, triangular, reddish-brown spot, on a yellowish-white ground, occurs on each side of the posterior slope. The falces are short, strong, conical, and vertical; the maxillæ are convex near the base, obliquely truncated at the extremity on the outer side, and slightly inclined towards the lip, which is triangular and pointed at the apex; and the sternum is heart-shaped. These parts are of a yellowish-brown colour, the maxillæ and sternum being the palest. The legs are robust, provided with hairs and spines, and are of a yellowish-brown hue, with red-brown and yellowish-white spots; the first and second pairs, which are much longer than the third and fourth, are equal in length, and the third pair is the shortest; each tarsus is terminated by two curved pectinated claws. The palpi are short, and resemble the legs in colour. The abdomen is very gibbous on the upper part of the posterior region, and is much broader there than at the anterior extremity, which has the appearance of having been cut in a direct line across; it is of a yellowish-grey colour, with numerous red-brown spots, and has several transverse red-brown and yellowish-white sinuous lines on its gibbosity; the under part is of a yellowish-white hue, with minute brown spots, and a broad dull yellow band extends along the middle; the colour of the branchial opercula is yellowish-white, and that of the sexual organs reddish-brown.

Genus Eripus, Walck.

Eripus spinipes.

Length of the female $\frac{1}{5}$th of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{7}{20}$; length of a leg of the third pair $\frac{1}{6}$.

The cephalothorax is compressed before, rounded on the sides, abruptly sloped at the base, depressed, with two conical tubercles in front, placed transversely; it is provided with numerous spines enlarged at the base, those on the sides being disposed for the most part in oblique rows forming slight ridges converging towards the centre, and those in the middle constituting three longitudinal rows; three spines are situated between the bases of the tubercles in front, and three others on the frontal margin, the six being directed forwards; it is of a reddish-brown colour, the sides and a broad and somewhat raised band extending along the middle being much the darkest. The falces are short, cuneiform, and vertical; the maxillæ are enlarged and rounded at the extremity, and inclined towards the lip, which is semicircular. These parts are of a reddish-brown colour, the extremity of the maxillæ and lip having a yellowish tinge. The sternum is heart-shaped, thinly clothed with whitish hairs, and has a yellowish-white colour, with brown spots on the lateral margins, opposite to the legs. The eyes are nearly equal in size, and are disposed on and about the cephalic tubercles; two are situated in front below the tubercles, one in front of each tubercle near its middle, one on the side, and another behind, at the base of each; the two seated on the side of the tubercles are rather the smallest of the eight. The first and second pairs of legs are much longer and more powerful than the third and fourth pairs; all are provided with numerous strong spines enlarged at the base, those on the first and second pairs being much the largest; the colour of the first and second pairs is dark brown, tinged with red, with the exception of the tarsi and the sides and under part of the base of the metatarsi, which have a yellow-brown tint; the third and fourth pairs are of a brownish-yellow hue, with a few dark brown spots on the under side; each tarsus is terminated by two curved pectinated claws. The palpi are short, and resemble the legs in colour. The abdomen is convex above, with whitish hairs and spines enlarged at their base distributed over its surface; the anterior part, contiguous to the cephalothorax, has the appearance of having been cut in a direct line across; and in the middle region, which is broader than the extremities, three long, conical, pointed processes or tubercles are situated in a transverse row, the intermediate one being the largest; it is of a dark brown colour, with a yellowish tinge in the medial line and at the base of the intermediate tubercle, and the point of each tubercle has a yellowish-white hue; the colour of the anterior region of the sides and of the under part is brownish-yellow; the sexual organs have a small process connected with their anterior margin which is directed backwards, and are of a dark reddish-brown hue, that of the branchial opercula and spinners being yellow-brown.

The collection of Brazilian spiders made by Messrs. Gray and Clark contained, besides this new and very interesting *Eripus*, two specimens of the *Eripus heterogaster* of Walckenaer, both of which were females. The males of *E. spinipes* and *E. heterogaster*, the only species of the genus at present known, have not yet been discovered.

Genus Sparassus, Walck.

Sparassus sylvaticus.

Length of the male $\frac{1}{3}$rd of an inch; length of the cephalothorax $\frac{1}{6}$; breadth $\frac{1}{7}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{9}{20}$; length of a leg of the third pair $\frac{7}{20}$.

The eyes are seated on black spots, and are disposed on the anterior part of the cephalothorax in two transverse rows; the two intermediate ones of the anterior row, which is straight and situated immediately above the frontal margin, are the largest of the eight, and the posterior row, which is the longer, is slightly curved, with its convexity directed backwards. The cephalothorax is large, somewhat compressed before, greatly rounded on the sides, sparingly clothed with hairs, convex, glossy, and has a very slight longitudinal indentation in the medial line; the falces are short, subconical, vertical, and armed with a few teeth on the inner surface; the maxillæ are straight, convex near the base, and rounded at the extremity; the lip is quadrate; and the sternum is heart-shaped; the legs are robust, and provided with hairs and sessile spines, a row of the latter occurring on each side of the under part of the tibiæ and metatarsi; the first pair is the longest, then the second, and the third pair is the shortest; each tarsus is terminated by two curved minutely pectinated claws, below which a small scopula is situated. These parts are of a brownish-yellow colour, with the exception of the sternum, which has a yellowish-white hue. The palpi resemble the legs in colour, but the digital joint has a dull brown spot near its extremity, and several streaks of the same hue on its convex surface; the cubital and radial joints are short, and the latter projects from its extremity in front a red-brown crescent-shaped apophysis, whose outer limb is the shorter; the digital joint is of a curved oblong-oval figure, and is deeply emarginated towards the extremity on the outer side; it is convex and hairy externally, concave within, comprising the palpal organs; these organs are highly developed and complicated in structure, with a large prominent spiral process, which extends beyond the extremity of the joint, and has a long slender filament in connexion with it, and a prominent spine near its base towards the outer side; their colour is red-brown, tinged with yellow. The abdomen is oviform, convex above, pointed at the spinners, and clothed with short hairs; it is of a dull yellowish hue, with a series of reddish-brown angular lines, whose vertices are directed forwards, extending along the middle of the upper part, and diminishing in extent as they approach the spinners; from the extremities of the angular lines spots of the same colour extend in oblique rows to the sides, and a few obscure spots of a similar hue occur on the under part.

Sparassus maculatus.

Length of the female $\frac{3}{10}$ths of an inch; length of the cephalothorax $\frac{1}{8}$; breadth $\frac{1}{9}$; breadth of the abdomen $\frac{1}{10}$; length of a leg of the second pair $\frac{11}{16}$; length of a leg of the third pair $\frac{11}{24}$.

The legs are long, and provided with hairs and fine sessile spines; the second pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by two curved, minutely pectinated claws, below which a small scopula is situated; and the palpi have a curved, slightly pectinated claw at their extremity; the cephalothorax is compressed before, truncated in front, greatly rounded on the sides, convex, and glossy, with a narrow longitudinal indentation in the medial line; the falces are powerful, subconical, vertical, and armed with teeth on the inner surface; the maxillæ are short, straight, convex near the base, and rounded at the extremity; and the sternum is heart-shaped. These parts are of a pale yellowish colour, the sternum being the palest. The lip is somewhat quadrate, rather broader than long, and has a brownish-black hue. The eyes are seated on black spots, and are disposed on the anterior part of the cephalothorax in two transverse straight rows; they are nearly equal in size, and those constituting the anterior row, which is the shorter, are situated immediately above the frontal margin. The abdomen is oviform, convex above, thinly clothed with hairs, and of a dull yellow-brown colour, with numerous minute yellowish-white spots, a broad space occupying the entire medial line of the under part, and a band extending from the anterior extremity of the upper part nearly half its length, being devoid of spots; to this band succeeds a large oval space, comprising numerous yellowish-white spots which extend about two-thirds of its length along the middle, and two parallel reddish-brown spots near its extremity.

This *Sparassus*, though the specimen described was immature, is a distinct and well-marked species.

Family Drassidæ.

Genus Drassus, Walck.

Drassus insignis.

Length of the male $\frac{1}{2}$ an inch; length of the cephalothorax $\frac{1}{4}$; breadth $\frac{1}{5}$; breadth of the abdomen $\frac{3}{20}$; length of a posterior leg $\frac{11}{12}$; length of a leg of the third pair $\frac{3}{4}$.

The eyes are disposed on the anterior part of the cephalothorax in two transverse curved rows having their convexity directed backwards; the posterior row is longer and more curved than the anterior row, which is situated near the frontal margin; the eyes of each lateral pair are seated on a tubercle, but are separated by a moderate space, and the four intermediate ones nearly form a square, the two anterior ones being much the largest of the eight. The cephalothorax is compressed before, rounded on the sides, convex, with a narrow longitudinal indentation in the medial line, and is densely clothed with short, yellowish-grey hairs; it is of a reddish-brown colour, the anterior part being much the darkest, and has narrow, brownish-black lateral margins. The falces are powerful, conical, vertical, and armed with teeth on the inner surface; the maxillæ are strong, convex on the outer side, obliquely truncated at the extremity on the inner side, and curved towards the lip, which is quadrate; the sternum is heart-shaped and glossy, with small prominences on the sides opposite to the legs. These parts have a reddish-brown hue, the falces being the darkest, and the sternum much the palest. The legs are long, robust, provided with hairs and sessile spines, and are of a yellowish-brown colour; the fourth pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by two curved minutely pectinated claws, below which there is a small scopula. The palpi have a red-brown hue, the radial and digital joints being much the darkest; the radial is larger than the cubital joint, and projects three apophyses from its extremity on the outer side; the superior one is slightly curved and pointed, the intermediate one is large and crescent-shaped, and the inferior one has a slender process near its termination, which is abruptly curved and pointed at its extremity; the digital joint is of an elongated-oval form, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, not very complicated in structure, with a strong curved process at their extremity, which has a small prominent pointed process near its base, and are of a dark reddish-brown colour. The abdomen is oviform, convex above, hairy, with a large dull yellow band extending from its anterior extremity along the middle of the upper part, more than a third of its length; a large dark brown spot occurs in the middle of the posterior extremity of this band, which is the broadest and trifid, and on each side of the intermediate prolongation, which is the narrowest and most elongated, there is a series of dark brown spots; these spots converge, and become confluent above the spinners, where they form short transverse bars; the sides are spotted and streaked with dark brown, and the under part, spinners, and branchial opercula have a pale yellowish-brown hue, the last being the palest.

After the description of this species was made, an adult male was received from Mr. Eyton Williams, who captured it in Pernambuco.

Genus Clubiona, Latr.

Clubiona subflava.

Length of the female $\frac{3}{10}$ths of an inch; length of the cephalothorax $\frac{1}{8}$; breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{3}{5}$; length of a leg of the third pair $\frac{3}{10}$.

The cephalothorax is compressed before, rounded on the sides, depressed and truncated in front, sparingly clothed with short hairs, convex, glossy, and has a slight longitudinal indentation in the medial line; the falces are long, powerful, subconical, vertical, and armed with a few small teeth on the inner surface; the maxillæ are straight, and enlarged and rounded at the extremity; the lip, which is longer than broad, is truncated and somewhat hollowed at the apex; and the sternum is heart-shaped, with small prominences on the sides, opposite to the legs; the legs are long, slender, and provided with hairs; the first pair is the longest, then the fourth, and the third pair is the shortest; each tarsus is terminated by two curved pectinated claws, below which there is a small scopula; the palpi are moderately long; the abdomen is oviform, somewhat pointed at the spinners, convex above, and clothed with short hairs. This spider is of a pale dull yellow colour, with the exception of the falces, the maxillæ, the lip, the sexual organs, and the extremity of the palpi, which have a red-brown hue, the circular sexual organs and the extremity of the falces being the darkest. The eyes are disposed in two transverse rows on the anterior part of the cephalothorax; the four intermediate ones nearly form a square, the two anterior ones, which are the largest of the eight and are situated immediately above the frontal margin, being somewhat nearer to each other than the posterior ones; the eyes of each lateral pair are seated obliquely on a tubercle, but are not in contact.

Clubiona fasciata.

Length of the male $\frac{5}{24}$ths of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{13}{24}$; length of a leg of the third pair $\frac{1}{4}$.

The eyes are seated on black spots, and are disposed in two transverse rows on the anterior part of the cephalothorax; the four intermediate ones form a trapezoid whose anterior side is the shortest, the two eyes constituting it, which are situated immediately above the frontal margin, being the smallest of the eight. The cephalothorax is compressed before, rounded on the sides, depressed and broadly truncated in front, sparingly clothed with short hairs, convex, glossy, and has a narrow longitudinal indentation in the medial line; the legs are long, slender, and provided with hairs and fine sessile spines; the first pair is the longest, the second and fourth pairs are equal in length, and the third pair is the shortest; each tarsus is terminated by two curved pectinated claws, below which there is a small scopula; the sternum is heart-shaped, and has small prominences on the sides, opposite to the legs. These parts are of a pale dull yellow colour, the cephalothorax, which has a very obscure longitudinal brownish band on each side, being rather the darkest; and the sternum has minute brown spots on the lateral margins. The falces are very long, very prominent, somewhat cylindrical, and armed with a long fang, and an obtuse process resembling a double tooth on the inner surface; the maxillæ are straight, and enlarged and somewhat quadrate at the extremity; and the lip, which is longer than broad, is truncated and hollowed at the apex. These organs have a yellowish-brown hue. The palpi are slender and of a yellowish-white colour, with the exception of the digital joint, which has a yellowish-brown hue; the radial is longer than the cubital joint, and has a small, red-brown, crescent-shaped apophysis at its extremity, on the outer side, whose superior limb is the longer; the digital joint is of an oblong-oval form, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, not very complex in structure, and whose colour consists of mixed shades of yellowish-brown. The abdomen is oviform, somewhat pointed at the spinners, convex above, and is clothed with hoary hairs; a broad, dentated, yellowish-grey band, which is bordered laterally with pale brown, extends from the anterior extremity of the upper part along the middle, diminishing in breadth to its termination at the spinners; the sides and under part are yellower than the medial band, and are without spot.

Clubiona affinis.

Length of the female $\frac{5}{24}$ths of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{14}$; breadth of the abdomen $\frac{1}{14}$; length of a posterior leg $\frac{3}{8}$; length of a leg of the third pair $\frac{1}{4}$.

The legs are long, provided with hairs and sessile spines, and are of a yellowish-brown hue, with the exception of the anterior ones, which are slender, devoid of spines, and have a yellowish-white tint; the fourth pair is the longest, then the second, and the third pair is the shortest; each tarsus is terminated by two curved pectinated claws, below which a small scopula is situated. The palpi resemble the legs in colour. The cephalothorax is compressed before, rounded on the sides, truncated in front, sparingly clothed with short hairs, convex, glossy, and has a narrow longitudinal indentation in the medial line; it is of a dull yellow colour, with a brown band extending along each side. The eyes are seated on black spots, and are disposed in two transverse rows on the anterior part of the cephalothorax; the four intermediate ones form a trapezoid whose anterior side is the shortest, the two eyes constituting it, which are situated immediately above the frontal margin, being the smallest of the eight. The falces are long, powerful, conical, rather prominent, armed with a few small teeth on the inner surface, and are of a red-brown colour. The maxillæ are straight, and enlarged and rounded at the extremity; and the lip, which is longer than broad, is truncated and hollowed at the apex. These organs have a yellowish-brown hue. The sternum is oval, with small prominences on the sides, opposite to the legs, and is of a pale yellowish-white colour, with minute brown spots on the lateral margins. The abdomen is oviform, convex above, and clothed with hoary hairs; a broad pale grey band, minutely spotted with dark brown, extends from the anterior extremity of the upper part about two-thirds of its length along the middle; the lateral margins of this band, and the space comprised between its extremity and the spinners, have a dark brown hue; the sides and under part are of a yellowish-grey colour, spotted with dark brown, the spots on the latter being few in number, minute, and obscure; a dark brown longitudinal streak occurs on the upper surface of the superior spinners, and the colour of the sexual organs is reddish brown.

I have given the specific name *affinis* to this spider provisionally, as it appears to be very closely allied to *Clubiona fasciata*, and may perhaps be the female of that species. It is true that it differs from it remarkably in the relative length of its legs; but a careful examination of the anterior pair has induced a suspicion that the antecedents of those limbs may have been simultaneously detached at the coxæ before the spider had arrived at maturity. Now, if such were the case, it is evident, from known physiological facts, that, on being reproduced, they must be defective in development, though, as in the present instance, they might be symmetrical in structure.

Family Theridiidæ.

Genus Theridion, Walck.

Theridion coniferum.

Length of the female $\frac{3}{20}$ths of an inch; length of the cephalothorax $\frac{1}{16}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{23}{48}$; length of a leg of the third pair $\frac{1}{6}$.

The abdomen is somewhat oviform, with a large, pointed, conical protuberance near the middle of the upper part; it is sparingly clothed with hairs, of a yellowish-white colour, obscurely marked with minute spots of a paler hue on the upper part, and the sexual organs are prominent and of a red-brown colour. The cephalothorax is short, broad, oval, convex, and glossy, with an indentation in the medial line; it is of a yellowish-white hue, with a faint orange-coloured band extending along the middle. The falces are slender, conical, prominent, and are terminated by a small, curved, red fang; the maxillæ are obliquely truncated at the extremity, on the outer side, and are inclined towards the lip, which is triangular and pointed at the apex; and the sternum is heart-shaped. These parts, with the palpi, which are slender and have a curved pectinated claw at their extremity, are of a dull whitish hue. The eyes are disposed on the anterior part of the cephalothorax in two transverse rows, and are seated on black spots; the four intermediate ones form a square, those of the anterior pair, which are the smallest of the eight, being placed on a tubercle; the eyes of each lateral pair are also placed on a tubercle, and are nearly in contact. The legs are long, slender, and provided with hairs; the first pair is the longest, then the fourth, and the third pair is the shortest; each tarsus is terminated by three claws, the two superior ones are curved and pectinated, and the inferior one is inflected near its base; their colour is dull yellowish-white, that of the extremity of the tibiæ and metatarsi of the first, second, and fourth pairs, and an obscure annulus on the tibiæ of the first pair, being orange-brown.

Family Epeïridæ.

Genus Epeïra, Walck.

Epeïra lepida.

Length of the female $\frac{1}{8}$th of an inch; length of the cephalothorax $\frac{1}{16}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{3}{20}$.

The cephalothorax is compressed before, rounded on the sides, convex, particularly in the posterior region, glossy, and has an indentation in the medial line; the falces are powerful, conical, vertical, and armed with a few teeth on the inner surface; the maxillæ are short, strong, straight, and enlarged and rounded at the extremity; the lip is semicircular, but somewhat pointed at the apex; the sternum is heart-shaped, and is supplied with long brownish hairs; the legs are long, and provided with hairs and spines; the first pair is the longest, then the second, and the third pair is the shortest; the tarsi are terminated by claws of the usual number and structure; the palpi are slender, and have a curved claw at their extremity. These parts have a yellowish-red colour; the base of the lip has a brown hue, and an oblong black spot occurs above each lateral margin of the cephalothorax. The eyes are seated on black spots on the anterior part of the cephalothorax; the four intermediate ones nearly form a square; those of the anterior pair are placed on a prominence, and are slightly nearer to each other than those of the posterior pair, which are the largest of the eight; the eyes of each lateral pair are seated obliquely on a small tubercle, and are contiguous. The abdomen is oviform, rather broader at the posterior than at the anterior extremity, sparingly clothed with short hairs, convex above, and projects over the base of the cephalothorax: it is of a dull yellow colour, with numerous white spots on the upper part, forming broad oblique bars on each side of the medial line; above the spinners there are three black spots, the intermediate one being much the largest; and a minute white spot occurs on each side of the under part, near its posterior extremity; the sexual organs are rather prominent, and of a brownish-yellow colour, tinged with red-brown.

Epeïra elegans.

Length of the female $\frac{2}{5}$ths of an inch; length of the cephalothorax $\frac{1}{6}$; breadth $\frac{1}{8}$; breadth of the abdomen $\frac{1}{5}$; length of an anterior leg $\frac{7}{10}$; length of a leg of the third pair $\frac{3}{8}$.

The eyes are seated on black spots on the anterior part of the cephalothorax; the four intermediate ones are placed on a prominence, and nearly form a square, the two anterior ones, which are rather wider apart than the posterior ones, being the largest of the eight; the eyes of each lateral pair are seated obliquely on a tubercle, and are near to each other, but not in contact. The cephalothorax is compressed before, rounded on the sides, somewhat pointed in front, moderately convex, with a large indentation in the medial line; it is clothed with short hoary hairs, and of a reddish-yellow colour, with a broad longitudinal brown band on each side, and a narrower one of the same hue, which extends from the eyes to the medial indentation. The falces are powerful, conical, vertical, armed with teeth on the inner surface, and of a reddish-yellow colour. The maxillæ are short, straight, and enlarged at the extremity; the lip is semicircular, but somewhat pointed at the apex; and the sternum is heart-shaped, with small eminences on the sides, opposite to the legs. These parts have a dark brown hue, the maxillæ and lip having a yellowish-brown tint at the extremity. The legs are long, robust, provided with hairs and spines, and of a yellowish-red colour, the extremity of the joints being the darkest; the first pair is the longest, then the second, and the third pair is the shortest; the tarsi are terminated by claws of the usual number and structure. The palpi have a yellowish hue, tinged with red, and have a curved pectinated claw at their extremity. The abdomen is oviform, clothed with hairs, convex above, and projects over the base of the cephalothorax; the upper part is of a dull yellow colour, reticulated with fine pale brown lines; a brown streak in front, whose posterior extremity is pointed, is succeeded by a large leaf-like band, with sinuous margins, that tapers to the spinners; the anterior part of the band, which has a brown hue, and is freckled and spotted with dull yellow, comprises four indented brown spots nearly forming a square, the two posterior ones being separated by a rather wider interval than the anterior ones; and the colour of the posterior part of the band is brownish-black, intersected by narrow, transverse, dull yellow bars; the sides have a brownish-yellow hue, and are marked with oblique brownish-black streaks; the middle of the under part is of a dark brown hue, bordered laterally with dull yellow; the sexual organs are well developed, prominent, of a dark reddish-brown colour, and have a long, slender, brownish-yellow process, directed backwards from their anterior margin, which is curved at its base and recurved at its extremity.

Epeïra multiguttata.

Length of the female $\frac{1}{3}$rd of an inch; length of the cephalothorax $\frac{3}{20}$; breadth $\frac{1}{7}$; breadth of the abdomen $\frac{1}{5}$; length of an anterior leg $\frac{11}{20}$; length of a leg of the third pair $\frac{3}{10}$.

The cephalothorax is compressed before, rounded in front and on the sides, thinly clothed with hairs, convex, with a large indentation in the medial line; the falces are powerful, conical, convex in front near the base, vertical, and armed with teeth on the inner surface; the maxillæ are short, straight, and enlarged and rounded at the extremity; the lip is semicircular, but somewhat pointed at the apex; the sternum is heart-shaped, with small eminences on the sides, opposite to the legs; the legs are robust, and provided with hairs and a few spines; the first pair is the longest, then the second, and the third pair is the shortest; the tarsi are terminated by claws of the usual number and structure; the palpi are rather short, and have a curved pectinated claw at their extremity. These parts are of a red colour, the sternum being the palest; the maxillæ and lip are tinged with brown at the base and dull yellow at the extremity; on the anterior part of the cephalothorax there is a large triangular black mark, whose base comprises the eyes, and whose vertex extends to the medial indentation; a black annulus occurs near the middle, and another at the extremity of the tibia of the first and second pairs of legs, the latter being the broader; and the extremity of the tibia, metatarsus, and tarsus of the third and fourth pairs, and that also of the digital joint of the palpi, are of the same hue. The eyes are disposed on the anterior part of the cephalothorax, in two transverse rows; the four intermediate ones nearly form a square, the two anterior ones, which are the largest of the eight, and rather wider apart than the posterior ones, being placed on a prominence; the eyes of each lateral pair are seated obliquely on a tubercle, and are near to each other, but not in contact. The abdomen has a short, broad, oviform figure; it is sparingly clothed with hairs, very convex above, and projects greatly over the base of the cephalothorax; the upper part is soot-coloured, a broad space in the anterior region having a brown hue; two pale yellow lines, whose bifid extremities are widely divergent, meet in an angle in front, and project within the angle a short streak of the same hue on each side of the medial line; to these streaks succeed two series of spots disposed in pairs, and exterior to each of these series there is a row of spots, the anterior one of which is the largest and somewhat curved, having its convexity directed outwards; a minute spot occurs near the extremity of the stronger branch of the bifid termination of each frontal line, and a series of oblong oblique spots extends along the upper part of each side; all the spots have a pale yellow hue; the colour of the under part is pale yellow, with the exception of a broad space in the middle, which has a brownish-black hue; the sexual organs are prominent, but not highly developed; connected with their anterior margin there is a small brownish-yellow process, which is curved backwards and recurved at its extremity; their colour is reddish-brown, and that of the branchial opercula is brownish-yellow.

Epeïra fumida.

Length of the male $\frac{3}{10}$ths of an inch; length of the cephalothorax $\frac{1}{6}$; breadth $\frac{1}{8}$; breadth of the abdomen $\frac{1}{6}$; length of an anterior leg $\frac{7}{10}$; length of a leg of the third pair $\frac{3}{10}$.

The legs are long, provided with hairs and spines, and have a brownish-yellow hue, the femora and extremity of the joints being the brownest; the first pair is the longest, then the second, and the third pair is the shortest; the tarsi are terminated by claws of the usual number and structure. The palpi are short, and resemble the legs in colour; the cubital joint has several long bristles directed forwards from its extremity; the radial joint has a large protuberance on its outer side, fringed with hairs; the digital joint is oval, with a process at its base, curved outwards, whose obtuse extremity is glossy; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, protuberant, complex in structure, with an obtuse prominent process at their base, having a projection near its base, on the inner side, whose dark extremity is bifid; they are terminated by the dark-coloured points of several strong processes, and their predominant colour is pale dull yellow faintly tinged with red-brown. The convex sides of the digital joints are directed towards each other. The eyes are seated on black spots on the anterior part of the cephalothorax; the four intermediate ones nearly form a square; the two anterior ones are placed on a prominence, and are rather wider apart than the posterior ones, which are the largest of the eight; the eyes of each lateral pair are seated obliquely on a tubercle, and are near to each other, but not in contact. The cephalothorax is compressed before, rounded on the sides, hairy, somewhat glossy, convex, depressed in front and in the posterior region, with a large indentation in the medial line; the falces are powerful, conical, vertical, and armed with teeth on the inner surface. These parts are of a yellowish-brown colour, faintly tinged with red. The maxillæ are short, straight, and enlarged and rounded at the extremity; the lip is semicircular, but somewhat pointed at the apex; and the sternum is heart-shaped. These parts are of a dark brown colour, the extremity of the first two and the middle of the last having a dull yellow-brown hue. The abdomen is subglobular, hairy, convex above, and projects over the base of the cephalothorax; the upper part and sides are of a greyish-brown colour, and a series of obscure, transverse, soot-coloured bars, which have their extremities enlarged, and decrease in length as they approach the spinners, extends along the middle; a curved line passes round its anterior extremity and along the lower part of the sides; two short streaks in front converge to an angle in contact with the curved line, and are succeeded by a small spot on each side of the medial line; the line, streaks, and spots have a yellowish-white hue; the under part is of a brownish-black colour, with two minute yellowish-white spots placed transversely near the middle, and two others of the same hue are situated on each side of the spinners, at their base; the colour of the branchial opercula is brownish-yellow.

Epeïra grammica.

Length of the female $\frac{1}{4}$th of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{7}{12}$; length of a leg of the third pair $\frac{1}{4}$.

The cephalothorax is compressed before, rounded on the sides, convex, thinly clothed with pale hairs, and has an indentation in the medial line; the falces are long, conical, vertical, somewhat divergent at the extremity, and armed with teeth on the inner surface; the maxillæ are short, straight, and enlarged and rounded at the extremity; the lip is semicircular, but pointed at the apex; the sternum is heart-shaped, with small eminences on the sides, opposite to the legs; the legs are long, and provided with hairs and spines; the first pair is the longest, then the second, and the third pair is the shortest; the tarsi are terminated by claws of the usual number and structure; the palpi are slender, and have a curved pectinated claw at their extremity. These parts are of a yellowish-brown colour, the base of the lip and obscure spots on the lateral margins of the sternum having a brown hue. The eyes are disposed on the anterior part of the cephalothorax; the four intermediate ones are placed on a prominence, and nearly form a square, those of the anterior pair, which are the largest of the eight, being rather wider apart than those of the posterior pair; the eyes of each lateral pair are in a horizontal line, and separated by a conspicuous interval; the anterior one is seated on a minute tubercle, and the posterior one is the smallest. The abdomen is oviform, thinly clothed with short fine hairs, convex above, projects over the base of the cephalothorax, and is of a dull yellowish colour; a fine black sinuous line originates in a large brown spot on each side of the anterior extremity of the upper part; and these lines, which converge to the spinners, comprise in the anterior part of the space included between them two other fine, black, slightly sinuous lines, which somewhat abruptly converge to a point nearly equidistant from the two extremities of the abdomen; on each side of the medial line there is a row of minute brown indented spots, and a series of obscure, brown, transverse, curved bars whose convexity is directed forwards extends from the anterior region to the spinners; the under part has a pale brown hue tinged with yellow, the medial line, which is much the darkest, having a pale yellow longitudinal line on each side; and small spots of the same hue surround the spinners; the sexual organs are moderately developed, prominent, and of a yellowish-brown colour, the orifice, situated at the base of an oval process connected with their anterior margin and directed backwards, having a dark reddish-brown hue.

Epeïra luteola.

Length of the male $\frac{1}{5}$th of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{12}$; length of an anterior leg $\frac{7}{16}$; length of a leg of the third pair $\frac{1}{4}$.

The eyes are seated on black spots on the anterior part of the cephalothorax; the four intermediate ones form a square, the two posterior ones are rather the largest, and the anterior ones are placed on a prominence; the eyes of each lateral pair are seated obliquely on a tubercle, and the anterior ones are much the smallest and lightest-coloured of the eight. The cephalothorax is compressed before, rounded on the sides, moderately convex, glossy, and has an indentation in the medial line; it is of a red-brown colour, with a short yellowish line in the middle of the cephalic region. The falces are small, conical, vertical, armed with a few teeth on the inner surface, and have a brownish-yellow hue. The maxillæ are straight, and enlarged at the extremity; and the lip is semicircular, but somewhat pointed at the apex. These organs are of a yellowish-brown colour, being much the brownest at the base. The sternum is heart-shaped, with eminences on the sides, opposite to the legs; it is clothed with hairs, and of a yellow-white hue, with dark brown spots on the margins. The legs are long, provided with hairs and spines, and are of a yellowish-brown colour, the metatarsi and tarsi being much the palest; the femora, genua, and tibiæ are tinged with red, and minutely spotted with black; the first pair is the longest, then the second, and the third pair is the shortest; the tarsi are terminated by claws of the usual number and structure. The palpi are short, and have a pale dull yellow hue; the cubital is smaller than the radial joint, and projects a bristle in front; the radial joint is protuberant on the inner and outer sides; the digital joint is oval, with a process at its base curved outwards; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, protuberant, complex in structure, with a trifid process near the middle, which projects a fine point from its anterior side, and a strong, brownish-black, curved spine at their extremity, whose prominent termination is directed downwards; the colour of these organs is pale red-brown. The convex sides of the digital joints are directed towards each other. The abdomen is oviform, slightly prominent on each side of its anterior extremity, sparingly clothed with hairs, moderately convex above, and projects over the base of the cephalothorax; it is of a pale dull yellowish colour, with a row of minute depressed brown spots on each side of the medial line of the upper part, and two small, nearly contiguous, yellow spots placed transversely above the spinners; the sides and under part are marked with short black streaks and spots, the latter, which is the darker, having a slightly curved yellowish-white band on each side; and on the outer side of the base of each inferior spinner there is a spot of the same hue.

Epeïra tristis.

Length of the female $\frac{5}{24}$ths of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{9}{20}$; length of a leg of the third pair $\frac{1}{5}$.

The abdomen is of a somewhat depressed oviform figure, projecting a little beyond the spinners and greatly over the base of the cephalothorax; it is thinly clothed with hairs, and has a large chocolate-brown oval band, whose slightly sinuous margins are bordered with yellowish-white, extending along the middle of the upper part; the anterior extremity of this band tapers to a point, and the posterior part comprises four longitudinal rows of very minute, obscure yellowish-brown spots; the sides have a yellowish-white hue, tinged with brown at the lower part, and are marked with black and dark-brown streaks and blotches;

the under part has a brownish-black hue, and there is an oblong white spot immediately behind the sexual organs; these organs are moderately developed, with a longitudinal transversely striated septum in the middle, whose anterior extremity is directed forwards, and whose posterior extremity is much the broadest; they are of a yellowish-brown colour, marked with dark brown at their termination. The eyes are disposed on the anterior part of the cephalothorax; the four intermediate ones nearly form a square, the two anterior ones, which are seated on a protuberance, being slightly wider apart than the posterior ones; the eyes of each lateral pair are placed horizontally on a minute tubercle; they are separated by a conspicuous interval, and the posterior ones are the smallest of the eight. The cephalothorax is compressed before, rounded in front and on the sides, convex, depressed before, abruptly so at the base, with a narrow indentation in the medial line; it is clothed with hoary hairs, and of a yellowish-brown colour, with narrow dark brown lateral margins, and a dull yellow triangular spot at the posterior point of the cephalic region. The falces are powerful, conical, vertical, and armed with teeth on the inner surface; the maxillæ are short, straight, and enlarged at the extremity; and the lip is semicircular, but somewhat pointed at the apex. These parts are of a dark brown colour, the first at the base in front, and the last two at their extremity, having a yellowish-brown hue. The sternum is heart-shaped, with small eminences on the sides opposite to the legs; it is of a pale dull yellowish colour, with a dark brown band extending along each side; these bands meet at its posterior extremity, and have their inner margin strongly sinuous. The legs are long, provided with hairs and a few spines, and are of a yellowish-brown colour, with brown annuli, those at the extremity of the femora of the first, second, and fourth pairs being the broadest, and, with the genua, almost black; the first pair is the longest, then the second, and the third pair is the shortest; the tarsi are terminated by claws of the usual number and structure. The palpi resemble the legs in colour, and have a curved pectinated claw at their extremity.

Epeïra gracilipes.

Length of the male $\frac{1}{6}$th of an inch; length of the cephalothorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{13}{24}$; length of a leg of the third pair $\frac{3}{16}$.

The legs are very long, slender, provided with hairs and spines, and of a pale reddish-brown colour, the femora and the extremity of the tibiæ of the anterior pair and the extremity of the tibiæ of the second pair having a dark brown hue; the first pair is much the longest, then the second, and the third pair is the shortest; each tarsus is terminated by claws of the usual number and structure. The palpi are short, and of a dull yellowish colour; a long slender bristle projects from the extremity of the cubital joint in front; the digital joint is oval, convex and hairy externally, concave within, and with this concavity the dark brown palpal organs are connected; they are highly developed, prominent, not very complex in structure, subglobose at the base, from which projects a long slender process, directed obliquely downwards and outwards, whose pointed extremity is curved. The convex sides of the digital joints are directed towards each other. The cephalothorax is compressed before, rounded on the sides, thinly clothed with hairs, convex, glossy, with a shallow indentation in the medial line, and is of a dark brown colour, with a large reddish-brown triangular mark, whose vertex is directed backwards, in the cephalic region. The eyes are seated on black spots on the anterior part of the cephalothorax; the four intermediate ones form a square, the two anterior ones, which are placed on a prominence, being the largest of the eight; the eyes of each lateral pair are seated obliquely on a small tubercle, and are near to each other, but not in contact. The falces are long, conical, vertical, and of a brownish-red colour. The maxillæ are straight, and enlarged at the extremity; and the lip has a short, oval form. These organs have a dark brown hue, the apex of the latter being tinged with dull yellow. The sternum is heart-shaped, and of a dull brownish-yellow colour, with dark brown lateral margins. The abdomen has an oblong-oviform figure; it is somewhat depressed, sparingly clothed with short hairs, glossy, and projects over the base of the cephalothorax; the upper part is of a yellowish-brown colour, with a dark brown band in the middle, which tapers to the spinners, and is somewhat irregular in outline; the under part has a dark brown hue, with an obscure pale yellow line extending from each branchial operculum to the spinners, and on each side of those organs there are two minute spots of the same colour.

Epeïra mucronata.

Length of the male $\frac{3}{16}$ths of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{14}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{13}{24}$; length of a leg of the third pair $\frac{1}{7}$.

The cephalothorax is compressed before, rounded on the sides, convex, glossy, with a large indentation in the medial line; the falces are conical, vertical, and armed with a few teeth on the inner surface; the maxillæ are short, powerful, obliquely truncated at the extremity, on the outer side, and inclined towards the lip, which is semicircular, but pointed at the apex; and the sternum is heart-shaped. These parts have a pale dull yellow hue, and the cephalothorax, which is rather the darkest, has a black line extending from the medial indentation towards the intermediate eyes, which gradually diminishes in breadth to its anterior extremity. The eyes are seated on black spots on the anterior part of the cephalothorax; the four intermediate ones are placed on a prominence and nearly form a square, the two posterior ones, which are the largest of the eight, being rather wider apart than the two anterior ones; the eyes of each lateral pair are the smallest; they are seated on a minute tubercle, and are almost in contact. The legs are slender, provided with hairs and spines, and are of a brownish-yellow colour, the extremity of the joints being much the darkest; the first pair is the longest, the second pair slightly surpasses the fourth, and the third pair is the shortest; each tarsus is terminated by the usual number of claws of the customary structure. The palpi are short, and of a pale yellow colour, with the exception of the digital joint, which has a yellowish-brown hue; the radial is stronger than the cubital joint; a long bristle projects forwards from the extremity of the latter, and the former is prominent on the outer side; the digital joint is oval, with an obtuse, glossy process at its base, curved outwards; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, prominent, complicated in structure, with several projecting processes, and a prominent spine, originating near the middle of the inner side, which curves across towards the outer side, and then passes downwards towards the extremity; they are of a yellowish-brown colour, intermixed with dark reddish-brown. The convex sides of the digital joints are directed towards each other. The abdomen is subcylindrical, somewhat convex underneath, and sparingly clothed with hairs; from the middle of the anterior extremity of the upper part a small acute corneous spine is directed obliquely upwards and forwards, and the posterior extremity, which is slightly elevated, projects beyond the spinners; it is of a dull yellow colour, with three narrow white bands extending from the anterior to the posterior extremity of the upper part, a small cruciform black spot occurring on the latter; the medial band is fusiform, and comprises a longitudinal line of a dull yellow hue; the colour of the spinners is dark brown, and that of the branchial opercula yellowish-brown.

[To be continued.]

XLVIII.—*Note on the supposed "Discovery of an extremely minute Vertebrate Lower Jaw in Mud dredged at St. Helena, by* Dr. Wallich, F.L.S." By C. Spence Bate, F.R.S., F.L.S. &c.

No doubt every naturalist must have received with astonishment Dr. Wallich's recent announcement of his discovery of the jaw of so minute a vertebrate animal as he records in the 'Annals' for October last.

I am sure he will not think that I am intrusively officious in pointing out some conditions in the specimen that appear to throw considerable doubt upon its being the jaw of any animal at all.

I would premise that, upon the announcement of any new or important circumstance, it is incumbent that we should first ascertain whether or not it be consistent with our present knowledge, before the discovery be accepted as a fact.

Assuming that Dr. Wallich's figure in the 'Annals,' as I have no doubt, is correct, there are two features that seem to be inconsistent with the idea of the specimen being the jaw of a vertebrate animal: I allude to the circumstance of there being no condyloid process, and the character of the teeth.

I believe that I am correct in asserting that we have not a single instance of an animal having the marginal process of the jaw developed into a serrature such as Dr. Wallich has figured. In those reptiles where the teeth anchylose with the bone, the teeth are yet implanted in alveoli of their own. In fish (of which this cannot be a jaw), the dermal attachments of the teeth, when removed, leave the jaw smooth.

The question will probably be put, If it be not the jaw of a vertebrate animal, what is it? In reply, I would state that it appears to me to be the dactylos or last joint of a leg of a small *Hyperine Crustacean*, and that the circumstance which has misled Dr. Wallich is that, the animal being near the period of moulting its skin, the joint exhibits, within, a second row of marginal armature, which has been mistaken for a second ramus.

I have repeatedly seen specimens under such conditions as I mention, which, though not agreeing in exact detail of serrature with that figured in the 'Annals,' may yet be sufficiently near to identify the group to which the part belongs.

In the sketch below, I figure a leg of *Phrosina longispina*, as well as one in which a drawing of the supposed jaw is substituted for that of the true dactylos, for comparison with Dr. Wallich's drawing.

The genus *Phrosina* is very abundant in the tropical and subtropical Atlantic Ocean.

Of course, in making this statement, I do so with all reservation, since I know nothing of the specimen beyond what has appeared in the 'Annals of Natural History' for October last.

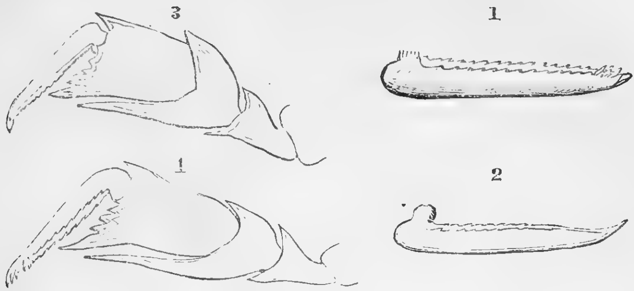


Fig. 1. Supposed vertebrate jaw; reduced from the figure in the 'Annals,' page 304.
Fig. 2. Dactylos of the fourth pair of pereiopoda of *Phrosina longispina.*
Fig. 3. Leg of ditto, with dactylos *in situ,* as it appears a short time previously to moulting.
Fig. 4. Ditto, with fig. 1 inserted instead of the true dactylos.

XLIX.—*On the supposed Vertebrate Lower Jaw, dredged in Mud at St. Helena.* By Dr. Wallich, F.L.S., F.G.S.

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

Gentlemen,

In the October Number of the 'Annals' you were good enough to insert my notice regarding the supposed discovery, in mud dredged at St. Helena, of a minute vertebrate lower jaw. That notice was more hastily penned than it should or indeed would have been, had I not been desirous of exhibiting the specimen at the then approaching meeting of the British Association.

Although more than one distinguished naturalist coincided in the opinion expressed by me as to its nature, there were others who at once pronounced it to be no part of a vertebrate structure, but referred it, each in turn, to portions of the invertebrate division very widely removed one from the other. My own impression, entertained and expressed from the first, was that, if not a vertebrate jaw, the object in question formed part of an Echinoderm, this supposition being based on a faint trace of reticulated texture observable under a high power at the point answering to the angle of the right ramus in the lateral view.

In order to show how diverse were the opinions expressed, I may mention that the specimen was pronounced to be—the mandible of a fish, a portion of the lingual ribbon of *Mitra*, a claw of a minute Crustacean, part of the manducatory apparatus of *Notommata* or an allied species, and, lastly, a valve of a Pedicellaria; some of the advocates of these conflicting judgments still retaining their views unchanged.

To Mr. Busk is due the merit of pointing out the extremely close analogy between the object in question and certain Pedicellariæ,—his intimate acquaintance with every kind of minute organic structure leading him to regard its Pedicellarian origin at all events as highly probable, if not certain.

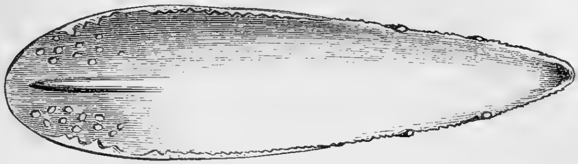
On being made aware of Mr. Busk's opinion, I immediately examined the Pedicellariæ of *Echinus lividus*, of which I possess a specimen obtained in the same locality. The valves, although not identical, bear a sufficient resemblance, both in configuration and detail, to satisfy me of the probable accuracy of Mr. Busk's view; at the same time I think it better to reserve my final determination of the structure, pending still further inquiry and comparison.

The communication on the subject by Mr. C. Spence Bate (politely submitted to me, at his request, prior to its publication in the present Number of the 'Annals') will show how far the occurrence of pseudomorphs in the organic world should put us on our guard against hasty generalisation founded on semblances in figure alone.

In the case more immediately under notice, I was by no means insensible to the facts that the appearance of minute teeth along the greater portion of each ramus of the supposed jaw might be due, in reality, to simple serrature of its margin, and that the true texture of vertebrate bone was not visible in its substance. But, on the other hand, it seemed unreasonable to assume that absolute identity in structural detail should exist between an object of such minute dimensions and the homologous parts of the larger animals to which it is allied. Or, even assuming that the intimate structure must be identical in type, we might fairly suppose that minute details, observable only under the microscope in the larger orders, would become so inordinately reduced in size in an organism already microscopic, as to be invisible.

The figure accompanying my former note, although accurate as a sketch, fails to convey the full extent of the resemblance to a jaw, the projecting digitate-like processes in the region corresponding to the articulation being too jagged, and the serrature too saw-like.

Probably the true figure of the object, seen from above, is that of an elongated spoon, as shown in the adjoining diagrammatic woodcut, the serrature being present along the entire margin



except at the broader extremity, where it takes the form of the digitations which, on a side view, constitute the most elevated portion; and anteriorly, where it is interrupted by the four large hollow teeth in the neighbourhood of the symphysis; the intermediate mass, seen in profile in the original figure, being a a triangular and somewhat irregular flattened ridge.

I remain, Gentlemen,

Your most obedient Servant,

G. C. Wallich.

L.—*Descriptions of a few West-African Birds.* By G. R. Gray.

To the Editors of the Annals of Natural History.

Gentlemen,

The following descriptions of a few birds, which appear new to the fauna of West Africa, may interest some of your readers. They were collected on the Cameroons Mountains, at an elevation of 7000 feet above the level of the sea. They were brought to this country by Mrs. Isabel Burton, the estimable lady of the distinguished traveller and Vice-Consul, Capt. Burton, and kindly presented by her to the British Museum.

Pratincola salax.

Pratincola salax, Verr., Rev. et Mag. de Zool. 1851, p. 307.

Cossypha Isabellæ.

Head black, with a shining white mark between the nostril and the middle above the eye; back olivaceous-black; wings black, each feather margined with olivaceous; beneath the body rufous-buff, deeper on the breast; rump and outer tail-feathers deep rufous, with the tips of the second, third, and fourth feathers, and tip and outer margin of the first feather, black; the four middle feathers black, with the outer margin of the fifth near the base deep rufous.

Total length, 6″; wings, 2″ 11‴; tarsi, 13‴; bill from gape 9‴.

This bird is named in compliment to Mrs. Isabel Burton.

Zosterops (*Speirops*) *melanocephalus.*

Mouse-colour, washed with olivaceous; head sooty black, with a spot on each side between the nostril and eye; mentum and under wing-coverts white; beneath the body pale obscure grey, tinged with olivaceous; quills and tail fuscous-black, the former margined outwardly with grey. Bill and feet whitish horn-colour.

Total length, 4″ 9‴; wings, 2″ 5‴; tarsi, 9‴; bill, from gape, 7‴.

Trichophorus tephrolæmus.

Yellowish-olive; head and throat slate-colour, darker on the head; abdomen yellow; breast, sides, and under tail-coverts olivaceous-yellow; quills fuscous-black, with outer webs olivaceous, the inner web margined near the base with buff; tail dull olivaceous, the end of the outer feather slightly tipped with yellow; bill black; feet plumbeous.

Total length, 7″ 6‴; wings, 3″ 3‴; tarsi, 10‴; bill, from gape, 10‴.

Closely allied to *Trichophorus canicapillus*, Hartl.; but the throat is pale ash-colour.

Euplectes phœnicomerus.

Black; rump and wing-coverts pale clear yellow; under wing-coverts pale rufous-white; thighs pale brown.

Like *E. xanthomelas*; but the yellow on the rump and wings is paler, and the thighs are pale brown instead of black.

Total length, 5″ 3‴; wings, 2″ 10‴; tarsi 11‴; bill, from gape, 7½‴.

Ligurnus olivaceus*, Hartl.

Coccothraustes olivaceus, Fras., Proc. Z. S. 1842, p. 144.

Adult male yellowish-olivaceous; head and throat deep black; sides and a narrow band round the neck, rump, and beneath the body bright orange-yellow; quills black, with the tertials and larger wing-coverts margined outwardly with bright yellow, and the quills inwardly with white; tail olivaceous-green, with each feather margined on the sides and tip with bright yellow; bill orange; feet pale.

The *female* agrees with Mr. Fraser's typical specimen, said

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* *Ligurnus rufobrunneus.*

Rufous-brown, slightly darker along the shaft of each feather; wings and tail dull brown, margined with rufous-brown; beneath the body much paler, varied in some places with darker; bill and feet horn-colour.

Length, 6″; wings, 3″ 5‴; tarsi, 9‴; bill, from gape, 7‴.

This bird has been many years in the collection of the British Museum. It was brought to this country from Western Africa by Capt. (now Major-General) Sabine, R.A., and was presented by him to that institution.

to have been obtained at Fernando Po, and which is now deposited in the British Museum. It is figured in the 'Zoologica Typica,' pl. 47, by Mr. Fraser.

Young.—Dull olivaceous-green; beneath the body dull olivaceous-yellow; bill and feet blackish lead-colour.

Strobilophaga Burtoni.

Fuscous, varied with pale olivaceous on the sides of the plumes; wing-coverts fuscous-black, tipped with white; quills and tail fuscous-black, margined narrowly with yellow; abdomen obscure white, spotted with fuscous-black down the shaft of some of the feathers; upper mandible horn-colour, lower mandible white; feet plumbeous.

Total length, 7″; wings, 3″ 6‴; tarsi, 9‴; bill, from gape, 8‴.

The formation of this bird agrees in every respect with the genus *Pinicola* or *Strobilophaga*. A species of this genus has not hitherto been recorded as found in Africa.

To these may be added the

Cosmetornis Burtoni.

It is very similar to the *Cosmetornis vexillarius* (Gould), G. R. Gr., but differs in the white spot at the base of each quill being narrower, while the white at the tip of the second, third, fourth, and fifth quills is more prominent and slightly mottled with rufous on the outer web; the first quill longer than the second, fuscous-black, and partly margined with rufous on the outer webs; the sixth feather is rather longer than the fifth, the seventh rather longer than the latter; both are fuscous-black, slightly mottled with pale rufous, having the bases of the inner webs white; the eighth is much longer than the first quill, and fuscous-black, slightly mottled with pale rufous, the base of the inner web white or pale rufous; the ninth feather (or, as it has been termed, "standard feather") is the longest of all, measuring more than 17 in.; it is white at the base of both inner and outer webs, but passing into pale rufous, or rufous-white mottled with black, on the outer web, while the inner is only rufous-white for its entire length from the basal white.

The specimen is in an imperfect state, and only sufficient to afford the above description so as to distinguish it from the previously known species. The British Museum is indebted to the liberality of Capt. Burton, H.M. Vice-Consul, who has just sent it with other zoological specimens, all marked as from Fernando Po, and after whom I have the pleasure of naming this interesting bird.

LI. *On the Aquiferous and Oviducal System in the Lamellibranchiate Mollusks.* By George Rolleston, Esq., M.D., F.L.S., Linacre Professor of Anatomy; and C. Robertson, Esq., Demonstrator of Anatomy, Oxford*.

Very different explanations have been offered of the means by which certain of the Lamellibranchiata are enabled to distend their muscular foot until the fluid with which it is swollen up causes it to appear all but transparent. These explanations, different as they are both in principle and in detail, admit yet of being reduced under one or other of three heads. Either they postulate the existence of a system of tubes homologous with the tracheæ of insects, and, like them, distinct from the animal's blood-vessels, as necessary for the explanation of the great changes of volume observed to take place in the mollusk's body; or they suppose these alterations of size to be effected by the agency of the blood-vascular system alone; or, thirdly, they hold the effect in question to be due to the joint working of these two systems of tubes.

Agassiz† refers the great distention observable in the foot of the *Natica heros*, of the *Pyrula carica* and *canaliculata*, and the Acephalous *Mactra solidissima*, to water inhaled by orifices more or less numerous, of less or greater calibre, in the muscular foot: these orifices, and the tubes in connexion with them, he speaks of as a water-vascular system, but he holds that they come into more or less direct and constant communication with the true blood-vascular system.

Theodor von Hessling‡, who obtained the same result of injecting fully the blood-vascular system, by throwing in fluid from the glandular depression in the foot of the *Unio margaritifera*, as Agassiz did by a similar procedure with the similar depression in the foot of the Gasteropodous *Pyrulæ*, speaks of the system (which on these grounds he holds to be continuous) as but one system and that a blood-vascular system, with certain orifices patent and communicating with the external medium in which the animal lives. Von Hessling holds also that the distention of the foot may be in part due to water inhaled through the organ of Bojanus, and mingled thus with the blood, as we shall presently describe.

M. Langer§ holds that the organ of Bojanus is the route by which the water, upon which the change of volume in the animal's body depends, passes into it, and that this water passes into the blood-vessels, and not into any specialized water-vascular system.

* From the Philosophical Transactions, Part I. for 1862, p. 29.

† Zeitschrift für wiss. Zoologie, Pt. 7. p. 176, 1855.

‡ Perlmuscheln und ihre Perlen. Leipzic, 1859: p. 241.

§ Denkschriften d. Kaiserlich. Akad. Wiss. xii. p. 55, 1856.

M. Lacaze-Duthiers has discovered and described* yet another route than that of the organ of Bojanus, by which, in the *Dentalium* and *Pleurobranchus*, water from without can find its way into the interior of vessels carrying blood, and carrying it in these instances towards the heart, and not towards the gills.

Gegenbaur† differs from these authors merely in postulating the existence of orifices of exit as well as of entrance for the water; and these he holds to correspond with the puncta scattered over the foot-surface, and visible in great abundance occasionally along and near its free edge.

Von Rengarten‡ exactly reverses the functions thus supposed to belong to the punctated foot-pores, and the passage through the organ of Bojanus severally.

In a paper read by us§ before the Royal Society, February 3, 1859, we spoke of the water-vascular system as having its outlet in close approximation to the external orifice of the organ of Bojanus; and its inlet we suggested might be indicated by the position of the parasites which are not rarely to be seen studding the foot-surface and marking out the presence of its numerous pores. Gegenbaur, we observe ||, considers that the great liability of the foot to injury from the entrance of foreign bodies into these pores is an argument for regarding them as exhalant rather than inhalant orifices.

Further iuvestigations, carried on by us subsequently to the reading of that paper, showed us that our views as to the oviducal system in the Lamellibranchiata were founded in error. An exceedingly courteous notice of this mistake by M. Lacaze-Duthiers¶ in the 'Proceedings of the Royal Society' rendered an earlier retractation of this part of our paper unnecessary. Our views, on the other hand, as to the permeation of the bodies of the Lamellibranchiata by a system of vessels distinct from those in which the blood is contained remain much what they were.

Before stating our views, and the arguments by which we would support them, we would say that the "perivisceral chamber" of the Brachiopoda, as described by Mr. Hancock** in a paper in the 'Philosophical Transactions,' which was published subsequently to the reading of our paper already referred to, holds much the same relation to the circulatory and reproductive and other viscera, as the system which we have called "aquiferous" in the Lamellibranchiata. As Mr. Hancock†† has

* Ann. des Sciences Naturelles, tom. xi. 1859, p. 255; Ann. Nat. Hist. ser. 3. vol. v. p. 225.

† Grundzüge der vergleichenden Anatomie, p. 352, 1859.

‡ Diss. Inaug. Dorpat, 1853, cit. Von Hessling, *loc. cit.* p. 236.

§ Ann. Nat. Hist., ser. 3. vol. iv. p. 65.

|| *Loc. cit.* p. 352.

¶ Ann. Nat. Hist., ser. 3. vol. v. p. 225.

** Philosophical Transactions for 1858. Read May 14, 1857.

†† *Loc. cit.* p. 844.

himself pointed out the close correspondences of the two systems, we will but remark upon one point of discrepancy between them. In the Brachiopods the genitalia are packed into the main stems of the arborescent perivisceral system, in the direct course of the stream, if we may speak of it as a water-vascular system; in the Lamellibranchiata, or, at all events, in the family Unionidæ, the cæca of the generative gland are appended laterally to the divergent twigs of the principal branches of the water-vascular tree; they do not lie in the direct course of the current of the aquiferous canals, and these canals, beyond and outside of them, break up into a very delicate minutely divided system of capillary tubes. What we shall attempt to prove is, that the orifices on either side of the foot in the Unionidæ lead not only to the generative gland, the products of which may be seen to issue forth from them at the spawning-season, but also to a system of tubes widely spread through the entire foot. We do not believe that any direct communication subsists either between the blood-vascular system and this system of tubes, or between either of these systems and the punctated depressions and inlets along the foot-edge. The blood-vessels seem to us to constitute a system of tubes closed, save at one point and at one lacuna. That point and that lacuna is the pericardial space—a cavity into which, besides the blood of the animal, the water in which it lives also finds its way. As the bivalve shell opens, it necessarily dilates this lacuna, and water is thus drawn into it through the compound sac known in the Acephala as the organ of Bojanus. The water then gains access to the interior of the blood-vessels, as we shall proceed to show, and is carried onward within them. From the blood-vessels we suppose it to transude into the system of water-tubes everywhere in apposition with them, and, under normal conditions, to find its exit by these tubes, whilst under such abnormal circumstances as the sudden removal of the creature from the water, the sudden contraction of the muscular foot, causing jets of water to pour forth from the dilated semitransparent mass, may unload the infiltrated organ in a yet more expeditious manner. As to the way by which the water used by the mollusk for distending its foot comes into the body, we are at one with many other writers upon this subject; but we are not aware that our views as to the method by which the animal disencumbers itself of the ingested fluid are shared in by other authors.

Our arguments will be principally based upon the results of experiments made in the way of injection. The animals we operated upon were almost exclusively of the family Unionidæ; and, on account of the size of the specimens, as well as for other reasons, we employed chiefly the species *Anodon cygneus* and *Unio margaritifera*. In all our experiments we strove to reproduce, as nearly as possible, the conditions of the animal's natural life: our injections were always performed under water, by which and by other means as much support was given to the animal's body and its several parts as the water and the shell gave to it during life. Means were always adopted for securing that the animal died with its muscular system in a state of relaxation. We found the prussian blue injecting-fluid of Prof. Beale's * invention to possess many properties especially recommending it for use in our experiments, but we employed several other fluids as well.

Experiment 1.—If an *Anodon* or *Unio* (size is of little consequence in this experiment, though large size is a convenience in most) be removed from its shell without injuring the somewhat easily injured tissues which limit the secreting-structure of the organ of Bojanus, and supported in water with its foot downwards in such a manner as to put its pericardial lacuna, and the parts in connexion with it, as nearly as possible into the condition in which they may be supposed to be in in the shell during life, and if an injection be then made into the pericardial lacuna, the following results will be seen to take place. The so-called "reddish-brown organ of Keber" (a plexus of vessels rich in pigmentary deposit, continuous with other vessels not so coloured in the mantle and elsewhere, and bounding the pericardium on either side, and opening into it by several patent orifices at its anterior end) will become filled with the injecting-fluid first; next the gill-vessels, and sometimes together with them, yet not invariably, the systemic veins; and lastly the external orifice of the organ of Bojanus will, on removing the animal from its prone position, be seen pouring out the injection on either side of the animal's foot.

Experiment 2.—A large *Anodon* was injected with a red stiffening-injection from the central branchial vein, a vessel readily injectible, lying as it does in the gill-cavity superiorly between the two innermost laminæ of the gills, in the angle where they become continuous with each other posteriorly to the posterior edge of the foot, with the following results:—The auricle and ventricle were filled to distention, the reddish-brown organ as well, and, besides the reddish-brown organ, the rest of the mantle, up to within a quarter of inch of its free edge. No fluid, however, had penetrated into the pericardial space. The absence of penetration into the pericardium we have invariably had to record in our numerous injections from the branchial veins, even when the injection is noted as having been so entirely successful as to have passed through the aorta in such abundance as to inject in fine ramuscular divisions the edge of the muscular foot.

* 'How to work with the Microscope,' p. 78, 1857.

The former of these two experiments is so easy of performance, and yet proves so much, that we cannot but express our surprise at nowhere finding any record of its having been made by any of the different experimenters who have employed injections as a method for investigating the economy of mollusks. We have repeated it so frequently with the same results, as to have become quite convinced that the pericardial lacuna communicates, on the one hand, with blood going gillward, and, on the other, with the water in which the animal lies.

The uniformity with which our repetitions of Experiment 2 have led to the same negative result inclines us to doubt the existence of any direct communication between the aquiferous pericardial lacuna and the branchial veins properly so called. We are the more disposed to accept this conclusion, as in no mollusk whatever which is possessed of branchial vessels, except the *Pleurobranchus* *, has the renal organ been shown to conduct the external water into the cavity of vessels homologous, not with the afferent, but with the efferent † branchial vessels of higher organisms.

Though Experiment 2 may seem to prove that the intravascular blood does not set in any very free current outwards into the pericardial space, especially when coupled with the observation that in multitudinous and varied injections of the different systems of blood-vessels we have never succeeded ‡ in filling the pericardium from the blood-vessels, easy though it be, as in Experiment 1, to make the injected fluid take the reverse direction, more direct evidence is yet needed in support of our view of the organ of Bojanus as the channel for an inwardly-setting current of water. The following considerations seem to us to show conclusively that, though Experiment 1 shows that it is possible for intrapericardial fluid to find its way outwards through the renal organ, such is not the direction usually taken by the fluid contained in the complex aquiferous system thus constituted.

1st. If we examine with the microscope the fluid contained in the pericardial space, we shall find it to contain, besides the morphological elements of blood, certain foreign bodies, such as the *Aspidogaster conchicola* and infusoria. Now these creatures must be supposed to have found their way inwards through the organ of Bojanus.

* M. Lacaze-Duthiers, Ann. Nat. Hist., *loc. cit.*

† Gegenbaur, Grundzüge, p. 367.

‡ M. Langer's language (Denkschriften d. Akad. Wiss. *loc. cit.* p. 43), in describing his success in such injections, is so qualified, "und sah, *doch nicht immer*," as to allow one, without discourtesy, to give less weight to his views on this than on most other points.

2ndly. The external orifice of the organ of Bojanus may be seen in a living *Anodon* (and, from its lying exposed in the gill-cavity, with yet greater ease in a *Unio margaritifera*) to execute movements of alternate opening and shutting, similar in character to those executed, as has been repeatedly noticed, by the analogous organ in the Pteropoda. These movements are repeated as frequently as once in every ten seconds (or oftener) in the *Unio margaritifera*; and they possess, there can be little doubt, in these as in other mollusks, the power of filling with water the cavities into which it leads.

3rdly. The glandular portion of the compound organ of Bojanus has its opening into the pericardium guarded by a funnel-shaped projection which acts as a valve looking heartwards, and offers resistance consequently to fluid passing outwards from that lacuna.

4thly (Experiment 3). Fluid thrown in by the external orifice of the organ of Bojanus, as it is either artificially, as in the *Anodon*, or naturally, as in the *Unio margaritifera*, exposed in the gill-cavity, finds its way even more easily into the pericardium than fluid thrown, as already described, into the pericardium finds its way into the gill-cavity by the reverse route. This experiment is but an imitation of what we may suppose to take place whensoever the animal by opening its valves dilates its pericardial space. As an immediate consequence of this dilatation, water is ingested into the blood-vascular system, and is forthwith applied to the purpose of distending the foot and protruding it through the opening valves.

Up to this point our views are in accordance with those adopted by several authors, though we are not aware that our method of proof has been employed by any other observers, so far as its detailed application is concerned.

We will now proceed to give our reasons for supposing that another system of tubes comes in aid of the blood-vascular system, and receives from it the fluid which that system has been the means of taking up in the manner described. Our arguments will go to show that water is transferred from the blood-vessels in the foot of the freshwater mussel to another set of vessels, the main stem of which has the additional function of outlet to the generative gland. As, however, Von Hessling* holds that the system of pores in the foot plays no inconsiderable part in the work of supplying the distending foot with water, acting in aid of, and in alliance with, the system of the organ of Bojanus, and, with Agassiz and Von Rengarten, as already cited, holds this office to be exclusively discharged by this system of pores and inlets, we will begin by stating our

* Perlmuscheln und ihre Perlen, p. 238 *et seq.*

reasons for demurring to these views, in which we ourselves at one time participated. It will be necessary to give the details of two sets of experiments, to show how we came to give up an opinion which can plead such high authorities as those we have cited for its defence.

Experiment 4.—A large *Anodon,* having died with its foot in a semidistended state, was injected from the venous sinus which receives the blood from the systemic veins and distributes it to the renal-portal system, with the prussian-blue injection already spoken of. The injection spread over the liver and over the whole of the generative gland, and the exclusively muscular part of the foot, spreading itself in especial richness along the free edge. No pressure which we subjected the foot to, when thus fully injected, caused any of the blue injection, easily and readily though it runs, to issue forth. Subsequently to this, a stiffening injection of red colour was thrown into the foot-mass from the oviducal outlets. This second injection spread itself very richly over the ovary, over the liver, and into the muscular foot, *along the free edge of which it issued in small jets without any pressure being applied.*

We will disregard, for the moment, the bearing which this experiment has upon the distinctness from the blood-vascular system of the system of tubes in the muscular foot, to which the stem opening (under the name of oviduct) into the mantle-cavity leads, and we will relate the details of another set of experiments, which led us to consider the phenomenon of the jets issuing from the foot-edge as due, in spite of the frequency with which we have seen it recur, to violence done, possibly unavoidably, to the delicate limitary tissues of these aquiferous tubes.

Experiment 5.—A *Unio margaritifera,* which had died with its foot quite relaxed, had the blue injecting-fluid introduced into its aorta, its venous system, and through the oviducal orifices, until the foot, from a state of perfect softness, became tense and swollen up. *On pressure, none of this triply-injected blue fluid could be made to issue forth from the foot-edge; but small hernia-like projections of transparent membrane rose out like bubbles all along the foot-edge.* They contained at first a transparent fluid, but after a little pressure they became filled with the blue injection. The thinness and transparency of these little sacs will account for the rarity of their appearance, and the comparative frequency with which jets of injected fluid have made themselves noticed in the region corresponding to the cæcal endings of tubes which these sacs must be held to represent. The depressions and pores which do exist in the foot of the Lamellibranchiate mollusk we believe to be glandular in character, and destitute of any direct communication with the blood-vessels or other tubes in the animal's body. Now the *Unio margaritifera* stands in the same relation with reference to these foot-pores to the *Anodonta cygnea* as the *Pyrula carica* and *P. canaliculata* do, according to Agassiz, to the *Mactra*; that is to say, the foot of the *Unio* presents us with a gigantic pore, in the shape of a glandular depression of as much as an inch in length and two lines in diameter, whilst that of the *Anodon* is pierced but by microscopic inlets. Von Hessling*, by whom this organ has been very accurately described, believes that injections can be made to pass, without rupture of any limitary membrane, from its cavity into the blood-vessels; and Agassiz holds a similar view with reference to the nearly similar structure in the *Pyrula*. But in the *Unio* just spoken of as so fully injected, as well as in several others similarly treated, though the sides and walls of this glandular depression were very richly injected, none of the injection could by pressure be made to issue out into the water in which the animal was lying. We should be inclined to consider this involution or glandular depression in the foot of the *Unio* as homologous with the foot-gland of the terrestrial Gasteropods; and the communication which has been held to exist between this Lamellibranchiate organ and its vascular system we should not believe to be more direct than that which subsists between the muciparous foot-gland of the *Limax* and its venous system†.

It is not quite beside the purpose, to remark that the foot of one of the Unionidæ, when thoroughly distended, has a smooth bright appearance, so uniformly spread over the whole surface of its semigelatinous mass as to suggest the idea of the depressions having become everted and thus contributed to increase the size of the infiltrated organism. Though this appearance may not justify such an interpretation, yet it does seem quite inconsistent with the existence of patent pores communicating with the animal's blood-vessels.

We have repeatedly observed that, if a freshwater mussel die with its muscular foot in a state of contraction, no distention of the foot takes place, either by leaving the animal to soak in water till putrefaction sets in, or by artificial injection.

We will now proceed to state our reasons for holding the existence of a water-vascular system distinct from the blood-vessels of the Lamellibranchiata. Siebold‡ states one of the objections urged against the existence of this system of vessels in the fol-

* *Loc. cit.* p. 238. Von Hessling, however, does not mention the occurrence of calcareous concretions impacted in this gland's duct. This we have observed.

† Siebold, Anatomy of Invertebrata, p. 255, note 6, American edition.

‡ Ibid. p. 213.

lowing words:—"The existence in these animals of a double system of lacunæ having this interpretation is attended with many difficulties. For then it must be admitted that one of these systems contains only water and the other blood, and it is difficult to understand how two kinds of wall-less canals can traverse the body without passing into each other." It is, however, demonstrable that in the Unionidæ, at all events, an all but perfectly closed system of blood-vessels exists. We have again and again, with various injecting fluids, found that they will pass from the aorta through a capillary system into a systemic-venous system, from that into what may be called the renal-portal system of the organ of Bojanus, and from that into the branchiæ, without any extravasation, or the formation of any lacuna anywhere. The pericardial space is, in the strictest sense of the phrase, a blood-lacuna; but, as already detailed, fluid cannot be made to pass into it from the blood-vessels, though such communication must take place to a certain extent during the life of the animal, and though the reverse direction of current is one easily demonstrable by artificial means, and is doubtless the ordinary one under normal conditions. There are two venous sinuses, however, in the Unionidæ, receiving, one after the other, the systemic-venous blood, and transmitting it into the organ of Bojanus. The first of these* lies just within the muscular foot, along its superior and posterior edge; it subtends the second, the only one mentioned by authors, and opens into it by an orifice more or less perfectly guarded in different species of Unionidæ. This second sinus lies between the two opposed organs of Bojanus; and from it the systemic-venous blood passes into the capillaries of the renal-portal system contained in those organs. But neither of these sinuses at all answers the character intended to be expressed by the term lacuna; they are homologous rather with the dilated great veins of certain vertebrata than with the lacunæ which do exist in certain molluscan families. There is the less occasion, however, to labour further at demonstrating the non-lacunar character of the blood-vascular system of the Unionidæ, as Von Hessling†, in his recent book on the Pearl Mussel, confirms in this

* Into this sinus the cæca of the generative gland project somewhat freely from amongst the trabeculæ which run across what we call the roof of the muscular foot, from one side to the other; and it is here, we believe, that in injections from the oviducal outlets extravasation so often takes place into the blood-vessels.

† *Loc. cit.* p. 219. Gegenbaur, in his 'Grundzüge,' p. 344, note, hints at some doubt still remaining in his mind as to the distinctness of these capillaries from the tissues they lie amongst. His work bears the same date (1859) as Von Hessling's; and we suppose both to have been published subsequently to the reading of our paper, February 3, 1859.

point the views previously enunciated by Langer, adding to them a description of the histological characters of the vessels intervening between the arterial and venous systems in the *Unio*. It may be considered as beyond a doubt that a system of tubes all but entirely non-lacunar exists in these Lamellibranchiata, carrying their blood from the heart through a systemic, a renal, and a branchial system. No pressure that can in fairness be applied will cause any extravasation of fluid thus injected. Such pressure we have repeatedly applied to *Anodons* very fully distended by injection; and though it be not rare for fluid thrown in by the oviducal outlets to find its way out, as already described, by orifices along the foot, we have never found this to take place with the blood-vascular system.

In making use of the method of injections as a means for showing the independence of the several vascular trees in the Lamellibranchiate mollusks, we have sometimes injected the animal from the oviducal orifice alone, sometimes we have injected the same animal with a differently coloured fluid from its venous or from its arterial system, or from both; in a word, our injections have been either single, double, or triple.

There is no difficulty in causing an injection to enter the body of any large individual of the family Unionidæ from its oviducal orifice; it is especially easy, however, to effect this in the *Unio margaritifera*, as the orifice is not in them, as in most species of the family, covered by the inner lamina of the inner gill, but, together with the orifice of the organ of Bojanus, lies exposed and uncovered in the gill-cavity, and, besides this, is prolonged out in such a manner as to render the introduction of the syringe-pipe a very easy matter.

Experiment 6.—An injection thrown in by this orifice will spread itself over the whole of the viscera contained within the foot, not confining itself by any means to the ovary, but passing on beyond the area occupied by it or the male generative gland, into the exclusively muscular part of the foot, and distributing itself with especial richness along its free edge. That an injection thrown in by this orifice should thus spread itself would go some way towards showing that in the Lamellibranchiate, as in the Brachiopod mollusk, the ducts through which the generative products are extruded lead elsewhere as well as to the generative gland, were it possible to be sure that no transference of the injected fluid had taken place from tubes confessedly in connexion with the generative gland to another system of vessels—that, namely, which carries the blood. That such a transference does not rarely take place in one part of the blood-vascular system, we have already mentioned*; and hence arose the

* Note, p. 454.

necessity for double injections, in which the blood-vascular system was (as has been and will again be described) injected and fully distended throughout the entirety of its own ramifications, before any fluid was thrown into the oviducal orifices, and by still mapping out a tree for itself showed the independence of the system it led to. Single injections, however inferior to double ones, still furnish us with strong arguments for the view we are supporting. A freshwater mussel may have its whole visceral mass perfectly injected, either from the blood-vessels or from the oviducal system; but when thus injected, a practised eye has no difficulty in seeing into which of the two systems the injection has been thrown. The blood-vascular injection is seen to be contained in coarser tubes, and to form a less close network than the aquiferous, which, though confined within fine capillaries, gives, till closely inspected, an appearance almost of uniform diffusion, on account of the closeness of the network it forms.

Secondly, we will give the details of two double injections.

Experiment 7.—A double injection from the venous system and the oviducal in the same *Anodon.* A stiffening size injection of red colour was used for the oviducal or aquiferous system, and the prussian-blue injection, a more easily running fluid, for the venous system, with the following results. The red injection occupies the area corresponding to the generative gland, with coarse as well as with fine twigs, has imparted a faintish blush to the regions occupied by the liver and stomach, but has filled the interior of the exclusively muscular portion of the foot with so close and fine a network as to give it at a distance a uniform red appearance. The blue injection occupies much of the foot-mass in common with and interposed between the red, its larger trunks holding the same position relatively to the larger red trunks as the larger systemic veins do to the larger generative ducts, but it has spread itself into the gills, which the red fluid has not.

Experiment 8.—A similar one to the preceding, but that the blood-vascular system was distended with the fluid used in Experiment 7 for the aquiferous, and *vice versâ.* The red fluid was thrown in by the aorta, it filled a large artery running parallel with the cap of the foot, it filled both labial tentacles, and it set, as it stiffened, in bossy masses along the edge of the foot, lastly it returned to the venous sinus and filled it and the organ of Bojanus,—occupying thus the entire systemic and renal-portal vessels. The blue cold injection was thrown in by the orifices through which the generative products are extruded; and we shall see that it, when thus thrown in, disclosed the existence of a system of vessels distinct from those already so clearly marked out as coextensive with the systemic vessels. It spread itself chiefly over the ovary, but formed a fine plexus along the free edge of the foot beyond the artery described as running parallel with the edge of the foot, and figured as doing so by Langer*.

This experiment must be thought to go a considerable way towards demonstrating the existence of a system of tubes distinct from, however closely apposed to, the blood-vascular system,—this system having been, in this experiment, filled with a rigid mass, and filled with it most thoroughly, as the injection of the organ of Bojanus proves, and yet allowing the trees injectible from the aquiferous outlet to coexist side by side with it, even though the fluid they contained was so much more easily displaced than the stiffening size injection.

Thirdly, of triple injections.

The readiness with which injections pass from the arterial into the venous system make the triple injections which we have practised of less physiological value than at first sight might appear to be the case; and consequently we will content ourselves with giving the details of one such injection.

Experiment 9.—A large *Anodon* was injected from the venous sinus with a yellow stiffening injection; after this had been done, a blue-coloured fluid, also with size for its basis, was thrown into the aorta; and thirdly, a red injection of the same character was thrown in by the aquiferous opening. The blue fluid thrown into the arterial system drove the yellow fluid before it out of the systemic veins almost entirely, but it did not follow it into the renal-portal system of the organ of Bojanus; this organ and the gills remained richly injected with yellow, to the exclusion of both the other colours; the red fluid, finally, which was thrown in by the aquiferous opening, spread itself in couples with the arterial blue over the entire visceral mass, filling alike the areas of digestive and of reproductive organs, and spreading itself with especial richness over the exclusively muscular part of the foot, which it will be recollected is the part of the animal most preeminently distended and distensible by both natural and artificial means.

Lastly, in a large individual of the freshwater-mussel family in which a stiffening or other injection has been thrown in by the orifice through which the generative products are extruded, a simple lens is sufficient to show that the tubes thus injected have the generative cæca affixed to them laterally, and pass on continuously into parts of the foot in which no generative cæca are lodged. It is most especially in that part of the muscular foot into which no viscera are packed, and which forms a belt of considerable width beyond and bounding the generative mass,

* Denkschriften der K. Akad. Wiss. Wien, Bd. viii. Taf. i. fig. 1.

and yet free from any admixture of its constituent elements (as the microscope will show), that we find the capillary network (shown to be in connexion with the oviducal outlet whilst clear of the terminal cæca) of the gland to attain its maximum development. Now this area is the area also of maximum distention in the distended foot. If in a *Unio* which has been injected from the blood-vascular system and from the oviducal, both with differently-coloured injecting-fluids, a portion of the injected tissue be taken from this area and placed under one of the higher powers of the microscope, the fluid which has been thrown in by the oviducal orifice will be seen to be contained in tubes as well and sharply defined as those of the capillaries which the other injected fluid will show to be in connexion with the blood-vessels.

Whilst the analogy of the Echinodermata and many Annelids does away with any *à priori* improbability which may have seemed to attach to the possession by these mollusks of the system of tubes the existence of which we have been striving to demonstrate, the homology of the Brachiopoda furnishes us with a strong *à priori* presumption in favour of the correctness of our view. On the other hand, we cannot forbear pointing out the great improbability which must attach to a view which supposes a fluid of such morphological and such chemical characters as is the blood of the freshwater mussel to be diluted as it must be diluted on the hypothesis of the blood-vessels being the agents by which the animal voluntarily distends itself often to thrice its undistended bulk. How do the blood-corpuscles which we may take from the interior of the animal's heart behave when thus mixed with water under the microscope *? But it is not upon considerations such as these that we would lay most weight, but upon the evidence which injections of the several systems furnish to the unassisted eye, and upon the confirmation of that evidence which microscopic inspection furnishes.

* "Reagentien, wie ein *Ueberschuss von Wasser,* verdünnte Essigsäure, lösen bei der ersteren Art (Blutkörperchen) den scheinbar festen Inhalt auf, und lassen den Kern, wie die eingeschlossenen Körnchen, deutlich hervortreten. Ihre häufigen Formveränderungen, z. B. die "spiessigen hirschgeweihähnlichen Fortsätze," welche sie treiben, hängen *von unvermeidlichen Diffusionverhältnissen ab,* welchen sie bei der grossen Wassermenge gegenüber ihrer verhältnissmässig geringen Anzahl ausgesetzt sind. Während A. Ecker dieselben *durch eine Bildung von Vacuolen, in Folge deren Vergrösserung sie einreissen,* zu erklären sucht, hält Lieberkühn diese Zellenbildungen für Amöben mit selbständigen contractilen Bewegungen. In innigem Zusammenhang mit diesen Erscheinungen steht *das leichte Austreten des Zelleninhalts,* welcher bisweilen in hellen und hyalinen Tropfen herumschwimmt, ja *nicht selten geht ein Zerfallen* desselben in zahlreiche kleine Tröpfchen noch innerhalb der Zellen vor sich, welche dadurch ein maulbeerartiges Ansehen bekommen, ebenso vereinigen die ausgetretenen Sarcodetropfen diese Körperchen zu den oben erwähnten Klümpchen und Flöckchen."—*Von Hessling, loc. cit.* pp. 219, 220.

LII.—*On the Production of similar Gonozooids by Hydroid Polypes belonging to different Genera**. By the Rev. Thomas Hincks, B.A.

[Plate IX. figs. 1 & 2.]

In the course of the past summer I have had the opportunity of studying at Ilfracombe the reproduction of the *Stauridia producta*, a small Tubularian Zoophyte, which abounds in rock-pools and under ledges near the base of the Capstone. It was first characterized by Dr. Strethill Wright (Edinb. New Phil. Journ., N.S., for April 1858); but he did not observe the reproductive bodies. It has been my good fortune to meet with one or two polypes on which they were present in an advanced stage of development, and I am thus enabled to complete the history of the species.

My principal object, however, in this paper is to put on record the remarkable fact *that the gonozooid of the* Stauridia producta *is identical with that of the* Coryne eximia (*Allman*), *a member of a distinct genus.*

Stauridia is nearly allied to *Coryne*, but is distinguished from it by having tentacles dissimilar in character. The upper, which are arranged in one or more whorls, are furnished with globular tips, as in *Coryne*, while the lower, which form a single verticil, are filiform. The former are armed with thread-cells, and endowed with vigorous percussive power, and constitute offensive and prehensile instruments; the latter are rigid, and furnished with palpocils, and seem to act as tactile organs only.

The *S. producta* is a small, creeping, unbranched form; the *C. eximia* is branched, and attains a considerable size. Yet of the life-series of these two Hydroids, thus dissimilar in general character, one term is identical. The free reproductive zooids of each are, at the time of detachment, undistinguishable from one another. A strictly analogous fact would be the production of flower-buds absolutely identical by two plants of different genera.

In his account of *Coryne eximia* ('Annals' for August 1859), Prof. Allman has remarked on the similarity of its gonozooid to that of another species of the same genus—the *Coryne Sarsii* of Lovén†. He was unable to indicate any character which could be "justly considered as pointing to a specific distinction between the two Medusæ," though he admits that "a more exact comparison with the living animal" might probably result in the detection of differences not then apparent. Dr. Wright,

* The substance of this paper was communicated to the Natural-History Section of the British Association, at the late Cambridge Meeting.

† The *Syncoryna decipiens* of Dujardin.

who has had the opportunity of observing the reproductive zooids of these two species, informs me that one of them has thread-cells on the umbrella, and the other not. He believes that they are present on that of *C. eximia*; and this opinion is confirmed by Mr. G. Hodge's drawing (Pl. IX. fig. 1). It may perhaps be doubtful whether the zooid of *C. Sarsii* is always destitute of them. They seem to be represented in Sars's figure of this species (Fauna Litt. Norvegiæ, tab. 1. figs. 3, 4). But, at any rate, if there be a difference between the gonozooids of these two species, it is of the slightest kind.

In the case of *Stauridia producta* and *Coryne eximia* the identity is complete; and it is the more remarkable as the polypes are generically distinct.

The gonophores of the *Stauridia* are produced at the base of the lower capitate tentacles. I have not observed more than two on a polype; and of these one was in a much more advanced stage of development than the other. They are pyriform at first, very slightly pedunculate, and of a pinkish colour. The contained zooid gradually assumes a hemispherical form as development proceeds; the marginal portion of the disk is folded in, and the knotted arms lie in the interior. After a while, the investing sac of the gonophore appears to be ruptured by the frequent contractions of the umbrella, and by the same movements the involved portion of the disk bearing the tentacles is slowly forced out. In the case which came under my observation, half the margin, with two tentacles, was first pushed out; after a few more violent spasms, the other half followed; and almost immediately the little crystal bell, with its rose-coloured manubrium and four rose-coloured tubercles, from which as many beaded arms were pendent, liberated itself and moved gracefully through the water. (Pl. IX. fig. 2.) The umbrella is studded with thread-cells, which show as bright points against a dark ground. From the centre is suspended a rose-coloured manubrium with a simple mouth. Four radiating vessels pass from the base of it to the marginal canal, and are continuous with as many tentacles. The latter originate in four rose-coloured tubercles, on one side of which is placed a dark reddish-brown ocellus*. The arms are very extensile, and are set, along their entire length, with knot-like clusters of thread-cells, and terminate in a large group which forms a spherical bulb at the tip. I have counted about three dozen of these clusters on a single arm. There are no marginal bodies except the tentacles.

A comparison of this description (which is taken from the

* Dujardin describes the ocellus of *Coryne Sarsii* as "black;" Sars, however, calls it "braun-rothen." The colour in the *Stauridia* is so deep that it might readily be mistaken for black.

Ilfracombe specimen of the *Stauridia*-zooid) with Prof. Allman's account of the Medusoid of his *Coryne eximia* will at once show the perfect identity of the two forms.

Mr. George Hodge has kindly permitted me to make use of a beautiful drawing of the latter from his own pencil (Plate IX. fig. 1), and I have placed beside it a sketch of the former by myself (fig. 2). The diversity in shape is probably due to a difference in age. The specimen from which my figure was taken was in an immature state*.

The *Sarsia turricula* of Prof. M'Crady's paper on "the Gymnophthalmata of Charleston Harbour" (Proc. of Elliott Soc. of Nat. Hist. vol. i. p. 138, pl. 8. figs. 6–8) appears to be identical with the form which I have just described. His account, however, of the *Coryne* from which he supposed it to proceed does not enable me to determine the species with certainty.

Throughout this paper I have employed the term *Gonozooid* to designate the free reproductive body, instead of the more usual term *Medusoid.* The latter seems to me objectionable, as tending to perpetuate a false conception of the nature of the sexual zooid. It helps to keep up the idea of a distinct and absolute individuality in the latter, and to conceal its real significance, as the mere equivalent of the flower-bud in the plant. In the life-series of the Hydroid, the polype is the *alimentary zooid,* and the sexual element or term may be conveniently and correctly designated the *gonozooid.*

EXPLANATION OF PLATE IX.

Fig. 1. Gonozooid of *Coryne eximia,* from a drawing by Mr. G. Hodge.
Fig. 2. Gonozooid of *Stauridia producta.*
Fig. 3. *Laomedea fragilis,* n. sp.; natural size and magnified.
Fig. 4. *Atractylis margarica,* n. sp., with its gonophore; 4 *a,* one of the tentacular clusters of thread-cells; *x,* a single thread-cell from the above; 4 *b,* the lid of the gonophore; 4 *c,* one of the branched processes; 4 *d,* an ovum; 4 *e,* a portion of the creeping stem, with cells.

BIBLIOGRAPHICAL NOTICE.

Memoir of the Rev. John Stevens Henslow, M.A. By the Rev. Leonard Jenyns, M.A. London: Van Voorst, 1862. 12mo.

Perhaps we are guilty of neglect in not having noticed the Life of Henslow sooner. Our readers must take this statement as an apology, if one is necessary, the fact being that no review was required to direct the attention of our readers to this work. All of them knew the lamented Professor by reputation, many personally; and

* There are other slight differences between the figures; but a comparison of the detailed descriptions of the two forms shows that those belong to the *drawings,* and not to the objects themselves.

none could do otherwise than highly appreciate his character and lament his death.

Mr. Jenyns justly remarks that "No man ever lived less to himself......Whatever acquirements he made in the various branches of human knowledge (and the degree to which he was master of many of them was very considerable), whatever he took in hand was done with a view to the benefit of all within his reach. There was no light hid under a bushel, there was no talent laid up in a napkin." Hence resulted his skill as a teacher, and his distinguished success in reforming a wild and neglected parish, and promoting the moral and religious character of all persons with whom he mixed.

In his own University he resided long enough to start the movement which is still in progress for the advancement of the natural sciences; and he just lived to see them take their true position as a means of attaining honourable distinction and academic degree.

Mr. Jenyns has entered in considerable detail upon the consideration of these subjects, and the mode in which Henslow's influence was brought to bear upon them. He has said much, but not too much, of the extent of that influence. He has shown how great it must have been had the Professor been resident at Cambridge during the later years of his life; and he causes those who take an interest in the advancement of such scientific studies heavily to feel the loss which the University has sustained. Had he continued an active resident member of that body, it is probable that we should never have heard of the strong opposition which has temporarily frustrated the plan for obtaining museums and lecture-rooms for the Professors of Science.

When he attained to the chair of Botany, it had been occupied by an eminent man who, at least thirty years previously, made one attempt to lecture on his science at Cambridge, and failing then to obtain a class, gave up the endeavour, and absented himself from the University until his death. Doubtless he had a tolerably good excuse for doing so; for then he would find all, or nearly all, the leaders of the University discouraging the study of the natural sciences to the utmost of their power. They knew nothing of those studies, and seemed to fancy not "omne ignotum pro magnifico," but exactly the reverse. The study of nature was trifling, if not worse. In their estimation (and we are sorry to add, in the opinion of many good and learned men now), it was of no use as a training for the mind, and utterly worthless by the side of classics and mathematics.

The possibility of using it to teach exactness in thought, accuracy in observation, and correctness in language, was first shown to them by Professor Henslow. It is true that they long continued to apply the opprobrious name of "non-reading men" to the lovers of natural science; but by degrees the majority of such persons have attained the knowledge that "non-reading men" (being naturalists) may really be hard and diligent students. It is worthy of remark that several of our most eminent naturalists and geologists of the present day were, from their preference of the study of nature, considered, when students, as neglecting the opportunities afforded them at Cambridge. We venture to say that there is not one of those men who does not now look back to the time of his residence at Cambridge as the period when, under the guidance of Henslow or Sedgwick, he acquired or largely increased the habit of mind and power of observation which has rendered him what he is.

Henslow was the chief founder of the now well-known Cambridge Philosophical Society, which originated from conversations with Prof. Sedgwick during a geological tour in the Isle of Wight. Not having at that time attained the degree of Master of Arts, he appeared less prominently amongst the original members of the Society than was due to his real connexion with its establishment.

Henslow commenced his study of nature with geology and mineralogy; and in 1822 he became Professor of Mineralogy in succession to the celebrated traveller, Dr. E. D. Clarke. He only held that chair for a short time; for in 1825 the Professorship of Botany became vacant, and he was elected to that office, which he retained until his lamented death. He immediately commenced lecturing on botany, and obtained a good class at once. He also took pains to become acquainted with the students of nature, and opened his house to them on one evening in each week. This had an excellent effect, by making those men acquainted who had congenial pursuits, by helping them in their difficulties, and creating emulation amongst them.

Henslow's attention was soon turned to the improvement of the Botanic Garden, which was small and surrounded by houses, and utterly insufficient for the uses to which such institutions are turned in the present day, although, when founded, it was excellently suited to the wants of that time. He hoped to raise the garden to "a level with some other establishments of the same kind," and happily lived to see his wishes attained to a very considerable extent. The garden was removed to the outskirts of the town, very much extended, and an efficient curator appointed.

He also commenced the formation of a herbarium; for very little was left by the Martyns, and even that little in a deplorable state of decay. He took active measures, and has left an immense and valuable accumulation of specimens in the possession of the University. When the requisite accommodation is provided for them, and his successor has been thus enabled to complete their arrangement, Cambridge will possess an excellent herbarium.

Unfortunately for the University, although happily for himself and most providentially for the parish, he was in 1837 appointed to the valuable living of Hitcham in Suffolk, and permanently established himself there in 1839. From that time the University became to him necessarily the second object, his parish taking the first place. Cambridge had the advantage of his presence for only about six weeks in the year. How he converted a place notorious for crime, immorality, and ignorance into a model parish must be sought in in Mr. Jenyns's book. It is a beautiful lesson to clergymen similarly situated, and ought to be studied by all who are intended for the ministry; but it is a subject foreign to our Journal. Nevertheless we may notice one of the means employed for opening the minds of the young: we mean the introduction of botany into the parish school. The study was optional, but was ultimately pursued by a considerable number of the elder children with very great success: they took an eager delight in their botanical lessons; and one of the Inspectors of Schools states, "that the botanical lessons did draw largely upon the intelligent powers of his little pupils' minds there can be no question; and that these children, who out of school were much more conversable than the generality of children in rural parishes, owed a considerable share of the general development of their minds to the botanical lessons and the self-exercise connected with them." "Neither," says another inspector, "had I any reason to think that the botanical lessons interfered with a due study of the usual subjects of a national school. Independently of the botany, the Hitcham school ranked *well* among the better class of rural schools in the district."

But we must stop. We have no intention to give an abstract of this book, but to show that it is well deserving of perusal. As such we strongly recommend it to all our readers.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

May 13, 1862.—John Gould, Esq., F.R.S., in the Chair.

Narrative of Search after Birds of Paradise. By Alfred R. Wallace, F.Z.S.

Having visited most of the islands inhabited by the *Paradiseæ*, in the hope of obtaining good specimens of those extraordinary birds, and some knowledge of their habits and distribution, I have thought that an outline of my several voyages, with the causes that have led to their only partial success, might not prove uninteresting.

At the close of the year 1856, being then at Macassar in the island of Celebes, I was introduced to the master of a prau trading to the Aru Islands, who assured me that two sorts of Birds of Paradise were abundant there, the large yellow and the small red kinds—the *Paradiseæ apoda* and *regia* of naturalists.

He seemed to think there was no doubt but I could obtain them either by purchase from the natives or by shooting them myself. Thus encouraged, I agreed with him for a passage there and back (his stay being six months), and made all my preparations to start by the middle of December.

Our vessel was a Malay prau of about 100 tons burthen, but differing widely from anything to be seen in European waters. The deck sloped downwards towards the bows, the two rudders were hung by rattans and ropes on the quarters, the masts were triangles standing on the decks, and the huge mat sail, considerably longer than the vessel, with its yard of bamboos, rose upwards at a great angle, so as to make up for the lowness of the mast. In this strange vessel, which, under very favourable circumstances, plunged along at nearly five miles an hour, and with a Buginese crew, all of whom seemed to have a voice in cases of difficulty or danger, we made the voyage of about a thousand miles in perfect safety and very agreeably; in fact, of all the sea voyages I have made, this was one of the pleasantest.

On reaching the Bugis trading settlement of Dobbo, I found that the small island on which it is situated does not contain any Paradise-Birds. Just as I was trying to arrange a trip to the larger island, a fleet of Magindano pirates made their appearance, committing great devastations, and putting the whole place in an uproar; and it was only after they had been some time gone that confidence began to be restored, and the natives could be persuaded to take the smallest voyage. This delayed me two months in Dobbo without seeing a Paradise-Bird.

When, however, I at length reached the main island and ascended a small stream to a native village, I soon obtained a specimen of the lovely *P. regia*, which, when first brought me, excited greater admiration and delight than I have experienced on any similar occasion. The larger species was still not to be seen; and the natives assured me that it would be some months before their plumage arrived at perfection, when they were accustomed to congregate together and could be more easily obtained. This proved to be correct; for it was about four months after my arrival at Dobbo that I obtained my first full-plumaged specimen of *P. apoda*. This was near the centre of the large island of Aru; and I there, with the assistance of the natives, procured the fine series which first arrived in England.

While at Dobbo I had frequent conversations with the Bugis traders and with the Rajah of Goram, who all assured me that in the northern parts of New Guinea I could travel with safety, and that at Mysol, Waigiou, Salwatty, and Dorey I could get all the different sorts of *Paradiseæ*. Their accounts excited me so much that I could think of nothing else; and after another excursion in Celebes I made my way to Ternate, as the best head-quarters for the Moluccas and New Guinea. Finding a schooner about to sail on its annual trading voyage to the north coast of New Guinea, I agreed for a passage to Dorey, and to be called for on the return of the vessel after an interval of three or four months. We arrived there, after a tedious voyage, in April 1858, and I began my second search after the Birds of Paradise.

I went to Dorey in full confidence of success, and thought myself extremely fortunate in being able to visit that particular locality; for it was there that Lesson, in the French discovery-ship 'Coquille,' purchased from the natives skins of at least eight species, viz. *Paradiseæ papuana, regia, magnifica, superba, sexsetacea, Astrapia nigra, Epimachus magnus,* and *Sericulus aureus*. Here was a prospect for me! The very anticipation of it made me thrill with expectation.

My disappointment therefore may be imagined when, shortly after my arrival, I found all these bright hopes fade away. In vain I inquired for the native bird-hunters; none were to be found there; and the inhabitants assured me that not a single Bird of Paradise of any kind was ever prepared by the Dorey people, and that only the common yellow one (*P. papuana*) was found in the district. This turned out to be the case; for I could get nothing but *P. papuana* sparingly, a few females of *P. regia*, and one young male of *Seleucides alba*, a species Lesson does not mention. Nevertheless Lesson did undoubtedly obtain all the birds he mentions at Dorey; but the natives are great traders in a petty way, and are constantly making voyages along the coast and to the neighbouring islands, where they purchase Birds of Paradise and sell them again to the Bugis praus, Molucca traders, and whale-ships which annually visit Dorey harbour. Lesson must have been there at a good time, when there happened to be an accumulation of birds; I at a bad one, for I could not buy a single rare bird all the time I was there. I also suffered much by the visit of a Dutch surveying-steamer, which, for want of coals, lay in Dorey harbour a month; and during that time I got nothing from the natives, every specimen being taken on board the steamer, where the commonest birds and insects were bought at high prices. During this time two skins of *Astrapia nigra* were brought by a Bugis trader and sold to an amateur ornithologist on board; and I never had another chance of getting a skin of this rare and beautiful bird.

The Dorey people all agreed that Amberbaki, about 100 miles west, was the place for Birds of Paradise, and that almost all the different sorts were to be found there. Determined to make an effort to secure them, I sent my two best men with ten natives and a large stock of goods to stay there a fortnight, with instructions to shoot and buy all they could. They returned, however, with absolutely nothing. They could not buy any skins but those of the common *P. papuana*, and could not find any birds but a single specimen of *P. regia*. They were assured that the birds all came from two or three days' journey in the interior, over several ridges of mountains, and were never seen near the coast. The coast people never go there themselves, nor do the mountaineers who kill and preserve them ever come to the coast, but sell them to the inhabitants of intermediate villages, where the coast people go to buy them. These sell them to the Dorey people or any other native traders; so that the specimens Lesson purchased had already passed through three or four hands.

These disappointments, with a scarcity of food sometimes approaching starvation, and almost constant sickness both of myself and men, one of whom died of dysentery, made me heartily glad when the schooner returned and took me away from Dorey. I had gone there with the most brilliant hopes, which I think were fully justified by the facts known before my visit; and yet, as far as my special object (the Birds of Paradise) was concerned, I had accomplished next to nothing.

My ardour for New Guinea voyages being now somewhat abated, for the next year and a half I occupied myself in the Moluccas; but in January 1860, being joined (when at Amboyna) by my assistant Mr. Allen, I arranged a plan for the further exploration of the country of the *Paradiseæ*, by sending Mr. Allen to Mysol, while I myself, after making the circuit of the island of Ceram, was to visit him with stores and provisions and proceed to Waigiou, both returning independently to meet at Ternate in the autumn.

I had been assured by the Goram and Bugis traders that Mysol was the very best country for the Birds of Paradise, and that they were finer and more abundant there than anywhere else. For Waigiou I had, besides the authority of the native traders, that of Lesson also, who visited the north coast for a few days, and mentions seven species of Paradise-Birds purchased there by him.

These two promising expeditions turned out unfortunately in every respect. On reaching Goram, after much difficulty and delay, I found it impossible to make the voyage I had projected without a vessel of my own. I therefore purchased a small native prau of about 8 tons, and after spending a month in strengthening and fitting it up, and having with great difficulty secured a native crew, paid them half their wages in advance, and overcome all the difficulties and objections which every one of them made to starting when all was ready, we at length got away, and I congratulated myself on my favourable prospects. Touching at Ceramlaut, the rendezvous of the New Guinea traders, I invested all my spare cash in goods for barter with the natives, and then proceeded towards Mysol.

The very next day, however, being obliged to anchor on the east coast of Ceram on account of bad weather, my crew all ran away during the night, leaving myself and my two Amboyna hunters to get on as we could. With great difficulty I procured other men to take us as far as Wahai, on the north coast of Ceram, opposite to Mysol, and there by a great chance succeeded in picking up a makeshift crew of four men willing to go with me to Mysol, Waigiou, and Ternate. I here found a letter from Mr. Allen, telling me he was much in want of rice and other necessaries, and was waiting my arrival to go to the north coast of Mysol, where alone the *Paradiseœ* could be obtained.

On attempting to cross the strait, seventy miles wide, between Ceram and Mysol, a strong east wind blew us out of our course; so that we passed to the westward of that island without any possibility of getting back to it. Mr. Allen, finding it impossible to live without rice, had to return to Wahai, much against his will, and there was kept two months waiting a supply from Amboyna. When at length he was able to return to Mysol, he had only a fortnight at the best place on the north coast, when the last boat of the season left, and he was obliged to take his only chance of getting back to Ternate.

Through this unfortunate series of accidents he was only able to get a single specimen of *P. papuana*, which is finer there than in most other places, a few of the *Cicinnurus regius*, and of *P. magnifica* only a native skin, though this beautiful little species is not rare in the island, and during a longer stay might easily have been obtained.

My own voyage was beset with misfortunes. After passing Mysol, I lost two of my scanty crew on a little desert island, our anchor breaking while they were on shore, and a powerful current carrying us rapidly away. One of them was our pilot; and, without a chart or any knowledge of the coasts, we had to blunder our way short-handed among the rocks and reefs and innumerable islands which surround the rocky coasts of Waigiou. Our little vessel was five times on the rocks in the space of twenty-four hours, and a little more wind or sea would in several cases have caused our destruction. On at length reaching our resting-place on the south coast of Waigiou, I immediately sent a native boat after my lost sailors, which, however, returned in a week without them, owing to bad weather. Again they were induced to make the attempt, and this time returned with them in a very weak and emaciated condition, as they had lived a month on a mere sand-bank, about a mile in diameter, subsisting on shell-fish and the succulent shoots of a wild *Bromelia*.

I now devoted myself to an investigation of the natural history of Waigiou, having great expectations raised by Lesson's account, who says that he purchased the three true *Paradiseæ*, as well as *P. magnifica* and *P. sexsetacea*, with *Epimachus magnus* and *Sericulus aureus*, in the island, and also mentions several rare *Psittaci* as probably found there. I soon ascertained, however, from the universal testimony of the inhabitants, afterwards confirmed by my own observation, that none of these species exist on the island, except *P. rubra*, which is the sole representative of the *Paradiseidæ* and *Epimachidæ*, and is strictly limited to this one spot.

With more than the usual amount of difficulties, privations, and hunger, I succeeded in obtaining a good series of this beautiful and extraordinary bird; and three months' assiduous collecting produced no other species at all worthy of attention. The parrots and pigeons were all of known species; and there was really nothing in the island to render it worth visiting by a naturalist, except the *P. rubra*, which can be obtained nowhere else.

Our two expeditions to two almost unknown Papuan islands have thus added but one species to the *Paradiseæ* I had before obtained from Aru and Dorey. These voyages occupied us nearly a year; for we parted company in Amboyna in February, and met again at Ternate in November, and it was not till the following January that we were either of us able to start again on a fresh voyage.

At Waigiou I learned that the Birds of Paradise all came from three places on the north coast, between Salwatty and Dorey—Sorong, Maas, and Amberbaki. The latter I had tried unsuccessfully from Dorey; at Maas, the natives who procured the birds were said to live three days' journey in the interior, and to be cannibals; but at Sorong, which was near Salwatty, they were only about a day from the coast, and were less dangerous to visit. At Mysol, Mr. Allen had received somewhat similar information; and we therefore resolved he should make another attempt at Sorong, where we were assured all the sorts could be obtained. The whole of that country being under the jurisdiction of the Sultan of Tidore, I obtained, through the Dutch resident at Ternate, a Tidore lieutenant and two soldiers to accompany Mr. Allen as a protection, and to facilitate his operations in getting men and visiting the interior.

Notwithstanding these precautions, Mr. Allen met with difficulties in this voyage which we had not encountered before. To understand these, it is necessary to consider that the Birds of Paradise are an article of commerce, and are the monopoly of the chiefs of the coast villages, who obtain them at a low rate from the mountaineers, and sell them to the Bugis traders. A portion is also paid every year as tribute to the Sultan of Tidore. The natives are therefore very jealous of a stranger, especially a European, interfering in their trade, and above all of going into the interior to deal with the mountaineers themselves. They of course think he will raise the prices in the interior, and lessen the demand on the coast, greatly to their disadvantage; they also think their tribute will be raised if a European takes back a quantity of the rare sorts; and they have besides a vague and very natural dread of some ulterior object in a white man's coming at so much trouble and expense to their country only to get Birds of Paradise, of which they know he can buy plenty at Ternate, Macassar, or Singapore.

It thus happened that when Mr. Allen arrived at Sorong and explained his intentions of going to seek Birds of Paradise in the interior, innumerable objections were raised. He was told it was three or four days' journey over swamps and mountains; that the mountaineers were savages and cannibals, who would certainly kill him; and, lastly, that not a man in the village could be found who dare go with him. After some days spent in these discussions, as he still persisted in making the attempt, and showed them his authority from the Sultan of Tidore to go where he pleased and receive every assistance, they at length provided him with a boat to go the first part of the journey up a river; at the same time, however, they sent private orders to the interior villages to refuse to sell any provisions, so as to compel him to return. On arriving at the village where they were to leave the river and strike inland, the coast people returned, leaving Mr. Allen to get on as he could. Here he called on the Tidore lieutenant to assist him and procure men as guides and to carry his baggage to the villages of the mountaineers. This, however, was not so easily done; a quarrel took place, and the natives, refusing to obey the somewhat harsh orders of the lieutenant, got out their knives and spears to attack him and his soldiers, and Mr. Allen himself was obliged to interfere to protect those who had come to guard him. The respect due to a white man and the timely distribution of a few presents prevailed; and on showing the knives, hatchets, and beads he was willing to give to those who accompanied him, peace was restored, and the next day, travelling over a frightfully rugged country, they reached the villages of the mountaineers. Here Mr. Allen remained a month, without any interpreter through whom he could understand a word or communicate a want. However, by signs and presents and a pretty liberal barter he got on very well, some of them accompanying him every day in the forest to shoot, and receiving a small present when he was successful.

In the grand matter of the Paradise-Birds, however, little was done. Only one additional species was found, the *Seleucides alba*, of which he had already obtained a specimen on the island of Salwatty on his way to Sorong; so that at this much-vaunted place in the mountains, and among the bird-catching natives, nothing fresh was obtained. The *P. magnifica*, they said, was found there, but was rare; the *Sericulus aureus* also rare; *Epimachus magnus, Astrapia nigra, Parotia sexsetacea*, and *Lophorina superba* not found there, but only much further in the interior, as well as the lovely little Lory, *Charmosyna papuana*. Moreover, neither at Sorong nor at Salwatty could he obtain a single native skin of the rarer species.

Thus ended my search after these beautiful birds. Five voyages to different parts of the district they inhabit, each occupying in its preparation and execution the larger part of a year, have produced me only five species out of the thirteen known to exist in New Guinea. The kinds obtained are those that inhabit the districts near the coasts of New Guinea and its islands, the remainder seeming to be strictly confined to the central mountain-ranges of the northern peninsula; and our researches at Dorey and Amberbaki, near one end of this peninsula, and at Salwatty and Sorong, near the other, enable me to decide with some certainty on the native country of these rare and lovely birds, good specimens of which have never yet been seen in Europe. It must be considered as somewhat extraordinary that during five years' residence and travel in Celebes, the Moluccas, and New Guinea I should never have been able to purchase skins of half the species which Lesson, forty years ago, obtained during a few weeks in the same countries. I believe that all, except the common species of commerce, are now much more difficult to obtain than they were even twenty years ago; and I impute it principally to their having been sought after by the Dutch officials through the Sultan of Tidore. The chiefs of the annual expeditions to collect tribute, have had orders to get all the rare sorts of Paradise-Birds; and as they pay little or nothing for them (it being sufficient to say they are for the Sultan), the head men of the coast villages would for the future refuse to purchase them from the mountaineers, and confine themselves instead to the commoner species, which are less sought after by amateurs, but are to them a profitable merchandise. The same causes frequently lead the inhabitants of uncivilized countries to conceal any minerals or other natural products with which they may become acquainted, from the fear of being obliged to pay increased tribute, or of bringing upon themselves a new and oppressive labour.

I have given this short sketch of my search after the Birds of Paradise, barely touching on the many difficulties and dangers I experienced, because I fear that the somewhat scanty results of my exertions may have led to the opinion that they failed for want of judgment or perseverance. I trust, however, that the mere enumeration of my voyages will show that patience and perseverance were not altogether wanting; but I must plead guilty to having been misled, first by Lesson and then by all the native traders, it never having occurred to me (and I think it would not have occurred to any one), that in scarcely a single instance would the birds be found to inhabit the districts in which they are most frequently to be purchased. Yet such is the case; for neither at Dorey, nor at Salwatty, nor Waigiou, nor Mysol are any of the rarer species to be found alive. Not only this, but even at Sorong, where the Waigiou chiefs go every year and purchase all kinds of Birds of Paradise, it has turned out that most of the specimens are brought from the central mountain-ranges by the natives of those places, and reach the shore in places where it is not safe for trading praus to go, owing to the want of anchorage on an exposed rocky coast.

Nature seems to have taken every precaution that these, her choicest treasures, may not lose value by being too easily obtained. First we find an open, harbourless, inhospitable coast, exposed to the full swell of the Pacific Ocean; next, a rugged and mountainous country, covered with dense forests, offering in its swamps and precipices and serrated ridges an almost impassable barrier to the central regions; and lastly, a race of the most savage and ruthless character, in the very lowest stage of civilization. In such a country and among such a people are found these wonderful productions of nature. In those trackless wilds do they display that exquisite beauty and that marvellous development of plumage, calculated to excite admiration and astonishment among the most civilized and most intellectual races of man. A feather is itself a wonderful and a beautiful thing. A bird clothed with feathers is almost necessarily a beautiful creature. How much, then, must we wonder at and admire the modification of simple feathers into the rigid, polished, wavy ribbons which adorn *P. rubra,* the mass of airy plumes on *P. apoda,* the tufts and wires of *Seleucides alba,* or the golden buds borne upon airy stems that spring from the tail of *Cicinnurus regius*; while gems and polished metals can alone compare with the tints that adorn the breast of *Parotia sexsetacea* and *Astrapia nigra,* and the immensely developed shoulder-plumes of *Epimachus magnus.*

I will now point out the distribution of the species of Birds of Paradise, as far as I have been able to ascertain it. The Aru Islands contain *P. apoda* and *P. regia*; and we have no positive knowledge of *P. apoda* being found anywhere else. Mysol has *P. papuana, P. regia,* and *P. magnifica*; Waigiou *P. rubra* only. Salwatty, though so close to New Guinea, has no restricted *Paradiseæ,* but possesses *P. regia, P. magnifica, Ep. albus,* and *Sericulus aureus.* The island of Jobie, and the Mysory Islands beyond it, certainly contain true *Paradiseæ*; but what species beyond *P. papuana,* is unknown. The coast districts of the northern part of New Guinea contain *P. papuana* and *P. regia* pretty generally distributed, while *P. magnifica, P. alba,* and *Sericulus aureus* are scarce and local. Lastly, the central mountains of the northern peninsula are alone inhabited by *Lophorina superba, Parotia sexsetacea, Astrapia nigra, Epimachus magnus,* and *Craspedophora magnifica*; and here also probably exist the unique *Diphyllodes Wilsoni* and *Paradigalla carunculata.*

The most widely distributed of the *Paradiseæ* is therefore the little *P. regia,* which is found in every island except Waigiou. Next, and probably most abundant in individuals, comes the *P. papuana,* wanting only in Aru, Salwatty, and Waigiou. The next most widely spread species is *P. magnifica*, occurring in two islands (Salwatty and Mysol) as well as on the mainland. The other species are all found on the mainland only—with the exception of *P. apoda* (probably restricted to Aru), and *P. rubra*, which, being certainly confined to the small island of Waigiou, offers the most restricted range of the whole family.

It is interesting to remark that all the islands on which true *Paradiseæ* are found are connected by banks of soundings to the mainland of New Guinea. The *hundred-fathom line* includes the islands of Aru, Mysol, Waigiou, and Jobie, which have probably been, at no distant geological period, connected with New Guinea; while Ké, Ceram, &c., are separated from it by deep sea, and on them no *Paradiseæ* exist.

The island of Gilolo, on which the genus *Semioptera* occurs, extends towards Waigiou, and has the island of Guebe exactly between the two, suggesting the probability of a connexion there; but the depth of the intervening sea is unknown.

It may be considered as certain that every species of Paradise-Bird yet obtained from the natives has come from the north peninsula of New Guinea, that being the part most frequented by the Malay traders. The vast extent of country east of long. 136° is quite unknown; but there can be little doubt that it contains other and perhaps yet more wonderful forms of this beautiful group of birds. If we look round the whole circumference of the globe, we shall be unable to find a region at once so promising to the naturalist and so absolutely a "terra incognita" as this great tropical land; and it is to be hoped that our explorers and naturalists may soon be induced to direct their attention to this hitherto neglected country.

MISCELLANEOUS.

Remarks in reference to the Gracula pectoralis *of* Mr. Wallace. By G. R. Gray.

Mr. Wallace has lately described an interesting bird under the appellation of *Gracula pectoralis*, which bird had been previously recorded by Lesson, under the name of *Sericulus anais*, from a specimen in M. Bourcier's collection. Lesson gives a correct description (Revue de Zool. 1839, p. 44) of the bird, so far as a mutilated New-Guinean skin would permit.

The late Prince C. L. Bonaparte, in 1850, refers to Lesson's species in his 'Conspectus Avium,' but in his very short notice of it he unfortunately uses the word *abdomine* when it ought to have been *pectore*, and thus this misapplication of a word has caused a difficulty in defining the bird. This mistake he also continued in the 'Comptes Rendus,' 1853, page 831, though he there gave a new and more lengthened description. At the same time he proposed it as the type of a new division, under the name of *Melanopyrrhus*.

In 1850, Mr. Cassin unknowingly described this bird under the new name of *Pastor nigrocinctus* (Proc. Acad. Philad. 1850, p. 68). The description, he informs us, was taken from two specimens—one in the Albany Museum, U.S., and the other in the Philadelphian Academy. The fact of the similarity of this species with that of Lesson was first pointed out by Dr. Sclater (Proc. Zool. Soc. 1857, p. 6). It is one of the birds which I had, in my 'List of Genera,' published in 1855, "so quietly recapitulated," as the learned Editor of 'The Ibis' (1862, p. 291) is pleased to remark, "with the dry interrogatory, 'Nonne avis arte facta?'" I was induced to affix this observation from the appearance presented in my drawing, which was taken from M. Bourcier's typical specimen. It is now proved, in part at least, that I was not altogether wrong in supposing that the art of the taxidermist had been employed in endeavouring to replace by artificial means what the New-Guinean natives had deprived the three previously known specimens of,—for example, their wings and legs. The false restoration of these organs was the cause of a wrong position being assigned to the bird in regard to the family it occupied in the system of ornithology. Mr. Wallace's perfect specimens prove that the true wings and legs are very similar to those of the genus *Gracula*, both in form and colour; and it appears to be intermediate between the genera *Gracula* and *Basilornis*, being allied to the latter in its more slender-formed bill.

The name and synonyma of this fine and singularly coloured bird will now stand as follows:—

Gracula (Melanopyrrhus) Anais.

Sericulus Anais, Less., Rev. de Zool. 1839, p. 44; Pr. Bon., Consp. Av. i. p. 349.
Melanopyrrhus Anais, Pr. Bon., Compt. Rend. 1853, p. 831; G. R. Gray, List of Gen. 1855, p. 46.
Pastor nigrocinctus, Cass., Proc. Acad. Philad. 1850, p. 68.
?*Oriolus Anais*, G. R. Gray, Gen. of B. App. p. 11; *id.* Cat. of Birds of N. Guin. p. 26.
Gracula pectoralis, Wall., Proc. Z. S. 1862, p. 166. pl. 20.

Hab. New Guinea (Wall.).

The Gorilla. By Thomas J. Moore.

A statement, resting upon no reliable authority, lately appeared in the Liverpool newspapers, announcing the arrival and exhibition in this port of a young living specimen of a Gorilla.

This announcement, having been copied into the 'Times,' and continuing to be copied into various other papers, being absolutely untrue, it becomes necessary to give it an unqualified contradiction.

The so-called Gorilla is simply a Chimpanzee, standing somewhat over two feet in height, and having the large ears, flesh-coloured muzzle, with white hairs on the chin, and the deeply cleft fingers so characteristic of the species.

It is a robust, lively, and amusing creature, imitating its keeper in various ways, as in trying to unlock a cupboard and to tack pieces of list over cracks in the door. But how any one who has once seen either a Chimpanzee or a Gorilla could mistake it for the young of the latter passes comprehension.

Mr. Bartlett and Mr. Waterhouse Hawkins, who have both seen the animal (the latter coming expressly from Wrexham, on the faith of the above public announcements, to do so), will confirm my statements, if they have not already published protests of their own.

One specimen of the Gorilla has certainly been imported into Liverpool alive. This occurred in the winter of 1855–56.

This individual, called "Jenny," was slightly larger, I believe, than the preceding, and was purchased by Mrs. Wombwell, in whose menagerie it lived some short time, and in which, on its subsequent arrival in Liverpool, I first saw it. A short notice of this animal was written by Mr. Waterton, and subsequently published in some local paper. It was active in its habits, and so far from being savage or ferocious, it lived with its mistress in her own special travelling carriage, about which it jumped and climbed freely.

Upon its death in March 1856, it was forwarded to Mr. Waterton, in whose museum at Walton Hall the preserved skin may still be seen. The skeleton is in the museum of the Philosophical and Literary Society of Leeds, whither it was forwarded direct from Walton Hall.

A young specimen, which died at the Gaboon, in the spring of this year, in the possession of Mr. R. B. Walker, may be seen, stuffed, in the museum of the Natural History Society of Manchester. This is smaller than the preceding, being, as nearly as I can remember, about the size of the young stuffed example in the British Museum.

The recent acquisition of the skin of an adult Gorilla, in first-rate condition, tempts me to make public the way in which it was preserved. It was very carefully skinned, down even to the very tips of the fingers and toes, and the skin preserved in spirit*. The carcase was exposed to insects for a short time, and then packed in a suitable box. By these means both skin and skeleton arrived in excellent condition, and indicate the most reliable methods of preserving future specimens for importation. They were secured for this Museum through the liberality of Mr. Henry Duckworth, F.G.S., of this town.

Before concluding, I may note that an enormous skeleton of a male Gorilla, presented to this Museum by Mr. R. B. Walker, measures $16\frac{5}{8}$ inches in the length of the femur.

Free Public and Derby Museum,
Liverpool, Nov. 24, 1862.

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* Instructions recommending this method of transmitting the skin of the Gorilla were sent to the Gaboon by Dr. J. E. Gray, of the British Museum, in 1861.—Eds.

Note on the Otothrix Hodgsoni. By G. R. Gray.

In a late Number of 'The Ibis,' Mr. Blyth refers to my *Otothrix Hodgsoni* (Proc. Zool. Soc. 1859, p. 101. pl. 152), and makes it absolutely identical with *Podargus cornutus.* He goes so far as to say that the former is the young of the latter species. If he had, however, actually compared them together, he could never have made such an erroneous identification. In his Catalogue of Birds, Mr. Blyth doubtfully considers the *Podargus cornutus* as the adult of *P. javanensis,* while in another work (Journ. A. S. B. 1847, p. 1180) he tells us that the *P. javanensis* is the young dress of *P. auritus* (!).

Mr. Blyth has, however, referred to two examples as B & C, under the head of *Podargus affinis,* in his Catalogue, p. 81, in these words: "Head, wings, and tail of two specimens of a nearly allied but distinct species. From Darjiling." This locality is identical with that from which the *Otothrix Hodgsoni* is brought, and I believe therefore that these fragments belong to my species; so that in these he could see distinctive characters, although he now ventures to judge from the figure only, and pronounces my *Hodgsoni* to be no other than *cornutus,* young.

The specimen of *Otothrix Hodgsoni* from which the description and figure were derived is that of an *adult* female, taken from the nest with its young; and it has, among other differences, a smaller bill than that of *P. cornutus,* its general coloration, the extreme length of the whiskers, &c.

Note on Pleuronectes sinensis, *Lacép.* By Dr. A. Günther.

The generic name of *Tephritis* has been given by me to the Chinese Turbot, or *Pleuronectes sinensis,* Lacép. (Catal. Fish. iv. p. 406). Having since found it preoccupied by a genus of insects, I propose to replace it by that of *Tephrinectes.*

Note on the Size of a Seal at the time of Birth. By Dr. J. E. Gray, F.R.S. &c.

We have received from the Zoological Gardens the body of a Ringed Seal (*Callocephalus fœtidus*), that had died soon after its birth. It was entirely covered with closely set, well-developed fur of a silver-grey colour, being rather browner on the upper surface. It is 2 feet 8 inches long, from the tip of the nose to the end of tail; the fore paws are 6, and the hinder 8 inches long, and the latter are 7 inches wide when expanded. The webs of the feet are covered with hair, and the claws are well developed and black. The whiskers are white, well developed, and slightly waved.—*Proc. Zool. Soc.* June 10, 1862.

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END OF THE TENTH VOLUME.

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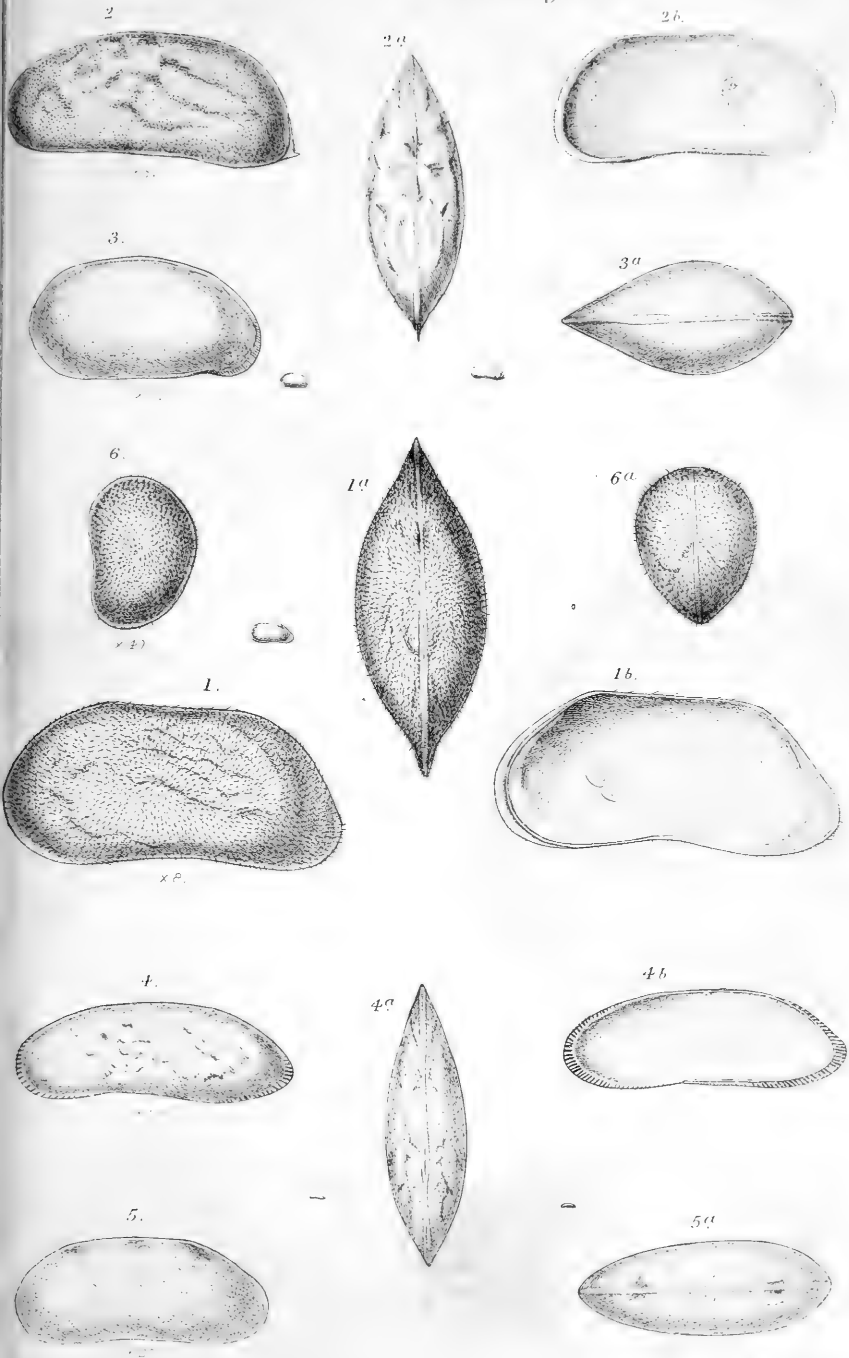
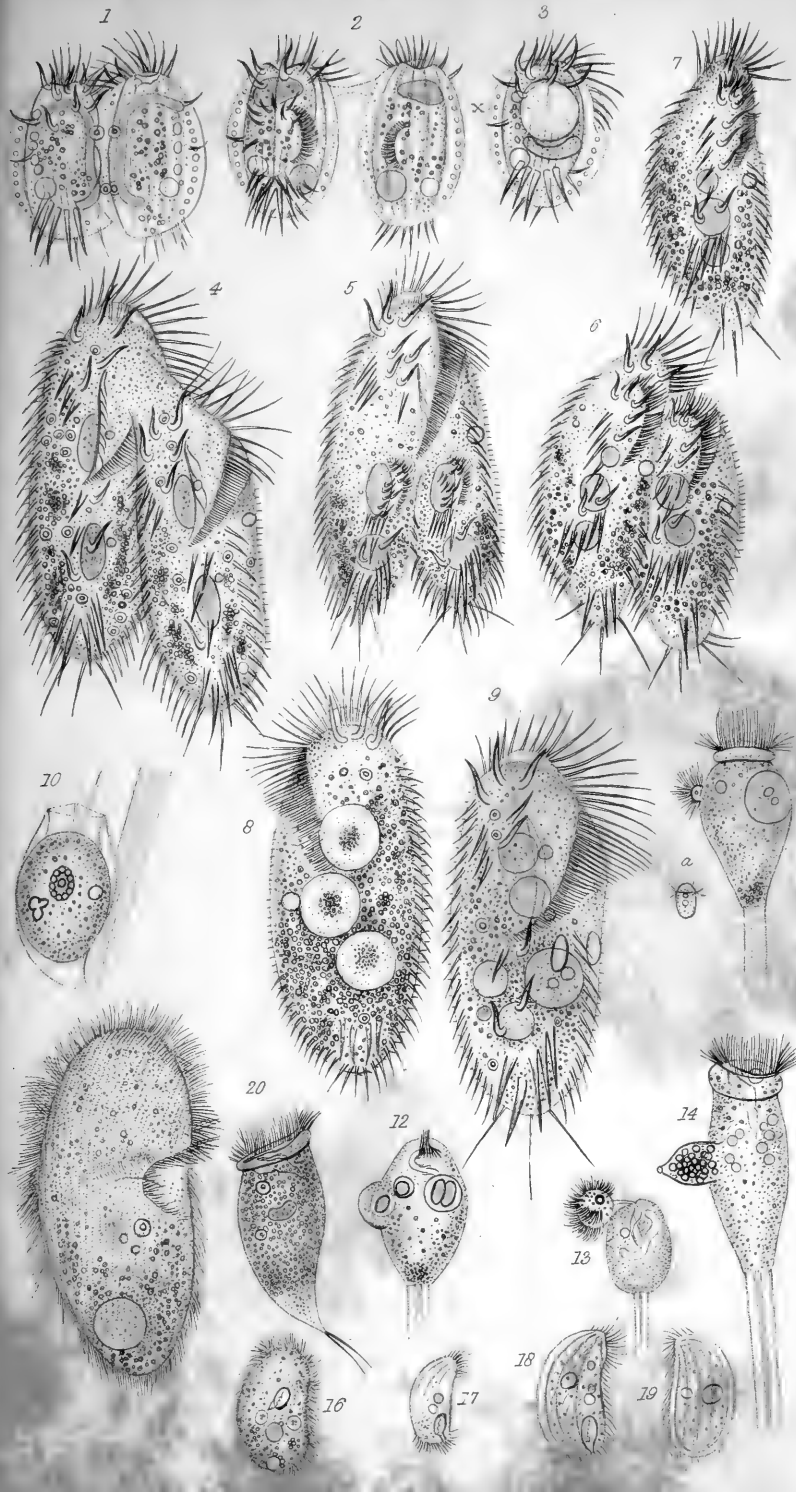


Tuffen West ad nat. del. et sc.


1
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x
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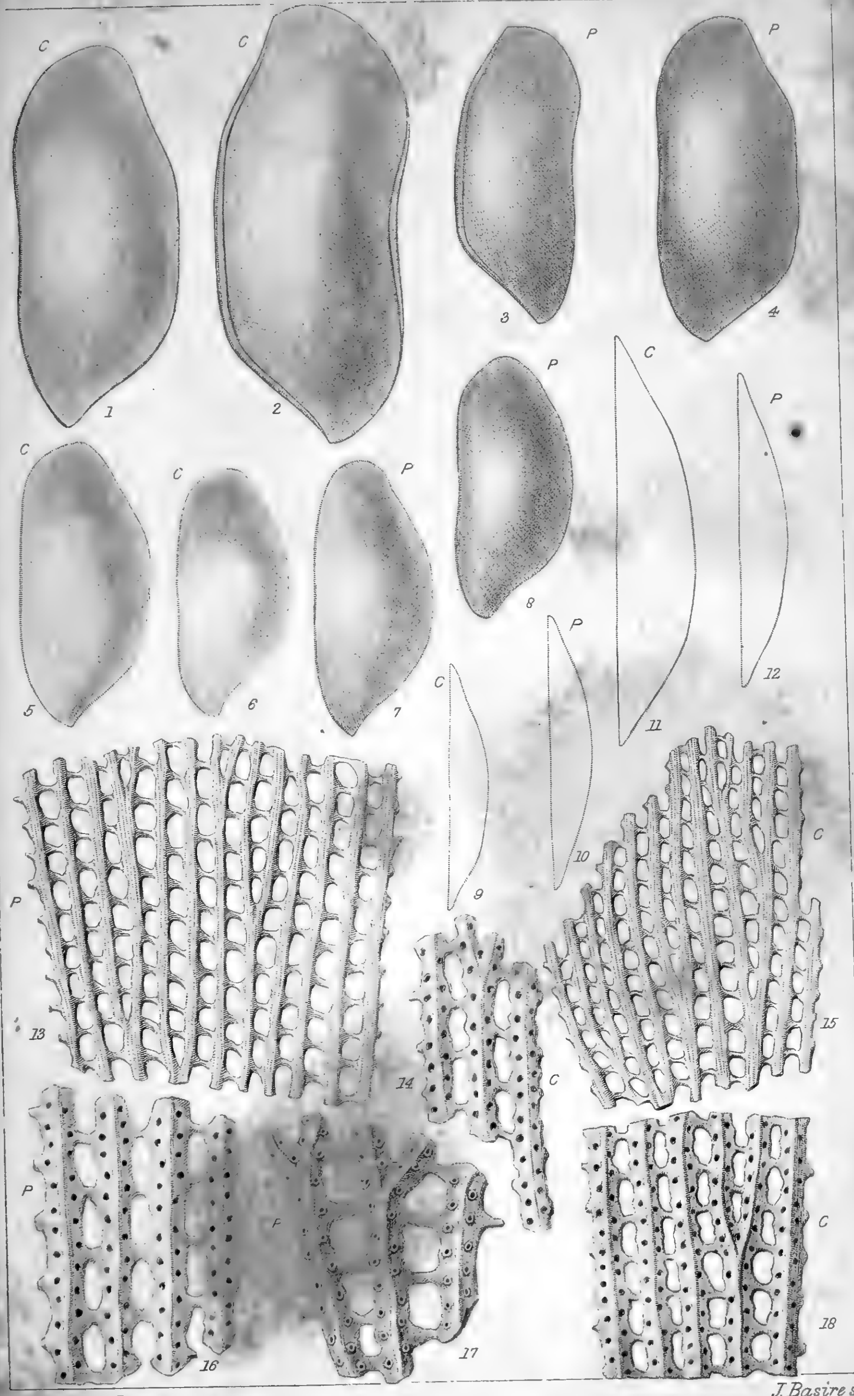


J. W. Kirkby del.

J. Basire sc.

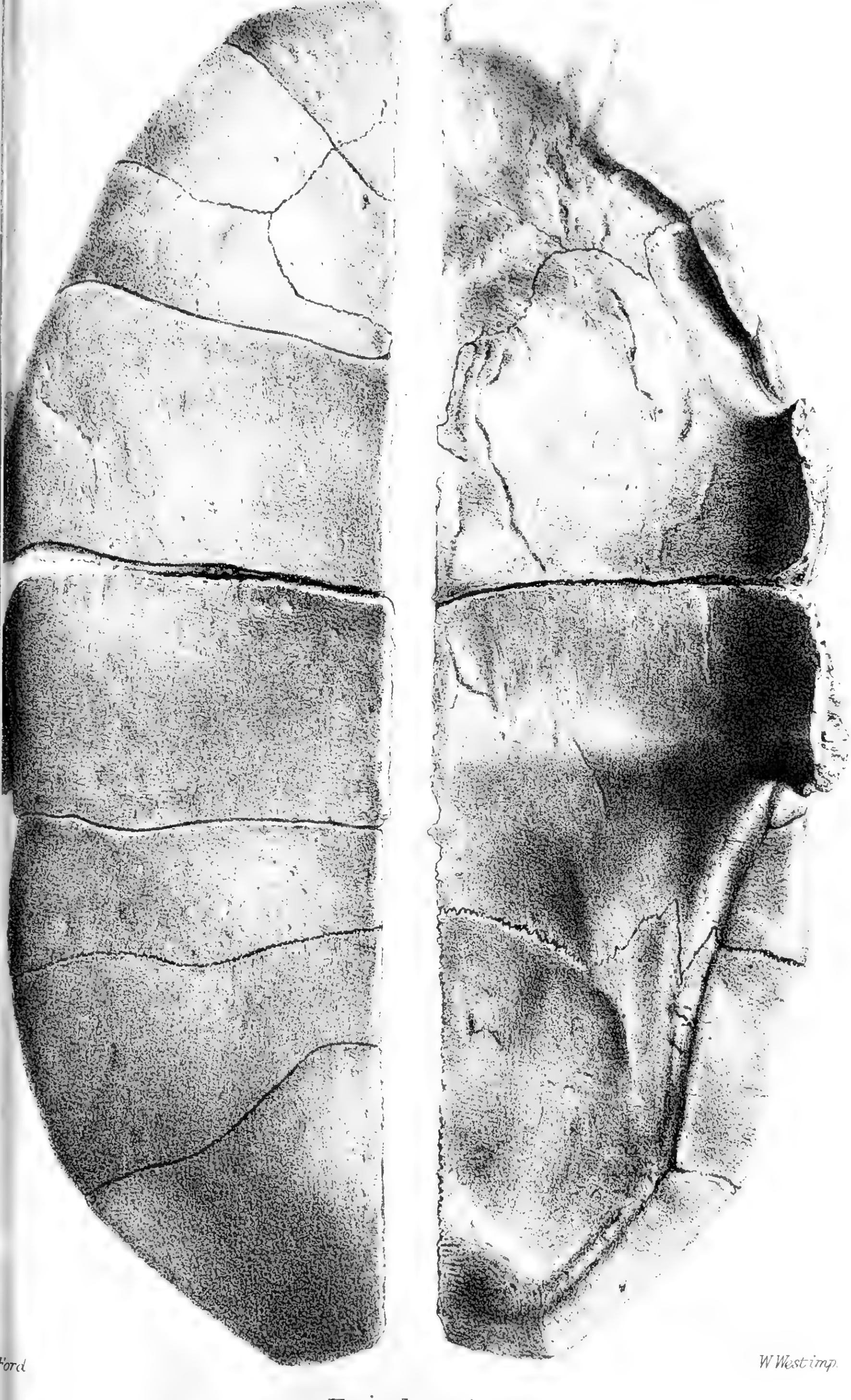
CARBONIFEROUS AND PERMIAN.

Xanthoxylum (Oxyactis) Danielli, Benn.

G. Jarman

J. H. Ford.

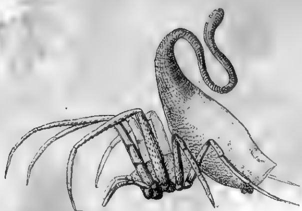
Emys lutaria.



Ford

W West imp.

Emys lutaria.



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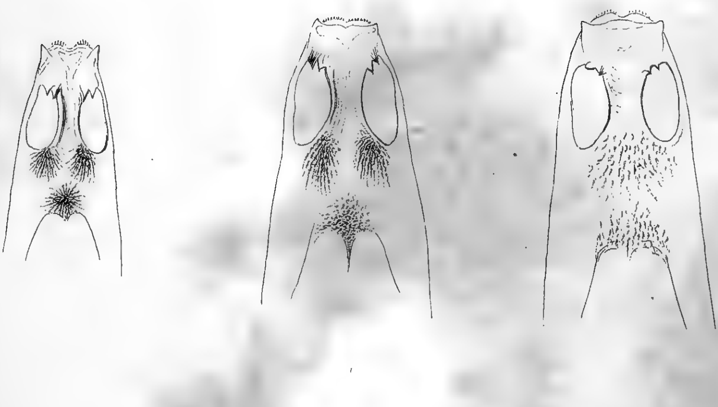

G.H.Ford del. J.Basire sc.

J. Basire sc