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AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

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

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1869.

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

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pou 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.

Biology

CONTENTS OF VOL. III.

[FOURTH SERIES.]

NUMBER XIII.

NUMBER XV.

NUMBER XVI.

NUMBER XVII.

NUMBER XVIII.

PLATES IN VOL. III.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

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

No. 13. JANUARY 1869.

I.—*On the Structure of the Diatomaceous Frustule, and its Genetic Cycle.* By JOHN DENIS MACDONALD, M.D., F.R.S., Staff-Surgeon, R.N.

[Plate III.]

FROM close examination of some of the larger forms of Diatomaceæ, more especially species of *Isthmia* and *Biddulphia*, I have long been under the impression that the commonly received views of the structure of the frustule and its mode of self-division require considerable modification. Though numerous inquirers have been engaged in the very inviting study afforded by these little organisms, I am not aware that any one has yet traced out their genetic cycle as satisfactorily as could be wished.

Having consulted the works of various authorities upon this subject, I find the views expressed in the writings of Dr. Wallich (particularly in his paper on *Triceratium*, vol. vi. Journal of Microscopical Science, p. 242, and on the Diatom-valve, vol. viii. Trans. Micr. Sci. p. 129) most in accordance with my own independent researches.

Dr. Wallich appears to have been the first to set forth clearly that the middle piece or "zone" consists, while the frustule is intact, of two distinct plates, the one received within the other, and that the growth of such plates can only take place at the free margins, or those which are not connected with the valves.

He has also shown how the capacity of the frustule may be augmented, at least in one direction, by the sliding out of those plates or "rings" telescope-fashion to accommodate themselves to the increase of the contents during division. This great fact is barely shadowed forth in Griffith and Henfrey's 'Micrographic Dictionary' (ed. 1856), p. 201, where it is said that "in *Biddulphia* and *Isthmia*, and similar forms, the new half-frustules formed inside the 'hoop' slip out from it like the inner tubes from the outer case of a telescope." The "inner tubes" in this case would of course be the hoops of the new valves, which in their turn assist in forming a so-called "intermediate piece" with their parent valves, though this is not specifically stated, and, strangely enough, a different inference may be drawn from the following quotation (*op. cit.* p. 199): the frustules of Diatomaceæ are described as consisting of "two usually symmetrical portions or valves comparable to those of a bivalve shell, but are in contact at their margins with an intermediate piece (the 'hoop'), variable in breadth, according to age." This view of the structure of the frustule is substantially the same as that given by Smith in his introduction to the 'Synopsis of the British Diatomaceæ,' only that he makes the hypothetical intermediate piece or "hoop" more insignificant by calling it a "connecting membrane," whereas it is in reality double, as before stated, one portion being included within the other, so as to admit of extension of the frustule in the direction of the axis of growth.

Each of these sliding segments, moreover, is not merely connected but directly continuous with the body of its own valve, that which is invaginated being always the younger, having been produced within the other or the parent valve by an endogenous process, combining fission with growth and remodelling of the primordial utricle. Whatever be the configuration of the true ends of the frustule, or, in other words, the body of the valves, viz. circular, triangular, foursquare, or navicular, the sides or "hoops" of the two forming the so-called "intermediate piece" are, as it were, marginal extensions of them, but perpendicular to their general plane. Quoting, again, from the 'Micrographic Dictionary,' p. 200, it is stated that "the ordinary mode of increase of the cells of Diatomaceæ is, like that of other vegetable cells, a process of division. . . . It may be briefly described thus:—the primordial utricle, enclosing the contents, divided into two portions, which separate from one another in a plane parallel with the sides of the individual frustules; the two valves of the parent cell gradually separate from one another, remaining connected by the simultaneous gradual widening of the 'hoop.'" This description would lead one to suppose that the hoop was a single and distinct segment, serving to connect those portions of the frustule to which the term valves is more particularly confined, and that the growth of the hoop was, therefore, not limited to one border more than the other.

Dr. Wallich, I think, very successfully refutes the idea of a continuous growth of the Diatomaceous frustule, the fact being, as he states, that "the variation in the size of the valve and the number of its striæ proceed *pari passu* during the process of division, but not subsequently." He admits that "growth may take place to the extent of new siliceous matter being secreted along the margins of the valve, its depth being thereby augmented;" but he considers it highly probable "that the connecting zone by which the young valve is protected during its secretion and consolidation determines the limit of the dimensions to be attained by it." He states, moreover, that "in truth no two valves of the same frustule can be of the same size, for the new valves, being formed within the 'connecting zones' of the parent frustule, must be smaller than these." This, I should think, is the essential cause of the great diversity of size observable in frustules of the same species being constant and universal; but he lays more stress upon the peculiar idiosyncrasy of the sporangial frustule, vicissitudes of climate, and increased or diminished sources of nutritive matter. Notwithstanding all the above important facts and deductions, in common with other authors Dr. Wallich seems to consider the hoops of the "connecting zone" quite supplementary, and not essentially persistent parts of the valves themselves, though often easily separable.

In the 'Micrographic Dictionary,' at p. 201, we read, "The hoop appears to be a provision for the protection of the nascent half-frustules, which probably do not become silicified until full-grown, and would thus be liable to be injured or disturbed by the movements of the rigid and heavy parent half-frustules if the centre of the frustule in process of division was naked, as in the Desmidiaceæ." In all this the existence of two distinct layers in the "hoop" is not even hinted at, nor their identity each with its own valve at the true ends of the frustule.

It stands to reason that as the two new half-frustules are developed endogenously, or within their parents, the former must be smaller than the latter by the whole thickness of the siliceous investment; and this will continue to be the case *gradatim* in the direct line of descent, though of course all the pullulations successively taking place in the same half-frustule will be uniformly of the same size, holding the relation of cast to mould with respect to their developing cell. Seeing, therefore, that the smaller the frustules of the same species are the more endogenous developments must have preceded them, and therefore, as one would naturally suppose, the nearer must be the fitness for conjugation to complete the genetic cycle, my great difficulty at one time was to know how the frustules of a given species ever regained their original size, or where this gradual diminution should end; but Mr. Thwaites has furnished us with the solution in his important discovery that the sporangial frustule resulting from the process of conjugation is so much larger than the parent cells. In relation to this subject we read (*op. cit.*):—"A great difficulty meets us here. The necessary consequence of the conjugation just described is, that every species in which it occurs must be represented by two forms, one small and the other large, between which a gap exists, over which we have at present no means of bridging, except by supposing that the two new halves formed in cell-division need not always be equal, and that by dwindling away through a succession of steps of this kind the progeny of the sporangial frustules may be reduced to the original size." This may be very ingeniously conceived; but the true key to the difficulty does not appear to have been apprehended by the writer. Mr. Smith, moreover, widens the breach by assuming a diametrically opposite hypothesis, in which, however, he only seems to account for difference of size, without observing the dilemma into which he falls. Thus he says at p. xxvi of his work, already alluded to, speaking of self-division, that "a careful examination of the process in the filamentous species has led him to conclude that a slight enlargement occasionally takes place in the new valves, thus causing a widening of the filament;" and reasoning upon this premiss, which, I humbly conceive, should have been taken the other way, he proceeds as follows:—"The increase in the new valves, although slight, will, however, sufficiently account for the varying breadth of the bands of the filamentous species, and the diversity of size in the frustules of the free forms, without obliging us to suppose that a growth or aggregation takes place in the siliceous valve when once formed." Yet it is actually within the fully formed valve that the new half-frustule is produced; and if so, it must, as before stated, be smaller than its parent by the whole thickness of the siliceous coat. "Starting from a single frustule," he goes on to say, "it will be at once apparent that if its valves remain unaltered in size while the cell-membrane experiences repeated self-division, we shall have two frustules constantly retaining their original dimensions, four slightly increased, eight somewhat larger, and so on in a geometrical ratio, which will soon present us with an innumerable multitude containing individuals in every stage, but in which the larger sizes predominate over the smaller; and such are the circumstances ordinarily found to attend the presence of large numbers of these organisms." I am afraid that this doctrine of a geometrical increase in the size of the frustules will not stand the test either of fair theoretical induction or comparison with natural fact; for although there is in truth a gradual diminution, even this does not take place in a geometrical ratio, which, in the nature of the case, can only apply to number, not to size, as will be clearly seen on inspecting fig. 5, purporting to trace the history of a single frustule through five grades of self-division, in which the numbers accurately express the relative sizes of all the half-frustules, new and old.

It is now full time to elucidate my own views by illustrative facts, which I hope will be considered satisfactory, as supporting all the observations previously made, and by inference affording a guide to the study of those forms which, from their extreme delicacy and minuteness, might be for ever problematical and difficult of analysis, both as to structure and physiology.

As each perfect frustule consists of an older and a younger valve, never of two valves of the same age, Kützing's names, primary as applied to the former, and secondary to designate the latter or the invaginated valve, can be open to no possible objection. But to these it is absolutely necessary to add two tertiary valves of the same age, resulting from the process of fission, viz. the first tertiary, developed in connexion with the primary valve, and the second tertiary, forming a new frustule with the secondary valve.

Of all these valves the primary or most external is the largest, the secondary and first tertiary are intermediate, while the second tertiary is the smallest.

Fig. 1 (Pl. III.) is a diagrammatic section of a perfect frustule previously to the transverse fission of its primordial utricle and contents.

a. Primary valve.
a 1. Body of the valve.
a 2. Primary hoop.

b. Secondary or invaginated valve.
b 1. Body of the valve.
b 2. Secondary hoop.

Fig. 2 represents a perfect frustule after the fission of the primordial utricle and contents and the formation of *c* and *d*, the first and second tertiary valves of the same age, and consisting of *c* 1 and *d* 1, the body of the valves, and *c* 2 and *d* 2, the incipient tertiary hoops. The remaining references are the same as in fig. 1.

Fig. 3 illustrates the ultimate separation of the two new frustules, in which the same process is repeated: A, the primary-valve frustule; B, that of the secondary valve. The smaller letters and numbers correspond with those in the foregoing figures.

In fig. 4, 1, 2, and 3 are ordinary examples of *Biddulphia*, drawn from nature for comparison with figs. 1, 2, 3 respectively, which are diagrammatic.

On submitting a large frustule of *Isthmia* to microscopic examination, the pitting or markings of the invaginated hoop may be distinctly focussed through the enclosing or external one connected with the primary valve; and it is remarkable that the artists employed by various writers to illustrate their works have shown this unequivocally in many instances, militating irreconcilably with the text.

The "hoops" of the tertiary valves are gradually evolved as the new frustules progress in development; and even while included within their formative valves their markings are often clearly discernible.

Before the tertiary "hoop" is of sufficient depth to give the new frustule its adult dimensions, the outer "hoop" will be seen to extend beyond the gibbous fulness of the younger valve in *Biddulphia* and *Isthmia*—a condition which is incompatible with the idea of a single "intermediate piece" or "connecting membrane" of the existing theory. Any deepening of the so-called connecting membrane is therefore only likely to happen in connexion with the tertiary hoop, no addition being necessary, nor, indeed, at all capable of proof, as respects the adult or outer "hoop." Dr. Wallich, however, assumes that additions are made to both in the manner above alluded to.

Of course, in particular genera, where the hoops of the valves are exquisitely thin and destitute of markings, it would be more difficult to trace out the particulars just described. The inference, however, appears legitimate, unless sufficient reasons can be advanced to warrant a contrary opinion, that, small and large, the same general laws of development obtain with all the Diatomaceæ. To conclude these remarks, it must be stated that every tertiary valve becomes in due course secondary, and ultimately primary, beyond which there is no further advance; but after having been the parent of an almost unlimited progeny it must tend to decay, if it be not privileged to close a genetic cycle by taking part in the development of a sporangial frustule from which another living chain may descend with renewed energy.

Mr. Ralfs uses the term "front view" for what appears to me to be in reality the "side view" of the frustule, corresponding with the position in which the axis of growth is perpendicular to the axis of vision, or, in other words, where the component frustules would form a band or filament seen sideways. On the other hand, when such a filament is seen end on, the axis of growth being coincident with the axis of vision, he would call the presenting end of the nearest frustule a "side view," though this is unquestionably an end view by all analogy.

It appears to me that the axis of growth should be the longitudinal axis, however short that may be, though the broadest diameter is generally recognized as the length of the frustule.

Besides the siliceous envelope and the amber tint of the contents, the Diatomaceæ differ very materially from the Desmidiaceæ in their process of self-division. Thus, in the latter, more especially the solitary species, fission is attended with the immediate and total separation of the valves, followed by genuine gemmation of a new valve from each parent. In the Diatomaceæ, on the contrary, fission takes place under cover of the sliding hoops, which retain the original valves in contact, while the new endogenously developed half-frustules are rather being modelled out of the preexisting material than produced by genuine gemmation as in Desmidiaceæ.

In the annexed diagram (fig. 5) I have attempted to trace the history of a single Diatomaceous frustule through several stages of self-division, expressing by simple figures the relative sizes of all the half-frustules. As a guide to the method adopted, it will only be necessary to bear in mind that valve No. 1 is the parent of valve No. 2, valve No. 2 the parent of valve No. 3, &c., the rising numbers representing the grades of diminution—which are certainly not in a geometrical ratio, like the simple multiplication of the frustules themselves. It will be seen that all the frustules to the left of the median line are the progeny of the primary valve, and those to the right the descendants of the secondary valve; and taking the grades in their order, we find, on the primary side, 1 in the first place, 2 in the second, 3 in the third, 4 in the sixth, 5 in the eleventh, and 6, the highest number, in the twenty-second. The highest numbers are also to be found in corresponding places on the secondary side, and the ratio is certainly much more complex than the geometrical.

Fig. 6 shows an undulating line by construction, giving each valve of the long series its relative breadth within seven thicknesses of the siliceous coat, but only representing one border; the progeny of valve 7 must exhibit a very appreciable diminution in size as compared with the original sporangial frustule; and in this theory every requisite for the completion of the genetic cycle of the species would appear to be supplied.

II.—*On* Physalia *and certain Scombroid* (?) *Fish which are frequently associated with it in Tropical and Subtropical Seas.* By G. C. Wallich, M.D., F.L.S.

Mr. Collingwood's interesting paper on "Oceanic forms of Hydrozoa," which appeared in the 'Annals' for November 1867, brought to my recollection some additional facts in connexion with *Physalia* which came under my observation during repeated voyages to and from India, and of which I retain copious notes. To these facts I will advert immediately; but I would point out, *en passant*, that the stinging-properties of this Hydrozoon are by no means so novel as Mr. Collingwood seems to think, every sailor with whom I have come in contact who has once traversed tropical and subtropical latitudes having been well aware that the "Portuguese man-of-war" is not a creature to be handled with impunity. The stinging-property resides in the tentacles, not in the polypites, and is produced by the discharge of acontia from minute oval sacs which are distributed at regular intervals along these organs.

Although I have invariably failed in my efforts to preserve the pneumatophore of *Physalia* in anything approaching to its pristine condition, I have been able readily to secure the tentacles in such a manner as to have retained their character up to the present period, namely, over a space of eleven years. This has been effected simply by placing the pneumatophore on a card or board (to which it adheres at once through a certain tenacity peculiar to it) and by then *winding off* the tentacle in the same way that one may wind off a skein of silk or cotton. The extensile quality of the organ is such that I have sometimes succeeded in stretching it, from its natural length of from 3 to 6 inches, to some 8 or 10 yards, and this without once breaking the continuity of the thread. On being so extended, the tentacle forms an extremely delicate flattened band, composed of several parallel fibres of highly contractile tissue arranged longitudinally, each fibre being from $\frac{1}{2500}$ to $\frac{1}{1700}$ of an inch in diameter*. On this, or, rather, imbedded *in* this composite filament, the acontia-sacs are distributed.

* A specimen of a piece of the preserved tentacle, mounted on an ordinary slide in Canada balsam, without further preparation, is to be seen in the cabinet presented by me to the Royal Microscopical Society.

But the most singular phenomenon connected with *Physalia* consists in its power of slowly and steadily depressing its pneumatophore from its normal erect position to a position which is horizontal, or, in other words, till the pneumatophore rests on one of its sides on the surface of the water. The act of elevation or depression occupies from eight to ten seconds or thereabout, and takes place as soon as the creature comes abreast of the bows of the ship, the state of depression continuing until it is abreast of the stern. I have so repeatedly witnessed this wonderful occurrence in moderately calm weather, at distances varying from a few feet to thirty or even fifty yards, that I should feel inclined to attribute it to some subtle influence produced either by molecular vibration in the water during the transit of the vessel, or to some equally subtle vibration communicated to the pneumatophore through the intervening atmosphere. The last, however, is, in all probability, the most rational way of accounting for it, inasmuch as the commencement of the depression takes place, in many instances, apparently quite beyond the reach of the surface-disturbance of the water, which causes a series of advancing waves ahead of the ship.

I would also take the opportunity of confirming what Mr. Collingwood says regarding the small fishes which he saw accompanying *Physalia*, having not only observed them over and over again, but captured them in some numbers in my casting-net thrown from the main-chains or the main-gangway port. Indeed, in a paper communicated by me, in December 1862, to 'The Intellectual Observer,' I distinctly drew attention to this fact, and mentioned that, having submitted some sketches of the fish to Dr. Günther of the British Museum*, he expressed his opinion that, if mature fish, and not young Scombridæ, they belong in all probability to some new and unknown genus. As these fish vary in size within very restricted limits only (I have never seen one longer than 4 or shorter than 3 inches †), Dr. Günther's suggestion as to their being new to science is doubtless correct.

As recorded by me, in the paper above referred to, these fish accompany *Physalia* just as the pilot-fish accompany the shark—in this instance swimming backwards and forwards and amongst the tentacles in such a fashion as to suggest a "co-operative" action between the two creatures, which results probably in a supply of food. I may add that, on many occasions, I have also detected, adherent or creeping amongst

* These sketches are now in the possession of the Microscopical Society.

† Mr. Collingwood speaks of having seen them 6 inches in length ('Annals' for November 1867).

the coiled masses of the tentacles and polypites of *Physalia*, isopod crustaceans from about half to three-quarters of an inch in length, of a similar species to some I also occasionally obtained adherent to the floats of *Ianthina*, or floating epiphytic Lepadidæ of the open ocean. It is further deserving of notice that both fishes and isopod crustaceans invariably presented the brilliant blue markings visible on the tentacles and polypite masses of *Physalia*—and, lastly, that, on placing specimens of *Physalia* on a piece of cardboard immediately after capture, I have seen a slow rolling movement of the pneumatophore continue to take place for upwards of an hour, and, indeed, until its wall had actually shrivelled with the heat. The slow and rolling nature of this action gave me the distinct impression, at the time, that it was due to vital (probably muscular) contractility, and not merely mechanical.

III.—*Description of some new Species of Fossil Ferns from the Bournemouth Leaf-bed.* By A. Wanklyn, B.A., Sidney Sussex College, Cambridge.

[Plate I.]

In the spring of 1867, Admiral Sulivan was kind enough to show me some specimens of ferns which he had obtained from the Bournemouth leaf-bed. Since then I have endeavoured to obtain sufficient data for the determination of these ferns. This I have done with regard to the ferns most commonly found, which I now propose to figure and describe.

I also figure two other ferns, which differ from these, but of which I have only been able to find the specimens from which the drawings are made.

Few patches of clay in this district are entirely without traces of leaves; their absence at any particular spot seems to be due, not so much to a scarcity of leaves when the strata were deposited as to the fact of the matrix having been unfavourable to their preservation.

The ferns, however, seem to be very local. I have only heard of their being found at one place in this district; and there they occur in great abundance. In the section exposed in 1867 there were two or three layers, each about an inch in thickness, which consisted of dicotyledonous leaves and fronds of ferns matted together. Beneath these there was usually a thin stratum of sand a few lines in thickness.

The state of preservation of the ferns varies with the nature of the deposit. Where the matrix is sandy, the carbonaceous matter has almost disappeared, and often only the cast of the frond remains; where it is a close and compact clay, the impressions of the upper and lower epidermis are preserved, and owe their colour to the decomposition of the intervening tissues. The veins are represented by channels which often contain the remains of fibre. Their distinctness depends upon the relative decomposition of the tissues. Where the vegetable matter has been quickly and entirely removed, the specimens present only indistinct traces of the venation; if, on the other hand, the matrix is charged with carbonaceous matter, the veins are lost in the substance of the frond, and leave no traces on the impressions.

It seems probable that these beds were deposited in a shallow estuary. Large masses of wood are to be found in the cliffs so honeycombed by *Teredo* as to leave but the thinnest partitions between the tubes. In strata deposited under estuarine conditions, we cannot look for a continuous record of events, because, although the accumulation of the materials may have been the work of ages, yet their final arrangement may have been effected in a comparatively short space of time.

With the exception of the *Teredo*-borings, few traces of animal life are to be found. Remains of insects from the pipe-clay at Corfe have been figured in the 'Quarterly Journal of the Geological Society,' in a paper by Mr. Prestwich. I have lately obtained from Bournemouth a fragment of an insect, which Mr. Dallas has kindly undertaken to determine if possible.

The ferns of which I have obtained sufficiently good specimens for description are closely allied to the recent subgenus *Mertensia* of the genus *Gleichenia*.

Subgenus Mertensites (nobis).

Stipes repeatedly dichotomous (Pl. I. fig. 2), the ultimate branches bearing simply forked pinnæ (figs. 1 *b*, *c*). Veins somewhat prominent, venules free. Sori near the middle of the two exterior venules of each fasciculus (fig. 1 *g*). Capsules sessile, deciduous, arranged round a punctiform receptacle.

Mertensites hantoniensis (nobis). Pl. I. figs. 1 *a–g*.

Stipes rounded; ultimate branches with a pair of pinnæ; pinnæ lanceolate pinnatifid; segments linear-acute, quite entire. Capsules globose, longitudinally striated, eight to ten in number.

This is the fern of which I have obtained the greatest number of specimens. The largest in my collection are from 5 to 6 inches in length. It is difficult to arrive at the entire length of the pinnæ, as it is not easy to separate them from the leaves, and I have not yet seen an entire specimen.

Mertensites crenata (nobis). Pl. I. fig. 3.

Segments of the pinnæ crenato-lobate and rather broader than those of *M. hantoniensis.*

This species is much rarer than the preceding. I have a specimen which indicates a pinna 4 inches broad. It seems to be altogether on a larger scale than *M. hantoniensis.*

Croziers and fragments of stipites belonging to one or other of these species have been found; the stipites would indicate a fern probably 4 to 5 feet in length.

I hope at some future time to obtain specimens which will enable me to determine the rarer forms, figs. 4 *a*, *b*, and 5. All that I can say of them is that fig. 4 seems to be allied to *Lindsœa* or *Adiantum*, and fig. 5 to some genus of *Cyatheœ.*

EXPLANATION OF PLATE I.

Fig. 1 *a.* Part of pinna of *M. hantoniensis*, showing the venation.
1 *b, c, d, e.* Ultimate branches, showing the habit of growth.
1 *f, g.* Fructification. (1 *g* is enlarged.)
Fig. 2. Stipes of *Mertensites* (reduced one-half).
Fig. 3. Part of pinna of *M. crenata.*
Figs. 4 *a, b. Adiantum?*
Fig. 5. *Cyatheœ?*

IV.—*Investigation of the Freshwater Crustacea of Belgium.* By Félix Plateau. (First Part.)*

The study of the little freshwater Crustacea, already carried so far by Müller, Jurine, and Straus, was resumed in 1837 by the English zoologist Baird, who extended the circle of our knowledge with regard to them, and set himself to describe the species (especially of the genus *Cypris*) which are met with in England.

I have made some investigations of the same kind in Belgium, which, wedged in between France, Holland, and Germany, has a fauna partaking of those of these three countries, and consequently very rich.

The present memoir, which is only the first part of my work, contains the results of my anatomical and physiological observations upon the genera *Gammarus*, *Lynceus*, and *Cypris*, as also a list of the species of these genera which are met with in Belgium. In this summary I shall leave this list unnoticed. I may state, however, that the number of species which it contains is distributed as follows:—three for the genus *Gammarus*,

* For this abstract, as also for a copy of the original memoir, from "Tome xxxiv. des Mémoires couronnés publiés par l'Académie de Belgique," we are indebted to the author.—W. F.

six for the genus *Lynceus*, and twenty-three for the genus *Cypris*; and among these last a species which I believe to be new, and for which I propose the name of *C. quadripartita.*

As regards my anatomical and physiological researches, the following are the results which I consider new.

Gammarus puteanus, Koch, is, as is well known, a singular animal, which lives exclusively in subterranean pieces of water, and its eyes are rudimentary and destitute of pigment. I have made some experiments on the sensibility of the eyes of *Gammarus puteanus*; and it appears from these experiments that light hurts them, as is the case in nocturnal animals, and that the *Gammarus* even flies from diffused light, taking refuge under the shadow of opaque bodies which may be offered to it for this purpose.

Since the time of Müller the genus *Lynceus* had never been the subject of any general work. I have taken up the anatomical study of these little animals, paying particular attention to the facts neglected by Müller and other authors. In my memoir I pass in review :—1. The form of the antennæ of the first and second pairs ; the latter do not originate here, as in the *Daphniæ*, from the outer sides of the head, but beneath the margin of the beak. 2. The form of the body, properly so called, which includes only seven segments. 3. The structure of the rudimentary eye or black point, and of the true eye. I show that the true eye, contrary to what is stated in this respect by Rathke with regard to the *Daphniæ*, is at first represented in the embryo by a pigment-mass supporting a sort of entire nucleus ; the mass and nucleus divide into two distinct parts, and by their subsequent development become reunited by their inner faces. 4. The digestive apparatus : the maxillæ of the *Lyncei* are triturant, and bear a crown of conical asperities ; the digestive tube is not uniform in the greater part of its extent, but we find in it an œsophagus, a first dilatation into which opens a diverticulum corresponding to the cæca of the *Daphniæ*, a large sac with glandular walls, which I shall call the stomach, a slender intestine forming several convolutions, already represented by Müller, and, finally, a straight large intestine inflated like the colon in man. 5. The feet, or respiratory limbs. The limbs of the *Lyncei*, in addition to the antennary rami, consist of five pairs, which, however, are far from being constructed upon a uniform plan ; they may be divided as follows :—natatory feet with a rudimentary respiratory vesicle, and furnished with a flat disk for striking the water ; feet destined to produce a current of water between the valves, also with rudimentary respiratory vesicles, but furnished with long, rigid setæ ; and exclusively respiratory feet, with enormous respiratory vesicles, and with scarcely any setæ. 6. The male and female reproductive apparatus. I have discovered the male of *L. trigonellus* and rediscovered that of *L. lamellatus*; they differ from the females by their smaller size, their more elongated body, and by the considerable size of the antennæ of the first pair. The essential part of the reproductive organs consists of a membranous sac on the inner surface of the penultimate joint of the tail, containing two sacciform glands, slightly constricted in the middle, and each furnished with a wide and short excretory duct; these two ducts open at the base of the caudal lamina. Spermatozoids are frequently met with in the fecundated females; these are, like those of the *Daphniæ*, fusiform bodies with a membranous border. The female apparatus of the *Lyncei* greatly resembles that of the *Daphniæ*; the winter eggs, which the incubatory cavity contains at certain periods of the year, are not enclosed in a common *ephippium*, but there is a membranous capsule or distinct *ephippium* for each egg.

Straus Dürckheim, in a memoir which has justly become celebrated, has given in much detail the anatomy of *Cypris fusca*; but he had never seen anything but ovaries in the individuals which he examined, which led him, like Ramdohr, Treviranus, and many others, to regard the *Cyprides* as hermaphrodites. In 1850, M. Zenker indicated the existence of distinct males. In 1854 he described in detail their sexual organs—consisting of two testes represented by masses of cæcal tubes, of two cylindrical glands of very complicated structure (*glandulæ mucosæ*), the secretion from which serves to form the spermatophores, and, lastly, of two corneous sacs, enclosing a corneous penis and hooks, or excitative organs, which are also corneous.

Having myself rediscovered the males of *Cypris monacha*, and studied great numbers of the females and young of other species, I have been able to verify most of M. Zenker's observations, and to add some new facts to those made known by him.

These new facts are as follows:—The mucus-glands of the male *C. monacha*, contrary to what is stated by M. Zenker, present a temporary sacciform prolongation, which is sometimes found filled with spermatophores. The place of formation of the spermatophores is not the deferent canal of each testis, but the central canal of the corresponding mucus-gland. The free spermatozoids (that is to say, destitute of the envelopes of the spermatophore) may be classed in two groups: those of the first group are filiform, without dilatation of any kind; and those of the second, which are met with in *C. ovum*, and perhaps in *C. punctata*, are furnished at one of their extremities with an inflation, which is constricted in the middle and set on at a right angle upon the principal stem, like the handle of a walking-stick. The copulation of the *Cyprides* appears to take place in the mud. M. Zenker has described, in the females, two pyriform sacs (*receptacula seminis*) in which the spermatozoids are stored up; these, according to him, communicate by two excretory canals with the oviducts. According to my observations, the canals in question simply open at the base of the tail.

Although the young *Cyprides* undergo no metamorphosis like those of a great number of other Crustacea, I have found that the form of the valves in the young of many species is the opposite of that observed in the adults.

Bosc and Straus succeeded in keeping *Cyprides* in wet mud for a period of time which they do not particularize. I have repeated the same experiment, and found that this time did not exceed eight days, and that many other small aquatic animals, such as *Cyclops*, *Hydrachna*, *Naïs*, and the larvæ of Diptera, possessed the same power of resisting for a long time a nearly complete privation of water.

V.—*Description of a Siliceous Sand-Sponge found on the South-east Coast of Arabia.* By H. J. Carter, F.R.S. &c.

Tethya dactyloidea (mihi).

Mammilliform, elongated, date-shaped, fixed, erect, fleshy, tough; surface smooth above, becoming hispid with recurved spines below; colour reddish brown, purplish. Upper extremity obtuse, round, perforated at the point by a circular aperture or vent separated into five divisions by as many septa extending from the circumference to a central union. Lower extremity terminating in a bundle of loose, soft, spiculiferous, keratose filaments, which, tending to a spiral arrangement, finally spread out root-like into the sand beneath. Hollow internally for the purpose of receiving the contents of the excretory system of canals, which, ramifying through the cortical fleshy body, thus empty themselves into the cloacal cavity, somewhat constricted at the vent, already described. Spicules fusiform, pointed at each end, or with one extremity terminating in a trifid extension. Body of sponge $1\frac{4}{8}$ inch long and $\frac{6}{8}$ inch broad; pedicel 1 inch long.

Hab. Sea, south-east coast of Arabia, in shallow sandy bottom near shore.

Obs. This is a siliceous sponge growing erect on the sand, to which it is attached by a loose flocculent bundle of filaments partially twisted into a spiral arrangement, either from the effect of currents or the instinct of the organism, or both. More detail I cannot offer, as I have given away the specimen.

There is a bright yellow sponge of the same kind, but growing in groups on the sandy bottom of the Mahim estuary, off the Island of Bombay. Of this I possess no record whatever; and the specimens were given away with that of *Tethya dactyloidea.*

I found many specimens of *Tethya* on the south-east coast of Arabia, opposite to Ras Abu Ashrin, close to the north-east end of the Island of Masira, where the land presents an expanse, unbounded to the view, of white, dome-shaped, calcareous sand-hills, upwards of 100 feet high, forming the southern part of the great Desert of Akhaf, with a very shallow shore and soft sandy bottom extending for many miles out to sea. Some of the specimens were alive, others dead, some floating and free, others fixed to the few black basaltic rocks which here and there skirt this otherwise all-white and desolate coast, but most among the exuviæ in the little bay at this point, where, upon the stoneless and barren strand, lay heaped together a mass of drift, looking more like an accumulation of great bushes than zoophytes, which on my arrival they proved to be.

Here I saw more *Tethyadæ* than on any other part of the coast. Those which were growing on the rocks adhered with such pertinacity, and were so rigid and unyielding in structure, that I could only get them off piece by piece with a hammer and chisel. Like Actiniæ, molestation appeared to increase their rigidity.

It might be assumed that the soft sandy nature of the shore and sea-bottom on this part of the coast of Arabia is peculiarly well adapted for the habitat of sponges generally and zoophytes, of which the enormous amount of drift on the strand bore ample testimony.

The specimens of *Tethya*, as already stated, are found globular and floating, or hemispherical and fixed to the rocks, or shaped like the one above described, throwing out a number of radical fibres coral-like into the sand beneath, thus differing from those Spongiadæ which seek a purer situation on the sloping or undersides of rocks, where foreign particles fall off rather than upon them.

Calcareous Sponges.

The spicules of *Grantia ciliata* among the Calcareous Sponges, as well as those of *Gorgonia* and those of *Operculina* *arabica* among the Foraminifera that I have examined, have no central canal, in which they thus decidedly differ from the spicules of the Siliceous Sponges.

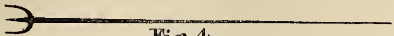
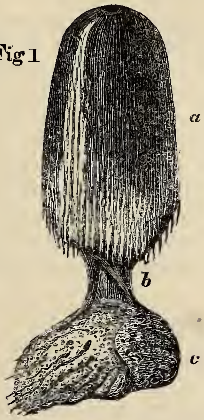


Fig 4

Fig 1



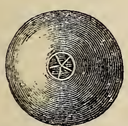


Fig 2

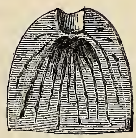


Fig 3

Fig. 1. *Tethya dactyloidea*, natural size: *a*, body; *b*, pedicel; *c*, root, or filamentous extension into the sand.
Fig. 2. Upper extremity, showing vent septated.
Fig. 3. Vertical section of same, showing vent, cloacal cavity, and termination of excretory canals.
Fig. 4. Trifid spicule.

VI.—*Descriptions of several new Species of Nymphalidian Rhopalocera.* By Arthur G. Butler, F.L.S., F.Z.S., &c.

[Plate IX.]

The following species would, according to the arrangement of Lepidoptera given in Westwood & Hewitson's 'Genera of Diurnal Lepidoptera,' belong to three distinct families; but these divisions, according to Bates, must be regarded as subfamilies of one large group.

Family **Nymphalidæ** (Westwood, *part.*), Bates.

Subfamily *Heliconinæ*, Bates.

Genus Heliconius, Fabricius.

1. *Heliconius Zelinde*, sp. nov. Pl. IX. fig. 1.

♂. Alæ supra fuscæ, area basali nigrescente certo situ cærulescente:

anticæ fascia (vel potius plaga) disco-discoidea ochraceo-flavida abbreviata ad nervulum primum medianum extensa, a venis nigris interrupta et a macula cuneiformi nigra in discocellulares disrupta; punctis tribus apud apicem oblique positis albidis, aliisque subanalibus cinereis squamosis: posticæ fascia costali ochracea, punctis tribus squamosis subapicalibus squamisque nonnullis analibus inter venas marginalibus cinereo-albis: corpus nigrum albido præ punctatum.

Alæ anticæ subtus area disco-costali fusca; area interna tricolorata, in cella grisea, infra venam medianam et nervulum primum pallide fusca, deinde pallide cinerea; plaga superna permagna sericeo-alba, maculis punctisve octo marginalibus increscentibus et quatuor decrescentibus submarginalibus apicalibus niveis: posticæ fuscæ costa basali sericeo-flava; fascia indistincta costæ subparallela alteraque undata magis distincta margini anali subparallela, ferrugineis; maculis tribus subapicalibus lunularibus niveis, quatuorque marginalibus analibus squamosis cinereis: corpus nigro-fuscum, palpis ad basin albis; thorace flavo maculato; abdomine linea media squamosa ochraceo-albida.

Exp. alar. unc. $3\frac{1}{2}$.

Hab. West coast of America. B.M.

Presented to the Collection by Capt. Kellett and Lieut. Wood.

This species is allied to *H. fornarina*, Hewitson (from Guayaquil), but differs from it in many important particulars.

2. *Heliconius primularis*, sp. nov. Pl. IX. fig. 2.

Alæ anticæ supra fuscæ, area basali nitide cærulescente, fascia obliqua media alteraque abbreviata obliquis sulphureo-flavis a venis nigris intersectis, externa extus diffusa, intus bidentata: posticæ area basali cærulea nitida, apicali sulphureo-flava a venis nigris intersecta; margine externo anguste albicante, margine costali late fusca: corpus fuscum albo præ punctatum.

Alæ subtus pallidiores, maculis in anticis una, in posticis sex coccineis; area basali fusca; anticis linea subcostali flava, fasciaque externa ad marginem fere externum abrupte extensa, aliter velut supra: corpus fuscum, fronte nivea, palpis pedibusque primoribus lateraliter niveis.

Exp. alar. unc. 3, lin. 1.

Hab. Guayaquil and Rio Napo. B.M.

Purchased of Mr. Stevens.

Most nearly allied to *H. Eleuchia*, Hewitson (from Bogota), but differing in the form and width of the bands in the front wings, and in having the apical area of the hind wings brimstone-yellow in place of the narrow snowy border of *Eleuchia*.

3. *Heliconius Zobeide*, sp. nov. Pl. IX. fig. 3.

Alæ supra nigerrimæ omnino cinereo nitentes; fasciis duabus anticis obliquis, abbreviatis, niveis, interna ad venam medianam late disrupta, externa a venis intersecta; posticæ ciliis niveis: corpus fuscum præ flavo punctatum.

Alæ subtus fuscæ, anticæ margine interno pallidiore sericeo; fasciis supernis niveis, stria subcostali basali et aliquando mediana flavis, costaque ad basin coccinea: posticæ striis duabus, inferiore multo longiore, punctisque duobus coccineis; ciliis niveis: corpus fuscum flavo maculatum; abdomine linea media, palpis pedibusque primoribus lateraliter flavis.

Exp. alar. unc. 3, lin. 5.

Hab. Para; B.M. Peru; Coll. Druce.

Presented to the National Collection by Mrs. J. P. G. Smith.

Nearly allied to *H. Antiochus*, Linnæus, and bearing nearly the same relation to it as exists between *H. arania*, Fabricius, and its Villa-Nova representative.

Subfamily *Satyrinæ*, Bates.

Genus Idiomorphus, Doumet.

4. *Idiomorphus Zinebi*, sp. nov. Pl. IX. fig. 4.

♂. Alæ supra fuscæ, certo situ roseo tinctæ; corpus fuscum.

Alæ subtus ochraceæ, roseo partim tinctæ, lineis tribus communibus obscurioribus, duabus mediis nigro-fuscis ad costam anticarum divergentibus; tertia pallidiore undulata submarginali: anticæ lineis duabus discoideis subbasalibus fuscis; apice obscuriore puncto uno alterove albis; plaga magna interna sericeo-cinerea: posticæ punctis septem ocellaribus albis discalibus: corpus ochraceum.

Exp. alar. unc. $2\frac{1}{4}$.

Hab. Gold Coast. Coll. Swanzy. Collected by Mr. Crocker.

Allied to *Idiomorphus Italus*, Hewitson (from Old Calabar), but very distinct; on the underside more like *I. Iccius*, Hewits.

Subfamily *Nymphalinæ*, Bates.

Genus Diadema, Boisduval.

5. *Diadema octocula*, sp. nov. Pl. IX. fig. 5.

♀. Alæ supra nigro-fuscæ: antice fascia postmedia obliqua ferruginea, ocelloque anali nigro indistincte pupillato fusco-ferrugineo cincto: posticæ fascia lata submarginali intus dentata ferruginea a venis nigris intersecta et puncta septem nigra ocellaria cæca inter venas includente; linea vix distinguenda obscure ferruginea undulata marginali; striola anali squamosa cærulea: corpus nigro-fuscum.

Alæ subtus pallidiores; fasciis striaque marginali supernis pallide roseo-albidis brunneo variis: anticæ characteribus quatuor discoideis subcostalibus, punctis quinque subapicalibus unaque majore anali cæruleo-albidis nigro cinctis, linea submarginali nigra: posticæ ocellis septem nigris albido pupillatis; stria submarginali lunulari nigra, striola superna anali cæruleo-albida: corpus fuscum.

Exp. alar. unc. 3, lin. 4.

Hab. Island of Tologa. Coll. Druce.

Belongs to the *Pandarus* group, and would, according to Mr. Hewitson's views, be a local variation of that species. I have not, however, seen any indication of such links between the several well-marked forms of the *Pandarus* group as are to be met with in the case of (*Lasinassa*) *Bolina** (though even here I am not at present satisfied that we have only one species). The present species comes nearest to the insect figured by Mr. Hewitson (Proc. Zool. Soc. 1858, pl. 54. fig. 2), but differs, upon the upperside, in the ferruginous band and ocellus of the front wings, the darker margin and absence of internervular white spots in the hind wings.

Genus ROMALÆOSOMA, Blanchard.

6. *Romalæosoma Crockeri*, sp. nov. Pl. IX. fig. 6.

Cyparissa, Doubleday (nec Cramer).

♂ ♀. Alæ supra nigræ, area basali cærulescente; disco virescente, puncto anticis apicali albo; area anali posticis purpurascente: corpus cinereum, palpis fulvis.

Alæ subtus ochreo virescentes; maculis marginalibus inter venas geminatis nigris, margine ipso fuscescente: anticæ maculis tribus discoideis basalibus, nonnullisque disco-discoideis fasciam formantibus nigris fuscisque; area interna fuscescente: posticæ area costali persicaria maculis sub septem mediis serie annulari positis nigris; area inclusa virescente; area anali flavescente; ciliis omnibus albidis: corpus ochraceo-fulvum vel fulvo-cinereum; antennis nigris, fulvo clavatis.

Exp. alar. ♂ unc. 2, lin. 10; ♀ unc. 3, lin. 4.

Hab. Ashanti: ♂ ♀, B.M.; ♂, Coll. Swanzy.

♂ ♀. Purchased from the Collection of the Wesleyan Missionary Society.

♀. Presented by E. Doubleday, Esq.

This species has long stood in the National Collection as the *Cyparissa* of Cramer; the latter, however, is identical with the *Cato* of Fabricius. I have named it after Mr. Crocker, a gentleman acting as agent for Mr. Swanzy on the Gold Coast.

* The East-Indian (Moulmein &c.) form of this species represents the true *Bolina* of Clerck and Linnæus; the *Bolina* of recent authors will have to take the name *Misippus*, applied by Linnæus to the female of that species.

This gentleman, in consequence of his great taste for entomology, has devoted all his spare time to the capture and study of the West-African insects within his reach, and has sent home a collection which, if not rich in novelties, can at least boast several great rarities; among the latter may be mentioned a fine pair of the handsome *Diadema Dinarcha* of Hewitson, *Myrina Maesa*, Hewits., &c.

VII.—*Descriptions of some new Genera and Species of Alcyonoid Corals in the British Museum.* By Dr. J. E. Gray, F.R.S., V.P.Z.S., &c.

My nephew, Mr. W. A. Smith, sent to the British Museum some years ago a kind of Alcyonoid Coral which he collected in Garden Island near Sydney.

Telesco Smithii.

Coral erect, cylindrical, simple, slightly furcately branched, tubular, cartilaginous, with a thin, hard, crustaceous external coat, smooth below and marked with eight grooves and white streaks. Polype-cells short, subcylindrical, closely adpressed to the side of the stem, with eight grooves radiating from and deeper near the aperture. Tentacles and mouth of the polype quite retractile. Polype-cells variously disposed, even on the same stem, sometimes opposite on alternate sides of the stem, at others solitary and alternate, and at others there are solitary cells in the series between the opposite ones; rarely the polype-cell on one side of the opposite pair is produced into a short branch bearing cells like the stem; the lowermost cells sometimes project nearly horizontally.

Telesco Smithii.

Hab. Australia, Garden Island, Sydney. (W. A. Smith, Esq.) B.M.

It grows erect in tufts on shells and stones, 6–8 inches high.

The genus *Telesco* may be divided into three subgenera or genera, thus:—

I. Telesco.—The coral shrub-like, furcately branched from the base, the polype-cells terminating the branches and branchlets.

1. *T. aurantiaca*, Lamx. Pol. Flex. t. 7. f. 6 (*T. lutea*, Lamx. Pol. Flex. 231). Australia.
2. *T. ramulosa*, Verrill (*Cornicularia aurantiaca*, Stimpson). Hongkong.
3. *T. pelagica*, Lamx. (*Alcyonium pelagicum*, Bosc; *T. fruticulosa*, Dana). North America.

II. Telescella. The coral erect, with successive spreading clusters of branches, which are ramulose on the sides.

4. *T.* (*T.*) *nodosa* (*Telesco? nodosa*, Verrill). Loochoo.

III. Alexella. The coral erect, simple, with short, cylindrical, adpressed polype-cells on the side of the stem, generally opposite each other, or scattered; some have one or more cells produced into a short lateral branch.

5. *T.* (*A.*) *Smithii.* Australia, Sydney.

The Museum has received from Mr. Rayner several most interesting Corals—among others, the two following Gorgonoids with calcareous axis:—

Raynerella.

Coral much branched, fan-shaped, expanded in a plane; branches and branchlets pinnate; branches diverging, subcylindrical, slender, nearly of a uniform size; branchlets opposite or alternate, diverging. Bark thin, with an even, very slightly corrugated surface, internally finely granular. Polype-cells prominent, roundish, close together, diverging irregularly on all sides of the slender branches; apex rather conical, contracted, with a central dot. Axis calcareous, hard, white, with well-marked longitudinal grooves.

Raynerella aurantia.

Coral orange-yellow; branches and branchlets diverging, pinnate; branchlets ending in a broader tubercle, simple, rarely forked.

Seba, Thes. iii. t. 100. f. 9?

Hab. Bass's Strait, Dewi Reef. (Rayner.)

Brandella.

Coral very much branched, very slender, linear; branches diverging, pinnate, and nearly parallel to each other; branchlets pinnate, opposite or alternate, diverging at nearly right angles, often sinuous, inosculating, uniting the diverging parallel branches into an irregular network. Bark, when dry, very thin, almost membranaceous, smooth, and slightly wrinkled. Polype-cells on all sides of the branchlets, alternate or opposite, cylindrical, short, smooth externally, with a convex 8-valved top. Axis very slender, thread-like, except the main stems, calcareous, hard, pale horn-colour, very brittle.

Brandella intricata.

Coral fan-shaped, expanded. Stem very irregular; branches and branchlets regularly pinnately disposed, forming an irregular network; some of the uppermost branchlets free.

Hab. Bass's Strait, Dewi Reef. (T. M. Rayner.)

VIII.—*On a new Genus of* Gorgonidæ *from Portugal.* By Edward Perceval Wright, M.D., F.L.S., Professor of Zoology, Trinity College, Dublin.

When in Lisbon in September 1868, my friend Professor J. V. Barboza du Bocage showed me three very remarkable specimens of Alcyonarian Corals which had been taken, from a considerable depth, off the coast at Setubal. The most remarkable of these was a magnificent specimen of *Paragorgia arborea* (Linn.), which was several feet in height, and was in excellent preservation. A second specimen was *Primnoa lepadifera* (Linn.); and the third appeared to me to present some affinities to *Mopsea arbusculum* (Yate Johnson*), a species taken at Madeira. Professor Bocage kindly gave me a specimen for examination, accompanied by a request that, if new, I would describe it. It appears to me not only to be a new species, but to present characters that render it necessary to form a new genus for its reception. I would therefore propose to characterize it as follows:—

Keratoisis, gen. nov.

Coral branched, irregularly furcate; axis jointed, composed of horny and calcareous portions; the latter are *hollow*, *smooth*†, varying considerably in length, and maintaining their form after maceration in caustic alkalies; the branches are given off from the calcareous portions. The so-called "barky layer" (cœnenchyma) is well developed, and contains a large number of calcareous spicules. The polypes are irregularly and somewhat

* "Descriptions of two Corals from Madeira belonging to the Genera *Primnoa* and *Mopsea*," Proc. Zool. Soc. 1862, p. 245, pl. 31. figs. 1 and 1 *a*.

† I have only been able to examine a portion of one of the smaller branches. It is possible that the calcareous joints near the point of attachment of the stem may be striated and solid.

densely grouped all round the axis; they are of large size and are completely covered with spicules, which are closely packed side by side. *A variable number (nine to eleven) of long fusiform spicules surround the apical portion of the polype, forming a calyx.* Tentacles eight, pinnately lobed.

Keratoisis Grayii, n. sp.

Deep water off Setubal, on the coast of Portugal*. In the Museum of the University of Lisbon, also the British Museum and Museum of Trinity College, Dublin.

I name the species after Dr. J. E. Gray, of the British Museum.

Fig. 1.

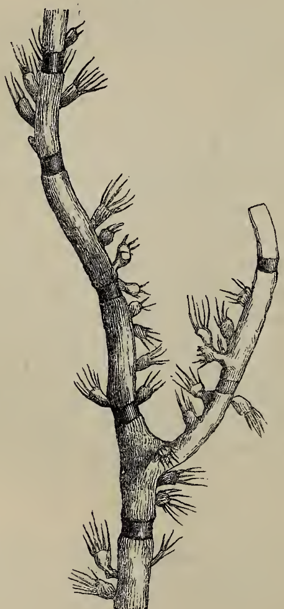


Fig. 2.

Fig. 3.

Fig. 1 represents a portion of the main axis, deprived of cœnenchyma and of nearly all its polypes.

Fig. 2 represents a branch, of the natural size, with the polypes.

Fig. 3. A polype magnified.

This Coral is of a loose irregular growth. The specimen examined by me is about one foot in length, and gives off three lateral branches: there is no apparent tendency in these to ana-

* *Vide* Annals & Mag. Nat. Hist. Dec. 1868, p. 427.

stomose. The horny nodes are short and very much of the same length throughout; but the calcareous internodes vary considerably in length. The whole of the stem is equally covered with polypes. The cœnenchyma developes such a mass of spicules, that they may be said to form a roughened mat-like tissue over its whole surface. The spicules forming the calyx around the polypes are large and fusiform; those scattered through the barky layer are much smaller, longer than broad, and slightly irregular, and they differ from any of those figured in Kölliker's 'Icones.' In the body-substance of the polypes, in what he regarded as the inner portion of the ectodermic layer, a third variety of spicules is met with: these are very small, and belong to the same generic type as those occurring in *Isis hippuris* (Linn.). I looked for polymorphism in this species, but it did not exist.

Not only am I indebted to Prof. Bocage for the specimen figured (fig. 2), which I have presented to the British Museum, but Sig. Capello, the Assistant in the Museum of Lisbon, had the great goodness to sketch for me the portion of the coral represented in fig. 1.

An interesting question now arises as to the position of this genus. All zoologists appear agreed to divide the Actinozoa with eight pinnately lobed tentacles (Alcyonaria) into the three divisions (families) of (1) Alcyonidæ, (2) Gorgonidæ, and (3) Pennatulidæ; and the points of dispute are chiefly as to the rank to which these divisions are entitled, as to the genera that are to be placed in them, and as to the sequence of these genera. The family Gorgonidæ is divided by Milne-Edwards into three subfamilies—Gorgoninæ, Isidinæ, and Corallinæ; the second of these contains the genera *Isis*, *Mopsea*, and *Melithœa*. Since the publication of the 'Histoire des Coralliaires' (1857), many new genera belonging to this family have been published by Dr. J. E. Gray and others; and Dr. J. E. Gray published the first part of a "Synopsis of the barked Corals" in the 'Proceedings of the Zoological Society' for 1857 (pp. 278–294). This synopsis was not completed; but all interested in this subject will be glad to know that Dr. Gray has in the press a Catalogue of the Alcyonaria in the British Museum, in which work we may expect to find an arrangement of the genera, based on a very extensive experience and on an examination of an immense number of genera and species. For my present purpose it will be sufficient to decide to which of the genera of Gorgonidæ as established by Milne-Edwards *Keratoisis* most nearly approaches. According to Milne-Edwards, the Corals with an axis presenting nodes and internodes (jointed) would necessarily belong to the subfamily Isidinæ; but if we refer to one of the latest works on the structure of the Cœlenterata, that of Kölliker*, we find an arrangement of the Gorgonidæ which, while essentially based on that of Milne-Edwards, departs in several particulars from it. Instead of three subfamilies, Kölliker establishes six, (1) Gorgoninæ, (2) Isidinæ, (3) Briareaceæ, (4) Sclerogorgiaceæ, (5) Melithæaceæ, (6) Corallinæ; and, passing over the characters given for the other subfamilies, we find the second and fifth characterized as follows:—

(2) *Isidinæ.*—Axis jointed, composed of horny and calcareous portions; of these the latter possesses a lamellose structure, and maintains its form after it has been placed in alkali. Genus *Isis.*

(5) *Melithœaceœ.*—Axis jointed; the flexible (soft) joints consisting of calcareous spicules surrounded by horny substance and connective tissue, the hard joints of coalesced calcareous spicules. Genera *Melithœa* and *Mopsea.*

It is interesting to see that this classification of Kölliker's, though it is based on the minute structure of the polypes and their cœnenchyma, does not differ very essentially from those already proposed by others, though they are based on more general considerations; but I am at a loss for a reason why these two subfamilies, which certainly are very nearly allied to one another, should be so far separated as in this scheme, the more especially as there are several species of *Mopsea* which are very closely related indeed to some species of *Isis*; and we may expect to find in Dr. Gray's Catalogue very many species intermediate between those at present known. But regarding for the moment the family Isidæ as having but the one genus *Isis*, and the typical species of this genus to be the *I. hippuris* (Linn.), then I am inclined to regard *Keratoisis Grayii* as having the same relation to it that *Mopsea arbusculum*, Yate Johnson, has to the genus *Mopsea*: for this latter species Dr. J. E. Gray proposes the new genus *Acanella*; so that these genera may be arranged thus:—

Subfamily Isidinæ, with the genera *Isis* and *Keratoisis.*
„ Mopseadinæ, with the genera *Mopsea* and *Acanella.*

I trust to have soon an opportunity of examining the spicules of several species of the latter two genera, as well as of several species of *Isis*, and may probably, in a paper describing some Alcyonaria from Australia, give a more detailed account of their histology. Kölliker figures, in tab. 19. figs. 1–3 of his 'Icones,' very beautifully and very truthfully the spicules of *Isis hippuris*, and those of *Mopsea* in figs. 41–44 of the same plate.

* Icones Histiologicæ, Part 2, 1866, p. 131.

IX.—*On* Rhinops vitrea, *a new Rotifer.*

By C. T. Hudson, LL.D.

[Plate II.]

I found a solitary specimen of this creature in a pond at the back of the mansion in Losely Park, near Guildford, some five years ago, and had only just made a rough sketch of it when I was called away from my microscope, and lost the Rotifer from the drying up of the water. Although I returned several times to the same pond, I never could succeed in finding any more specimens; but last week I captured scores of them in a pond in Garraway's Nursery Gardens, at Bristol.

This is an illoricated Rotifer, with its ciliated wreath divided into several series: it belongs therefore to the Hydatinea; but its two eyes set in a sort of proboscis forbid, I think, its being ranked under any of the genera given in Pritchard. I apprehend, therefore, that it will have to be placed in a new genus, which I venture to name *Rhinops*, as well as to give to this species the title *vitrea*, from its glassy cuticle.

The trochal disk has two parallel lines of cilia running round it from the foot of the proboscis to the buccal funnel, the ventral side of the upper portion of which is formed by a projecting fold of the cuticle, as is shown at Pl. II. fig. B, *a*. The cilia of the inner row are the larger, and are sometimes held erect; from their bases the substance of the disk slopes downwards and inwards, so as to form a hollow inverted truncated cone like the glass in a beetle-trap. The smaller and lower end of this cone is the aperture of a large cavity, whose only other opening is the buccal funnel.

The proboscis (Pl. II. fig. A, *b*) is ciliated all over its ventral surface and its edge, except at the extreme point; it carries also two brilliant-ruby eyes. The buccal funnel and the large wedge-shaped aperture above it are also richly ciliated; but I could not detect any cilia on the truncated cone.

I have frequently seen objects swept into the cavity, and so down the buccal funnel to the mastax, and have noticed how skilfully the ciliated proboscis directs the atoms down the cone.

Rhinops usually swims at a moderate pace, rolling gently round its longer axis as it goes; and every now and then it bends its proboscis over towards its back (thus fully displaying the cilia), and turns somersets, as *Synchæta* does, only in a much more leisurely manner. Occasionally, however, it darts suddenly forward; and at each time that I have watched it doing so, I have fancied that I saw the atom which it wished to secure; certainly the impression produced on my mind was that the animal made a conscious effort to seize prey of whose presence it was aware; and it is the first rotifer whose actions would lead me to credit its red spots with being eyes.

It is curious, too, to see how it presses together the broad flaps of the trochal disk when an unusually large atom has entered the cavity above the buccal funnel.

The pseudopodium is a short, extremely transparent cone, ending in two minute toes, and capable of being drawn up into a fold of the trunk, so as to leave only the tip exposed. It has in it what appears to be a club-shaped gland, from which a prolongation runs upwards in the median line: this latter does not seem to be a muscle, as it simply bends into a sigmoid curve when the foot is drawn up.

The muscular system is shown in Pl. II. fig. 1, which represents *Rhinops* held down by the compressorium. Four longitudinal muscles, *a a*, *b b*, spring from the same points, *f f*, and proceed to the edges of the trochal disk; they are tied to the cuticle at *g g*, and the outer pair again at *e e*. The muscles *c c* also act in drawing down the trochal disk, and send off branches, *d d*, to the proboscis. The pair *h h* draw up the foot, and the five incompletely circular muscles at *k* compress the trunk and force out the retracted trochal disk or foot.

The mastax (fig. 2) contains the usual mallei and incus, the former with five teeth, *b b*, the latter with ridges, *a a*, on the inner edges of the rami.

The proventricular canal is long; and the stomach has thick walls, in which yellow oil-globules are frequently imbedded: it is divided by a constriction into two portions, of which the lower is densely ciliated. The cloaca opens in the usual position, where the trunk meets the foot, and is also ciliated.

The two gastric glands on the upper surface of the stomach are transparent subcones, with their bases on the stomach; oddly enough, they are not generally of the same shape, one being more bent than the other.

There is a moderate-sized contractile vesicle, and tubes or cords passing up from it on either side to the trochal disk, under which they end in numerous convolutions bearing three vibratile tags.

The proboscis appears to contain a nervous mass (fig. 3 *c*), which sends off two processes, *a a*, to its unciliated tip, and one, *b*, to each eye. I have been unable to detect any antennæ or tactile setæ; but I imagine that the tip of the proboscis is an organ of touch.

The ova become so developed before being extruded, that the young animal quits its case and fills up a large portion of the body of its parent. I have seen several specimens in which the young *Rhinops* lay with its head close to the contractile vesicle, and its foot close under the mastax.

My specimens average $\frac{1}{80}$ inch in length, and have been living in captivity for upwards of a week.

X.—*Descriptions of new Genera and Species of* Tenebrionidæ *from Australia and Tasmania.* By Francis P. Pascoe, F.L.S., F.Z.S., &c., Honorary Member of the Natural History Society of Natal.

[Plate X.]

Dr. Howitt, of Melbourne, having recently sent me a large collection of Heteromera from Australasia and New Zealand, I propose to describe in this Magazine such of the new Australian species as belong to the family Tenebrionidæ, adding several more derived from other sources, leaving the remainder and those from New Zealand for a future opportunity.

The Tenebrionidæ* belong preeminently to the hot and dry regions of the earth; the epigeous or more normal forms are found in very small numbers, either in the humid lands of the tropics or in the northern parts of the northern hemisphere. England contains only seventeen (or, with the doubtful and introduced, twenty-seven) species, while the countries surrounding the Mediterranean have, according to M. de Marseul's Catalogue, 1327 species. From Australia and Tasmania we have about 210 described—a number probably far below that contained in the rich collections of Melbourne and Sydney, and which we cannot doubt will be still greatly increased as those countries are more explored. The lists which Dr. Howitt has favoured me with from time to time bear evidence of the narrow limits in which a large number of species are localized.

There is some confusion in regard to the use of the terms for those parts of the elytra known as the "epipleura" and the "epipleural fold"†, which it is necessary to notice: when

* In the sense in which it is constituted by M. Lacordaire (Gen. des Coléopt. t. v.). The great advantage of having a standard which is in everybody's hands appears to me to render it desirable to conform as closely as possible to the classification and to the principles of analysis applied to the characters of the various divisions of the family. Only, for the sake of greater simplicity, I have called his "tribus" and "groupes" (the latter often of equal rank with the former) subfamilies. The "sections" and "cohorts," being merely designations of the primary branches of a dichotomous arrangement, do not themselves form natural divisions.

† "*Repli épipleural*" of M. Lacordaire. "Fold" is a bad rendering of "*repli*," but I know of none better. Dr. Leconte does not appear to notice this part.

only one is present or strongly marked, either term is often used indifferently; while the former, in a second sense, is supposed to express generally the descending or inflected sides of the elytra. In future I propose to use the term "epipleura" for that part of the flank of the elytron marked off from the rest by a line more or less sharply defined; when there is a descending side above this line, as in *Zopherosis*, I propose to call it the "pleura." This should have been the epipleura, if the word had been used in the strictest sense; but it is too late now to attempt to alter its ordinary signification. The stripe along the lower border of the epipleura will be the "epipleural fold" (*plica epipleuralis*); when nearly obsolete, there is still very often a sort of raised line or border which marks its position. Good examples of well-marked epipleura and epipleural fold, without the pleura, will be found in our common *Blaps mortisaga*, or, still better, in the genus *Acis* (*Akis*).

Orcopagia.

Subfamily *Boletophaginæ*.

Antennæ clavatæ, 10-articulatæ; clava biarticulata.
Tibiæ anticæ crescentiformes.

Head vertical, deeply sunk in the prothorax, excavated in front between the eyes and clypeus, the latter cornuted, the lip lying in the space between the mandibles; antennary ridge bilobed. Eyes small, transverse, impinged on by the antennary ridges, but not divided. Antennæ clavate, ten-jointed, the scape elongate; the third joint longer than the second, the rest to the eighth gradually shorter, the ninth and tenth forming a large oval pubescent club, the latter twice as large as the former. Mentum subcordiform; lower lip transverse, broadly emarginate, and fringed anteriorly, its palpi short, with the last joint large, obovate. Maxillæ with the lobes of equal breadth; the palpi moderate, with the last joint cylindrical and obliquely truncate. Prothorax transverse, rounded, crenate, and expanded at the sides, but not foliaceous, elevated and compressed above, and projecting over the head at the apex. Elytra elongate, parallel, narrower than the prothorax, posteriorly abruptly declivous, sides nearly vertical; the epipleuræ indistinct. Legs short; femora not thickened; tibiæ compressed, the outer edges 5–6-toothed, the anterior crescent-shaped, the intermediate arched externally. Prosternum elevated, rounded, not produced behind. Mesosternum entire. Metasternum moderately elongate. Intercoxal process narrowly triangular. Body tuberculate; prothorax and elytra above in an even plane throughout.

There are three genera of Boletophaginæ with ten-jointed antennæ: one is North American (*Phellidius**, Leconte), another (*Ozolais*, Pasc.) is from Ega, on the Amazons, and the above†; as might be expected from three such widely separated localities, there is very little affinity between them. There are several genera, some new, with eleven-jointed antennæ, which, as they do not belong to Australia, I propose to consider in a future article: one of them has been recently published as a *Diceroderes* (*D. elongatus*, Redtenbacher), but it is a true Boletophagin (*Dysantes*, MS.).

Orcopagia monstrosa. Pl. X. fig. 8.

O. elongata, indumento rufo-ferrugineo vestita, subtus pedibusque squamosis.

Hab. Clarence River.

Elongate, covered above and on the head with a reddish-ferruginous felt-like substance; beneath and legs with small scales of a yellower colour; head completely concealed above by the prothorax, the horn on the clypeus horizontal (in reference to the body); prothorax longitudinally excavated above, the excavation bordered above with a row of tubercles, except posteriorly, where it is also notched for the reception of part of the scutellum; the latter oblong rounded, a little raised; elytra irregularly tuberculate, particularly a strongly marked crest, which is also tuberculate, on each side of the scutellum, and projecting forwards on the prothorax at the edge on the declivous portion on each side a conical tuberculate projection. Length 4 lines.

Ulodica.

Subfamily *Ulodinæ.*

Antennæ haud clavatæ; art. 3^{io} quam 4^{tus} duplo longiore.
Prothorax transversus, utrinque rotundatus, marginibus squamosis.

This genus differs from *Ulodes*‡ in its antennæ having the third joint much longer than either the second or fourth. *Ulodes* has the remarkable character of having all the joints of equal length, the last three, as in *Ulodica*, being pubescent, while all the others are covered with stiff scale-like hairs arranged in dense whorls. The genus was referred by its author, as well as by M. Lacordaire (to whom, however, it was

* = *Boletotherus*, Candèze. The name in the text has priority.

† It was briefly characterized by me in the Proc. Entom. Soc. for April last (1868).

‡ Erichson in Wiegmann's Archiv, 1842, i. p. 180, Taf. 5. fig. 1. To this genus also belongs *Endophlœus variicornis*, Hope; the same author's *E. australis* is a *Dipsaconia*.

unknown), to the vicinity of *Boletophagus*. From the subfamily to which the latter belongs, all the species, as well as those of the cognate genera which have come under my notice, differ in being destitute of the transverse excavation which occurs behind the insertion of the mentum of the *Boletophaginæ*; and, so far as I know, they have globose, not cylindrical, anterior coxæ. Probably, if the illustrious author of the 'Genera' had known any of the species, he would have made *Ulodes* the type of another group, as I have now ventured to do. The four genera which constitute the subfamily at present may be tabulated thus:—

Antennæ clavate .... *Ganyme*, Pasc.
Antennæ not clavate.
  Prothorax scaly at the sides.
    Antennæ with the third joint longest .... *Ulodica*, Pasc.
    Antennæ with the third joint not longer than the rest .... *Ulodes*, Er.
  Prothorax ciliated at the sides .... *Dipsaconia*, Pasc.

Ulodica hispida.

U. oblonga, fusca, dense brunneo-nigroque squamosa; prothorace disco quadri-verrucoso-fasciculato.

Hab. Clarence River.

Oblong, dark brown, closely covered with pale reddish brown, varied with black, scales; head with small dull reddish-brown scales; antennæ brownish grey ringed with black—principally the third and fourth, sixth, eighth, and base of the ninth joints; prothorax roughly scaly, the apex with two wart-like tubercles clothed with a bunch of erect blackish scales; behind the middle two similar tubercles, but of a pale brownish colour, like the rest of the disk, except a small black spot on the margin on each side; scutellum transversely oblong, scaly; elytra striato-punctate, the alternate interstices with small, blackish, wart-like tubercles, which are obscured by irregular black patches, giving the elytra a dull brownish ferruginous hue; body beneath and legs ferruginous, with greyish-yellow scales; tibiæ with a black ring in the middle. Length $3\frac{1}{2}$ lines.

Dr. Howitt has also sent me a specimen of this species, but without a locality.

GANYME.

Subfamily *ULODINÆ.*

Antennæ clavatæ, art. 3^{io} quam 4^{tus} longiore.
Oculi transversi, angustati.
Prothorax utrinque fortiter angulatus.

Head small, inserted into the prothorax nearly to the eyes, a little produced in front; clypeus indistinct; antennary ridge very small. Eyes prominent, transverse, narrow throughout. Antennæ clavate, the joints, except the last three, surrounded with whorls of stiff hairs; scape not stouter than the other joints, the third twice as long as the second, and longer than the fourth, the remainder to the eighth becoming gradually shorter, ninth and tenth transverse, eleventh rounded, discoloured, the last three forming a short pubescent club. Oral organs apparently as in *Ulodes*, but the labium less transverse and more decidedly quadrate. Prothorax short, transverse, apex strongly emarginate, each side expanding into a broad pointed angle extending from the apex to the base, and fringed with short, curved, stoutish hairs; the base broadly lobed; the disk slightly convex, irregular. Elytra rather short, much broader than the prothorax, convex, slightly irregular, not costate, broadest at the base, the shoulders rounded and prominent. Legs shortish; tarsi slender, slightly hairy beneath, the posterior claw-joint not so long as the rest together; anterior coxæ globose, not approximate. Prosternum flat. Metasternum moderately long.

A well-marked genus, on account of its peculiar prothorax and clavate antennæ. In colour and clothing the species described below bears a striking resemblance to *Lemodes coccinea*, Boh., an anomalous form supposed to belong to the Pyrochroidæ, common in fungi under the bark of decaying trees in Victoria. *Boletophagus Sapphira*, Newm.*, is another member of this genus, larger and more brightly coloured, with the suture and borders of the elytra black.

Ganyme Howittii. Pl. X. fig. 7.

G. sordide miniacea, subsericea; antennis, art. ultimo excepto, pedibusque nigris.

Hab. Victoria; Tasmania.

Closely covered with a dark miniaceous, somewhat silky, scale-like pubescence, paler, less dense, and more scale-like beneath, and without a vestige of punctuation; upper lip and palpi brownish black; antennæ black, except the last joint, which is of a reddish-white colour; prothorax with two vague impressions in front and two behind, the latter more towards the sides; scutellum cordiform, indistinct; elytra short in proportion to the breadth, but about four times the length of the prothorax, very convex, irregular, rather abruptly declivous behind, one little callosity behind the shoulder, and two on the declivity, the epipleura curving sharply up towards the shoulder; legs black, the tips of the tibiæ and tarsi inclining to ferruginous. Length 2 lines.

* Entom. i. p. 104.

Melytra.

Subfamily *Apocryphinæ.*

Antennæ apice paulo incrassatæ, art. 3^{io} sequentibus multo longiore.
Mentum subquadratum; palpi labiales art. ultimo conico; labium membranaceum.
Maxillæ lobo exteriore brevi, transverso; palpi maxillares art. ult. subsecuriformi.

Head triangular, subvertical, inserted into the prothorax nearly as far as the eyes; antennary ridge almost obsolete. Eyes prominent, round, entire. Antennæ exposed at their insertion, long, filiform, but a little thicker at the apex; scape globose-ovate, second joint obconic, third twice as long as the scape, fourth to the eighth much shorter than the third, ninth and tenth thicker than the preceding, eleventh elongate-ovate. Mentum subquadrate; lower lip very small, membranous. Maxillæ very short; outer lobe transverse, inner unarmed. Maxillary palpi long, with the last joint securiform; last joint of the labial palpi conic. Prothorax oblong, a little depressed, slightly rounded at the sides, the flanks confounded with the pronotum, base and apex truncate. Elytra rather short, ovate; epipleura vertical, narrow, with the flanks of the elytra raised above them, the shoulders obsolete; no wings. Legs moderate; femora thickened; tibiæ filiform; tarsi narrow, all nearly equal, the claw-joint elongate. Anterior coxæ globose, exserted, not approximate. Prosternum on the same plane with the rest of the propectus; the anterior cotyloid cavities rather remote from its posterior edge, intermediate with trochantins angulated externally. Metasternum shorter than the mesosternum. Interfemoral process rather narrow, triangular. Abdomen with the ventral segments nearly equal in length.

This genus and the following are so far connected that in both the flanks of the prothorax are not separated from the pronotum, and the mentum is sessile to the throat. In other respects their principal characters are very dissimilar. For further remarks I must refer to the next genus.

Melytra ovata. Pl. X. fig. 1.

M. subnitida; capite et prothorace nigro-piceis; elytris cupreis; antennis pedibusque ferrugineis.

Hab. Tasmania.

Subnitid; head and prothorax pitchy black, finely punctured; palpi and antennæ light ferruginous, the latter more than half the length of the body, and paler at the apex; scutellum transversely triangular, acuminate behind; elytra copper-brown, seriate-punctate, the punctures rather coarse and somewhat longitudinally impressed, the intervals between the rows minutely punctate; body beneath chestnut-brown, finely punctate; legs light ferruginous. Length 3 lines.

Hymæa.

Subfamily *Apocryphinæ.*

Antennæ clavatæ, art. tertio sequentibus haud longiore.
Mentum transversum, antice gradatim angustius; labium corneum.
Maxillæ lobo exteriore elongato, angustato; palpi maxillares art. ultimo ovato.

Head subtriangular, rounded and obtuse anteriorly, subvertical, inserted into the prothorax nearly as far as the eyes; the clypeus separated from the front by a deep slightly arched suture; antennary ridge small, auriform. Eyes conically projecting, round, entire. Antennæ exposed at their insertion, subelongate; scape globose, second joint shortly turbinate, third to the eighth elongate-turbinate, nearly equal in length, ninth and tenth nearly equilaterally triangular, eleventh ovate, pointed, not longer than the tenth, the three forming a depressed club. Mentum transverse, rounded at the sides, gradually and rapidly narrowing towards the insertion of the lower lip, the latter small, rounded, corneous. Maxillæ narrow, the inner lobe unarmed. Maxillary palpi long, with the last joint ovate, of the labial shortly cylindrical. Prothorax oblong, narrowed posteriorly, the sides rounded, the flanks confounded with the pronotum, apex and base truncate. Elytra short, ovate, the shoulders obsolete; epipleura narrow, vertical; no wings. Legs moderate; femora thickened in the middle; tibiæ gradually stouter towards the apex; tarsi lengthened, slender, the claw-joint moderate. The under parts nearly as in the preceding genus, but the anterior cotyloid cavities very close to the posterior border of the propectus, the mesosternum and metasternum a little longer, the interfemoral process very considerably broader, and the ventral segments gradually decreasing in length to the fourth.

The position of *Hymæa* and *Melytra* is somewhat doubtful. From the characters of the "*Apocryphides*," as given by M. Lacordaire*, they seem to me to belong to them. Mr. F. Bates, who has made the Heteromera his especial study, inclines to the opinion (*in litt.*) that, from the narrow antennary ridges, they are more nearly related to the *Strongyliinæ*, and that they form a distinct subfamily. In the 'Genera,' the "*Apocryphides*" are classed among the "*Hélopides*," an arrangement to which Dr. Leconte † objects, because of the absence of the

* Genera, &c. v. p. 432. † Classif. Col. North Am. p. 218.

membranous margin of the third and fourth abdominal segments, "which is so evident in Helopini and all the allied tribes." He admits, however, that "the observation of such characters as are relied on for the classification of this family is sometimes very difficult in small species, unless specimens may be submitted for dissection." *Hymæa*, as it appears to me, has entirely corneous ventral segments, while *Melytra* has the third and fourth segments membranous posteriorly. Both have the mentum without a pedicel, and the base of the maxillæ and lower lip exposed. There are trochantins *, I think, in both. At any rate, their intermediate cotyloid cavities are angulated externally. M. Lacordaire ascribes trochantins to *Apocrypha*, although he says it is difficult to decide if they really exist. Dr. Leconte refuses them without any doubt. With regard to the antennary ridges, it sometimes happens that the difference between the continuous ridge (Platygene) and the narrowed and more limited ridge (Otidogene) is one of degree, leaving it doubtful to which category they belong. Dr. Leconte places his two North-American "tribes" Meracanthinæ and Strongyliinæ (both otidogenous) in his "subfamily Tenebrionidæ (genuini)" together with Blaptinæ, Boletophaginæ, Helopinæ, and many others, all platygenous—an arrangement very different from M. Lacordaire's, and attaching to the character a much less degree of importance than is done by him. The strongest argument against placing *Hymæa* and *Melytra* among the *Apocryphinæ* is that the mentum is attached to the throat without the intervention of a pedicel.

Hymæa succinifera. Pl. X. fig. 3.

H. nitida, fulvo-brunnea; elytris tuberculis succineo-flavis instructis.

Hab. Tasmania.

Shining fulvous brown; head rather coarsely punctured; prothorax not broader than the head measured across the eyes, coarsely punctured, the intervals here and there raised into small tubercles; scutellum large, but its limits very indistinct; elytra scarcely longer than the head and prothorax together, seriate-punctate, the punctures large and connected by a slight longitudinal impression, a few erect, stiffish hairs scattered chiefly at the sides; on each elytron towards the outer side two rows of large, oblong, amber-like tubercles, the outer of

* The trochantin is a small piece attached to the outer edge of the coxa; in the Tenebrionidæ, when it is present, it is confined to the intermediate pair, and it is generally, if not invariably, correlated with a cotyloid cavity having a very pronounced angle over the spot where it occurs. I have given a diagram of the coxa with a trochantin attached on Pl. X. fig. 9.

them of three (one on the shoulder), the inner of two tubercles, and one or two spots of the same amber-colour; body beneath brownish ferruginous, coarsely punctured; antennæ and legs yellowish ferruginous, with a few longish scattered hairs. Length 2 lines.

Atryphodes Howittii.

A. viridi-æneus, aureo-versicolor, nitidus; prothorace transverso, angulis anticis rotundatis, lateribus modice foliaceis, rotundatis, sulcis discoidalibus leviter impressis; elytris costis alternis minoribus.

Hab. Kiama.

Greenish bronze, with varying golden reflections, shining; antennæ pitchy black; prothorax transverse, broader than the elytra, anterior angles rounded, the sides with a moderately wide foliaceous margin, slightly rounded, narrower at the base, the discoidal lines shallow, the lateral abbreviated; scutellum subcordiform; elytra about twice the length of the prothorax, their alternate costæ much smaller than the others; body beneath and legs pitchy brown, shining. Length 10–11 lines.

Atryphodes is perhaps better known under its old name *Thoracophorus* *; but, as that name had been previously used by Motschulsky, I proposed to replace it by the above †. The characters as given by M. Lacordaire ‡ apply to all the species hitherto described, and therefore they need not be repeated here. Only one species was then known (*A. Walckenaeri*, Hope); the other two, *dilaticollis*, Guér., and *Kirbyi*, Sol., I have no doubt are referable to it. The above is a very handsome species, and easily distinguished by its colour. All the species appear to have the head and prothorax impunctate, or nearly so, the former has a frontal horseshoe-shaped or stirrup-like impressed line, the anterior portion being the groove dividing the clypeus from the front; on the prothorax there are a central and two lateral impressed lines, each terminating posteriorly in a more or less strongly marked fovea; the lateral lines are frequently abbreviated. The males have the anterior tarsi slightly dilated, and the antennæ thicker than in the females. I am not sure that the greater breadth

* Erichson said long ago, "The name must be altered, not only because it has been already used, but also because it does not comply with the rules of nomenclature." Wiegmann's Arch. 1842, ii. p. 239. *Thoracophorus*, however, in Motschulsky's sense, has been adopted by Dr. Gemminger and Baron von Harold in their great 'Catalogus Coleopterorum,' now in course of publication.

† Journ. of Entom. ii. p. 478 (1866). ‡ Gen. v. p. 436.

of the prothorax noticeable in some individuals is always a sexual character.

Atryphodes Castelnaudi.

A. niger, vix nitidus; prothorace transverso, angulis anticis obtusis, lateribus rotundatis, modice foliaceis, sulcis discoidalibus subtiliter impressis; elytris subnitidis, costis alternis minoribus.

Hab. Kiama.

Black, scarcely or only very slightly nitid on the head and prothorax, more so on the elytra; antennæ nitid, especially at the base; prothorax transverse, not broader than the elytra, anterior angles obtuse, the sides with a moderately wide foliaceous margin, well rounded, and considerably narrower at the base; the discoidal lines nearly obsolete, except at the base, the foveæ in which they terminate very shallow; scutellum subcordiform; elytra about twice the length of the prothorax, their alternate costæ smaller than the others; body beneath and legs pitchy black, shining. Length 10–11 lines.

I have dedicated this fine species to Count F. de Castelnau, who, in addition to numerous previously well-known entomological works, has recently presented us with an apparently exhaustive list of the Australian Cicindelidæ and Carabidæ.

Atryphodes cordicollis.

A. niger, nitidus; prothorace subcordiformi, lateribus modice foliaceis, antice fortiter rotundatis, postice conniventibus, angulis anticis late rotundatis, sulcis discoidalibus fortiter impressis, lateralibus elongatis; elytris costis æqualibus.

Hab. Brisbane.

Black, shining; included part of the stirrup-shaped impression of the front raised above the surrounding parts; prothorax somewhat heart-shaped, the sides with a moderately wide foliaceous margin, strongly rounded anteriorly, gradually contracting behind into a narrow base; anterior angles broadly rounded; discoidal lines strongly impressed, the two lateral nearly extending to the apex, becoming, however, gradually fainter; scutellum deeply ensconced between the elytra, rounded posteriorly; elytra more than twice the length of the prothorax, their costæ equal; body beneath and legs glossy brownish chestnut, tarsi ferruginous. Length 9–10 lines.

The strongly marked form of the prothorax is exclusively the character of this species.

Atryphodes æricollis.

A. niger, nitidus; capite prothoraceque æreo-brunneis, hoc transverso, angulis anticis obtusis, marginibus sat late foliaceis, sulcis discoidalibus lateralibus interruptis; elytris costis æqualibus.

Hab. Queensland.

Black, shining; head and prothorax bronze-brown, the former with the frontal impression somewhat hexagonal, the upper line forming three shorter sides; antennæ black; prothorax transverse, strongly rounded and rather broadly foliaceous at the sides, the anterior angles obtuse, lateral discoidal lines interrupted; scutellum triangular, on the same level as the elytra; the latter about twice the length of the prothorax, their costæ equal; body beneath and legs glossy brownish black. Length 6 lines.

This species in habit more nearly approximates, although very different, to *A. Howittii*; but the strongly rounded prothorax is more characteristic of *A. Walcknaeri.* Its precise habitat is uncertain.

Atryphodes encephalus.

A. angustatus, niger, nitidus; prothorace oblongo, antice sat fortiter emarginatus, lateribus anguste foliaceis, modice rotundatis, sulcis discoidalibus lateralibus interruptis vel fere obsoletis; elytris costis æqualibus.

Hab. Rockhampton.

Narrow, black, shining; part within the frontal impression raised and marked above with two foveæ; prothorax oblong, sides slightly rounded, foliaceous margin of moderate width, anteriorly rather strongly emarginate, the anterior angles somewhat obtuse, central discoidal line well marked, the two lateral interrupted, occasionally nearly obsolete; scutellum triangular, lying below the level of the elytra; the latter about the width of the prothorax and nearly twice as long, their costæ equal; body beneath and legs glossy pitchy brown. Length 7 lines.

A narrow species, readily distinguished by its strongly emarginate prothorax.

Atryphodes pithecius.

A. niger, subnitidus, elytris cupreo-fuscis; prothorace paulo convexo, utrinque modice rotundato, marginibus anguste foliaceis, sulcis lateralibus nullis.

Hab. Queensland.

Black, slightly nitid, the elytra dark copper-brown; antennæ brownish, much more slender in the female; prothorax rather longer than broad, slightly convex, the anterior angles obtuse, the margins narrowly foliaceous, the sides most rounded anteriorly, straighter behind the middle, not incurved at the base towards the posterior angle, which is therefore obtuse, the lateral dorsal grooves represented only by the foveæ at the base; scutellum small; elytra as broad as or broader than the prothorax, ovate, the costæ equal in breadth; body beneath and legs glossy brown; tarsi ferruginous. Length 7–8 lines.

Allied to *A. errans*, Pasc., a black glossy species, but differing essentially, *inter alia*, in the form of the prothorax, which is longer, considerably less rounded posteriorly, and with the foveæ, but without any trace of the lateral grooves. I have four specimens, all slightly differing, *inter se*, but agreeing in the characters given above. Another very near may hereafter, on more extensive examination of specimens, be found distinct.

The species of *Atryphodes* form three divisions: all above described, together with *errans* and *brevicollis**, belong to the *Walcknaeri* category, and are more or less glossy, with the foliaceous margins of the prothorax below the general level of its disk; the second category contains *Macleayi*, *aratus*, and *egerius*, and are opaque, with the margins directed upwards, especially in the two former, and the disk of the prothorax flat and lying below them; lastly, there is the following species, in which the foliaceous margins become obsolete.

Atryphodes caperatus.

A. angustatus, niger, nitidus; prothorace oblongo, angulis anticis leviter rotundatis, lateribus haud foliaceis, in medio haud rotundatis, ad basin subito contractis, sulcis discoidalibus interruptis.

Hab. Hunter's River; Darling Downs.

Narrow, black, shining; frontal space with five foveæ (three above, two below); prothorax oblong, slightly broader than the elytra, sides moderately rounded anteriorly, then nearly straight, but narrowing posteriorly, near the base rounded, and then suddenly contracted and passing into the usual acute basal angle; no foliaceous margin, the two lateral discoidal lines broken up and irregular, but varying in different individuals; scutellum transverse, scarcely below the level of the adjacent part of the elytra; the latter considerably more than twice the length of the prothorax, and with a bronze tint, their costæ equal; body beneath and legs glossy brownish black, the first two abdominal segments with a more or less decided broad longitudinal depression. Length 9 lines.

A very narrow form, without foliaceous margins to the prothorax, and in these respects leading to *Otrintus*. The frontal

* Redtenbacher, Novara-Reise, p. 130. The "*licinoides*" of the same author appears to be synonymous with *aratus*.

foveæ are, in one of my specimens, connected with the upper central one by impressed lines; in another there are four or five irregular undefined depressions.

Blepegenes*.

Subfamily *Adeliinæ.*

Caput exsertum, culmen supraantennarium in spinam productum.
Maxillæ lobo interiore majore, subquadrato, apice dense fimbriato.
Prothorax apice truncatus.
Elytra costata, plica epipleurali ad humerum haud attingente.

Head exserted, gradually narrower behind the eyes, the antennary ridge prolonged into a nearly erect, slightly recurved spine; clypeus very thick, rather suddenly bent down anteriorly, its apex emarginate, separated from the front by two fine oblique lines not meeting in the middle. Eyes transverse, narrow, entire. Antennæ filiform; the scape obconic, the third joint not so long as the fourth and fifth together, thickened at the tip, the rest to the tenth subequal, obconic; the eleventh not dilated, longer than the preceding joint. Mentum very narrow at the base, spreading and rounded at the sides and anteriorly; lower lip transverse, bilobed, its palpi small. Maxillæ small, densely fringed, the inner lobe larger than the outer and unarmed; their palpi slender, the basal joint elongate, the last securiform. Prothorax depressed, spined at the sides, apex narrowed, truncate, posterior angles obliquely truncate. Elytra oblong-ovate, costate, flat above; epipleura terminating before the apex, the epipleural fold slightly sinuate, not extending to the shoulder. Legs rather long; femora and tibiæ slightly compressed; tarsi slender, the anterior in the males rather strongly dilated, the penultimate joint of all subbilobed. Sterna and abdomen as in *Adelium* and *Atryphodes*.

Although this genus has the subbilobed tarsi of *Adelium*, its affinity appears to me to be nearer *Atryphodes*, on account of its costate elytra, only slightly sinuate epipleural fold, and habit; in the latter respect it approaches *Atryphodes egerius*. It is among the most remarkable genera of Tenebrionidæ. The earliest specimens of this species which I saw were stated to be from Queensland; Dr. Howitt, however, gives Kiama as the habitat of the individuals he has kindly sent me.

* This genus, with its type, was shortly described by me and published in the Proc. Ent. Soc. for April 1868. From some error, "*Clypeus valde*" was printed "*Clypeus haud.*" M. Preudhomme de Borre some time after published a description of the same species, in the 'Annales' of the Belgian Entomological Society, under the name of *Ceradelium armatum*.

Blepegenes aruspex. Pl. X. fig. 2.

B. cupreo-fuscus vel -niger, subopacus; elytris costis quatuor nitidis.

Hab. Kiama.

Dark copper-brown or bronze, sometimes bronze-black, nearly opaque; head and prothorax impunctate, the latter with four foveæ on the disk, or the lateral foveæ are connected and form an irregular longitudinal impression, each side before the middle expanding into a strong triangular spine, subhorizontal or directed a little upwards; near the base a much smaller spine or tooth, the posterior part of which slopes directly inwards to the base; scutellum transversely triangular; elytra more than three times the length of the prothorax, each with four glossy costæ, none of them reaching to the apex, the sutural and second costa having a less elevated opaque costa between them, each apex ending in a short diverging mucro; legs ferruginous brown, shining; body beneath very glossy, brown; antennæ ferruginous. Length 8–9 lines.

Byallius.

Subfamily *Adeliinæ.*

Antennæ art. tertio elongato, cylindrico.
Frons parum convexa, sulci longitudinales nulli.
Maxillæ lobo interiore unciformi.
Elytra obovata, reticulata, plica epipleurali obsoleta.

Head deeply inserted into the prothorax, the front slightly convex, without any grooves; the clypeus broadly truncate at the apex, separated from the front by a narrow, distinct, arched line. Eyes transverse, impinged on by the antennary ridges. Antennæ filiform; scape obconic, the third joint cylindrical, longer than the fourth and fifth together; the two latter and remainder to the tenth obconic, becoming very gradually shorter; the eleventh longer, ovate, depressed. Mentum rather narrow behind, rounded at the sides anteriorly; lower lip transverse, slightly emarginate and fringed at the apex, largely excavated in the middle on each side for the insertion of the labial palpi. Maxillæ with the inner lobe narrow, curved, and gradually terminating in a very distinct point; their palpi stout, the basal joint very short, the terminal securiform. Prothorax depressed, slightly foliaceous and rounded at the sides, the apex strongly emarginate and much narrower than the base, the latter broadly lobed. Elytra obovate, reticulate, the epipleural fold obsolete. Legs moderately long; femora nearly linear, compressed; posterior tarsi compressed, the basal joint nearly as long as the rest together, the penultimate of all entire. Mesosternum deeply notched for the reception of the prosternal process. Metasternum and abdomen as in *Adelium*, the former, however, rather longer.

This is a very distinct genus, for which at present it is difficult to assign any very near ally, although its habit is that of *Atryphodes*.

Byallius reticulatus. Pl. X. fig. 6.

B. niger, infra et pedibusque nitidis.

Hab. Mountains of Gippsland.

Black; head and prothorax very slightly nitid, minutely punctured, the lateral borders of the latter recurved; scutellum very transverse and glossy; elytra gradually broader from the base, shortly rounded towards the apex, wrinkled with small irregular vermiculate depressions, giving the whole surface a reticulate appearance, the epipleuræ minutely punctured; sterna, abdomen, and legs black, shining; tarsi ferruginous brown, clothed beneath as well as the edge of the lip with rich golden hairs; antennæ with a greyish pubescence towards the tips. Length 9 lines.

Seirotrana proxima.*

S. nigra, convexa, subnitida; prothorace marginibus erosis; elytris fusco-æneis, lineis interruptis elevatis, interstitiis biseriatim punctatis.

Hab. Victoria.

Resembles *S. catenulata*, Boisd., but more convex, entirely subnitid above; the elytra dark brown bronze, with double rows of small simple punctures between the raised interrupted lines or tubercles. In *S. catenulata* the middle of the prothorax and elytra is decidedly flattish, the latter a pure dense black, and between the glossy lines of tubercles opaque; the punctures, also in double rows, have each a glossy granule at the anterior edge. The prothorax in both species is marked with minute short longitudinal lines, between which the punctures are placed, and the lateral margins are jagged or erose at their edges. Dr. Howitt says that this new species is the Victorian representative of *S. catenulata*, whose habitat appears to be confined to the Sydney district. My specimens of *S. proxima* are about 6 lines long; the older species is larger.

Seirotrana crenicollis (Howitt's MS.). Pl. X. fig. 4.

S. planata, brunnescens, subopaca, granulis nitidis instructa, mar-

* Pascoe, Journ. of Entom. ii. p. 483.

ginibus prothoracis crenatis; elytris lineis interruptis elevatis, et granulis minutis seriatim interpositis.

Hab. "Mountains of Victoria."

Light reddish brown, subopaque above, with numerous glossy granulations of various sizes; antennæ dark brown; head finely granulate; prothorax longer than broad, nearly flat, closely covered with small irregular granulations, the margins pale yellowish brown and crenate; scutellum nearly hidden by the overlapping base of the prothorax; elytra nearly flat, except towards the apex, where they bend down rather suddenly, a little wider than the prothorax at the base, the sides subparallel; the disk with granulations mostly of two sizes, the largest (of a dark amber-colour) forming interrupted lines, of which there are four on each elytron; between these lines are rows, generally three in number, of small round ones; body beneath thickly granulated; legs light reddish brown, femora with a broad yellow ring near the apex; tarsi slender, filiform. Length 5–6 lines.

A remarkable species, somewhat departing from the normal form in the longer prothorax and very slender tarsi. *Seirotrana* is distinguished from *Adelium* by its prothorax closely applied to the elytra, and the shortness of the third antennary joint, and from *Coripera* by the complete or nearly complete absence of the epipleural fold; it is barely to be noticed in the above species, being indicated by a very narrow line nearly in the middle of the epipleura.

*Coripera** *ocellata* (Howitt's MS.). Pl. X. fig. 5.

C. cupreo-fusca, nitida; elytris biseriatim impressis, interstitiis annulis oblongis impressis, marginibus disci flavis.

Hab. Mount Macedon (Victoria).

Dark copper-brown; head finely and irregularly punctured; prothorax with minute shallow punctures, its lateral margins paler; scutellum small, transverse; elytra nearly flat above, each with seven rows of small punctures, the two outer on the epipleural line, the inner bordering the suture, the four intermediate lines placed in pairs, each pair and the sutural and marginal rows separated by a line of oblong impressed rings; the disk bordered with yellowish; body beneath and legs very glossy brown; antennæ and tarsi ferruginous, the latter very slender, filiform. Length 4–5 lines.

Closely agreeing in form with *C. deplanata*, Boisd., but very distinct on account of the peculiar sculpture of the elytra. In my description of the genus *Coripera* the term epipleura was

* Pascoe, Journ. of Entom. ii. p. 483.

by some oversight used to express the epipleural fold, which, although narrow, is well marked and extends along the whole length of the epipleura; the latter is nearly vertical.

EXPLANATION OF PLATE X.

Fig. 1. *Melytra ovata*: *a*, mentum, lower lip, &c.; *b*, maxilla &c.
Fig. 2. *Blepegenes aruspex*: *a*, mentum &c.; *b*, maxilla &c.; *c*, head.
Fig. 3. *Hymæa succinifera*: *a*, mentum &c.; *b*, maxilla &c.
Fig. 4. *Seirotrana crenicollis.*
Fig. 5. *Coripera ocellata.*
Fig. 6. *Byallius reticulatus*: *a*, mentum &c.; *b*, maxilla &c.
Fig. 7. *Ganyme Howittii*: *a*, antennæ.
Fig. 8. *Orcopagia monstrosa*: *a*, mentum &c.; *b*, maxilla &c.; *c*, antenna; *d*, head; *e*, fore tibia. N.B. The figure is much too broad in proportion.
Fig. 9. Coxa and part of the femur of a *Pimelia*: *a*, the trochantin; *b*, the trochanter. The left side is supposed to be towards the spectator.

[To be continued.]

XI.—*Contributions to the Study of the Entomostraca.* By George Stewardson Brady, C.M.Z.S. &c.

No. IV. *Ostracoda from the River Scheldt and the Grecian Archipelago.*

[Plates VII. & VIII.]

Lists of Species.

River Scheldt, near Antwerp.

Cypris gibba, *Ramdohr.*
Cypridopsis obesa, *nov. sp.*
Candona candida (*Müller*).
—— compressa (*Koch*).
—— lactea, *Baird.*
Cythere viridis, *Müller.*
—— pellucida, *Baird.*
—— castanea, *Sars.*
—— porcellanea, *nov. sp.*
—— villosa (*Sars*).
—— fuscata, *nov. sp.*
—— pulchella, *Brady.*
Cytheridea littoralis, *Brady.*
—— (?) cornea, *nov. sp.*
Loxoconcha elliptica, *Brady.*
Xestoleberis aurantia (*Baird*).
Cytherura similis, *Sars.*
—— flavescens, *nov. sp.*
—— acuticostata, *Sars.*
—— cellulosa (*Norman*).
Cytherideis subulata, *Brady.*
Paradoxostoma variabile (*Baird*).

Besika Bay, 14 fathoms.

Pontocypris(?) angusta, *Brady.*
—— intermedia, *Brady.*
Cythere tenera, *Brady.*
—— crispata, *Brady.*
—— affinis, *nov. sp.*
—— senticosa (*Baird*).
—— plicatula, *Reuss.*
—— tarentina, *Baird.*
—— antiquata (*Baird*).
—— Jonesii (*Baird*) and var. ceratoptera.
Cytheridea Mülleri, *Bosquet.*
—— littoralis, *Brady.*
*Ilyobates judæa, *Brady.*
Loxoconcha glabra, *Brady.*
—— tumida, *nov. sp.*
—— angustata, *nov. sp.*
Xestoleberis margaritea, *Brady.*
*—— intermedia, *Brady.*
Cytherideis teres, *nov. sp.*
Paradoxostoma ensiforme, *Brady.*
Cytherella punctata, *Brady.*

Dardanelles, 17 fathoms.

Cythere tenera, *Brady*.
—— crispata, *Brady*.
*—— (?) Stimpsoni, *Brady*.
—— tarentina, *Baird*.
—— plicatula, *Reuss*.
—— Jonesii, var. ceratoptera, *Bosq*.
Cytheridea Mülleri, *Bosq*.
Xestoleberis margaritea, *Brady*.
Cytheropteron acutum, *nov. sp.*
Cytherella punctata, *Brady*.

Piræus.

Pontocypris intermedia, *Brady*.
—— obtusata, *nov. sp.*
*Cythere Berchoni, *Brady*.
*—— Stimpsoni, *Brady*.
—— plicatula, *Reuss*.
—— antiquata (*Baird*).
Cytheridea littoralis, *Brady*.
*—— castanea, *Brady*.
Loxoconcha tamarindus ? (*Jones*).
—— tumida, *nov. sp.*
Xestoleberis margaritea, *Brady*.
Cytherura obtusata, *Brady*.
*Cytheropteron stellatum, *Brady*.
Paradoxostoma ensiforme, *Brady*.
Cytherella punctata, *Brady*.

Crete, mud.

Polycope, sp.

THE gathering from the river Scheldt (for which I am indebted to Mr. E. C. Davison) exhibits a curious mixture of marine and freshwater species, the former, however, being chiefly such as exhibit a decided preference for littoral, estuarine, or sub-brackish habitats, e.g. *Cythere castanea*, *Cytheridea littoralis*, *Loxoconcha elliptica*, *Xestoleberis aurantia*, and *Cytherideis subulata*. The uniformly good preservation of the shells would, nevertheless, lead to the supposition that all the species were really living in company at the place where they were found. Two of the new species included in this list (*Cypridopsis obesa* and *Cytheridea cornea*) will be described and figured from British specimens in a future communication. It may be noted that the specimens here referred to *Cytherura similis*, though agreeing perfectly in shape with an outline drawing obligingly sent to me by Herr G. O. Sars, differ strikingly from his description in their surface-ornament, being distinctly punctate, and bearing also several small, distant, circular papillæ. The drawing of *C. similis* given in my 'Monograph of the Recent British Ostracoda' is faulty, and has the posterior beak too much produced.

The lists of species from the Mediterranean exhibit an intermixture of British species similar to what has been noticed on a previous occasion. Those marked with an asterisk have been described in a French periodical, 'Les Fonds de la Mer;' the remainder of those to which my name is affixed will be found in the 'Transactions of the Zoological Society,' vol. v., in the 'Monograph of the British Ostracoda,' or in previous papers of the present series. The specimens which I have doubtfully referred to *Loxoconcha tamarindus* are rather larger than that species as it usually occurs on the British coast, measuring about one-fortieth of an inch in length: they are also somewhat more ventricose, and slightly different in outline; but the differences seem to be too slight to warrant separation as a distinct species. One of these specimens is figured in Pl. VIII. figs. 9, 10.

Pontocypris obtusata, nov. sp. (Pl. VIII. figs. 7, 8.)

Carapace, as seen from the side, elongate, reniform, highest in the middle; greatest height considerably less than half the length; extremities rounded: superior margin well arched; inferior sinuated in the middle. Seen from above, the outline is compressed, ovate; greatest width in the middle and scarcely equal to one-third of the length, pointed in front, narrowly rounded behind. Shell-surface smooth. Colour whitish. Length $\frac{1}{40}$ inch.

Cythere porcellanea, nov. sp. (Pl. VII. figs. 1–4.)

Valves, as seen from the side, subclavate, higher in front than behind; greatest height in front of the middle, and equal to half the length; anterior extremity broadly rounded, posterior obliquely rounded or subtruncate: superior margin boldly arched in front of the middle, thence sloping backwards with a slight concave curve, and ending abruptly in an obtuse angle; inferior gently sinuated. Outline, as seen from above, ovate, equally pointed at the extremities, widest in the middle; width much less than the height. Shell-surface smooth, each valve bearing an elongated mamilliform protuberance behind the middle of the ventral surface. Colour yellowish white. Length $\frac{1}{55}$ inch.

One specimen only of this species was found. Though approaching in shape *C. castanea*, it is very different in general appearance; the smooth unsculptured shell and lateral protuberances are perhaps its best diagnostic marks.

Cythere fuscata, nov. sp. (Pl. VII. figs. 5–8.)

Carapace, as seen from the side, oblong, subreniform, rather higher in front than behind; greatest height equal to half the length; anterior extremity rounded, posterior slightly emarginate above the middle: superior margin almost straight, inferior sinuated in the middle. Seen from above, the outline is oblong ovate, acutely pointed in front, subtruncate behind; greatest width less than the height, situated behind the middle. Surface of the valves closely punctate. Colour yellowish brown. Length $\frac{1}{40}$ inch.

Cythere affinis, nov. sp. (Pl. VII. figs. 13, 14.)

Carapace compressed, oblong. Seen from the side, subreniform, nearly equal in height throughout; greatest height less than half the length; anterior extremity evenly, posterior obliquely rounded: superior margin slightly concave in the middle, and more distinctly emarginate close to the posterior extremity; inferior rather deeply sinuated in the middle. Outline, as seen from above, oblong, irregularly ovate, widest behind the middle, obtusely pointed in front, broadly mucronate behind; greatest width less than the height. Surface of the valves irregularly pitted, marked with several peripheral concentric rugæ and an indistinct transverse central sulcus. Colour yellowish brown. Length $\frac{1}{35}$ inch.

Cythere Stimpsoni, Brady. (Pl. VII. figs. 9–12.)

Cythere Stimpsoni, Brady, Les Fonds de la Mer.

This species exhibits a near approach to *C. fistulosa*, Baird, and seems to be separated from that species chiefly by its less abrupt and prominent ribbing, the more delicate reticulation of the surface, and the less elongated form of the carapace. *C. runcinata*, Baird, seems to me very likely to be the male of *C. fistulosa*.

Loxoconcha tumida, nov. sp. (Pl. VIII. figs. 11, 12.)

Carapace of the female, as seen from the side, subrhomboidal, highest in the middle; greatest height equal to more than two-thirds of the length; extremities obliquely rounded, the posterior emarginate at its upper extremity: superior margin arched, highest in the middle; inferior slightly convex. Seen from above, the outline is lozenge-shaped, widest at the middle and acuminate at each extremity; width equalling rather more than half the length. Shell-surface closely and rather coarsely punctate. Length $\frac{1}{35}$ inch.

This is closely allied to *L. affinis*, but much more tumid.

Loxoconcha angustata, nov. sp. (Pl. VIII. figs. 16, 17.)

Carapace, as seen from the side, elongated, subrhomboidal, nearly equal in height throughout; height equal to half the length; extremities obliquely rounded, the posterior emarginate at its upper angle: superior margin quite straight, inferior slightly sinuated. Outline, as seen from above, ovate, widest behind the middle; extremities sharply mucronate, greatest width about equal to the height. Shell-surface marked with closely set, deep, angular pittings. Substance of the shell rather thin and horny. Length $\frac{1}{55}$ inch.

Cytherura flavescens, nov. sp. (Pl. VIII. figs. 13–15.)

Carapace, seen from the side, oblong, constricted in the middle; height fully equal to half the length; anterior extremity rounded, posterior produced in the middle into a short obtuse beak: superior and inferior margins both distinctly sinuated in the middle. Outline, as seen from above, ovate, mucronate behind, pointed in front; greatest width situate in the middle, much less than the height. Surface of the valves marked with delicate raised reticulations, the longitudinal markings being most conspicuous. Colour yellowish. Length $\frac{1}{70}$ inch.

I have specimens of this species also from the estuary of the Thames, and perhaps from other British localities; but the genus to which it belongs is so perplexing, the species being numerous and separated by such apparently variable characters, that I had not hitherto ventured to describe it under a distinct specific name. These foreign specimens, however, appear to place the species on a more certain foundation.

Cytheropteron acutum, nov. sp. (Pl. VIII. figs. 1–4.)

Carapace, seen from the side, oblong, subrhomboidal; greatest height in the middle, equal to half the length: anterior extremity rounded; posterior obliquely truncate, produced above the middle into an obtuse beak: superior margin arched, inferior sinuated in front of the middle. Seen from above, the outline is diamond-shaped, widest behind the middle; extremities acuminate, width greater than height. Surface of the shell smooth, marked with small, distant, circular papillæ; lateral ala prominent. Length $\frac{1}{60}$ inch.

Cytherideis teres, nov. sp. (Pl. VIII. figs. 5, 6.)

Carapace, as seen from the side, elongated, oat-shaped, higher behind than in front; greatest height in the middle, and equal to one-third of the length; anterior extremity rather attenuated, posterior rounded: superior margin evenly arched, inferior almost straight. Seen from above, compressed ovate, acutely pointed in front, more obtusely behind, widest in the middle; width equal to the height. Surface of the shell smooth. Colour yellowish white. Length $\frac{1}{45}$ inch.

Polycope, sp. (Plate VII. figs. 15, 16.)

A few separated valves of a species of *Polycope*, not much different in appearance from *P. orbicularis*, Sars, but smooth and wholly destitute of sculpture, were found in soundings taken by Capt. Spratt off the coast of Crete. Diam. $\frac{1}{50}$ inch.

EXPLANATION OF THE PLATES.

Plate VII.

Fig. 1. *Cythere porcellanea,* seen from left side.
Fig. 2. The same, seen from above.
Fig. 3. The same, from below.
Fig. 4. The same, from the front.
Fig. 5. *Cythere fuscata,* seen from the left side.
Fig. 6. The same, seen from above.
Fig. 7. The same, from below.
Fig. 8. The same, from the front.
Fig. 9. *Cythere Stimpsoni,* seen from the left side.
Fig. 10. The same, from above.
Fig. 11. The same, from below.
Fig. 12. The same, from the front.
Fig. 13. *Cythere affinis,* seen from the left side.
Fig. 14. The same, seen from above.
} ×40.
Fig. 15. *Polycope,* sp., seen from the side.
Fig. 16. The same, end view.
} ×60.

Plate VIII.

Fig. 1. *Cytheropteron acutum,* seen from the left side.
Fig. 2. The same, seen from above.
Fig. 3. The same, seen from below.
Fig. 4. The same, seen from the front.
Fig. 5. *Cytherideis teres,* seen from the left side.
Fig. 6. The same, seen from below.
Fig. 7. *Pontocypris obtusata,* seen from the left side.
Fig. 8. The same, seen from above.
Fig. 9. *Loxoconcha tamarindus* (?), seen from the left side.
Fig. 10. The same, seen from above.
Fig. 11. *Loxoconcha tumida,* seen from the left side.
Fig. 12. The same, seen from above.
} ×40.
Fig. 13. *Cytherura flavescens,* seen from the left side.
Fig. 14. The same, from above.
Fig. 15. The same, seen from the front.
} ×60.
Fig. 16. *Loxoconcha angustata,* seen from the left side.
Fig. 17. The same, seen from above.
} ×40.

XII.—*Reply to Dr. E. P. Wright's Observations on Dredging.*

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

Gentlemen,

The remarks of Dr. Wright, in this month's Number of the 'Annals,' on what he is pleased to term the "accidental" discovery by me of starfishes normally living in the deeper abysses of the ocean, are so far incorrect that I must beg to be permitted to reply to them.

In the first place, I would observe that I accompanied the expedition, in the course of which that discovery was made, with the express purpose of ascertaining if my belief in the existence of animal life at the greatest depths was well founded or the contrary. The capture of any particular genus or order of animals not having been anticipated by me, the capture of the *Ophiocomæ* might, under a strained and perverted interpretation, receive the verdict of "accidental;" or it might be called accidental in the sense that, from that particular locality, that particular sounding, or the instrument employed on that special occasion, no distinct result was looked for. In this sense, but in this sense only, I had myself already described it as being "accidental." I certainly did not expect to capture an *Ophiocoma*, any more than I expected to capture a turbot. If it affords Dr. Wright any satisfaction to learn this, he is welcome to the fact; but since I can adduce the clearest evidence in support of my having anticipated the general scientific result which it was my good fortune to be able to establish, I must say it appears to me that Dr. Wright has gone out of his course, somewhat ungracefully in this instance, to deliver himself of what appears very like a sneer.

Scientific men are quite competent to decide whether a discovery made with a "*sounding-line*" (for which Dr. Wright expresses such contempt) is a discovery of less value than one made with a "dredge," and, further, whether the mere circumstance of a set of Echinoderms showing a preference for a piece of sounding-line, when they might have secured an upward passage of a mile and a half within a comfortable copper or iron receptacle, can detract in the slightest degree from the value or the significance of the discovery *when worked out to its legitimate conclusion.*

I would, however, remind Dr. Wright that, whilst he seems so ready to call my discovery "*accidental*," he does not appear to be aware that he has placed in my hands a weapon which recoils somewhat unpleasantly on himself; for he does not hesitate to claim full credit (see 'Annals' for December 1868, p. 426) for having "*added to the fauna of this deep-sea valley* [from a depth of 480 fathoms] *a shark*" as well as "a sponge!" and this in the same page that he naïvely informs your readers that "*he was not prepared to find sharks at such a depth, and was surprised when the padrone asked for leave to throw out the fishing-lines just over the place where they had drawn up the dredge*" from the above-mentioned depth of only 480 fathoms.

As bearing on Dr. Wright's discovery of the shark at 480 fathoms, I may mention that many years ago MM. Pouillet and Biot, from independently conducted observations, were enabled to prove that fish lived at depths of 500 and 550 fathoms—and, further, to arrive at some really important conclusions regarding the constitution of the gases contained in their swimming-bladders when subsisting under the conditions there present.

Dr. Wright has, moreover, to inform the scientific public on what basis (when referring to my starfish-sounding at 1260 fathoms) he would have us believe that the "dredge" is alone capable of affording "indications of animals higher than the Rhizopods living at those depths" (*loc. cit.*), unless when, *by accident*, that instrument happens to bring one of these "higher animals" to the surface.

Surely, if my discovery was an accident, the discovery of Dr. Wright's shark was "*an accident of an accident.*"

I remain,
Gentlemen,
Very faithfully, yours,
G. C. WALLICH.

Kensington, December 6, 1868.

XIII.—*Descriptions and Sketches of some new Species of Araneidea, with Characters of a new Genus.* By the Rev. O. P. CAMBRIDGE, M.A.

[Plates IV., V., VI.]

Genus STORENA (Walck.).

This genus was founded in 1805 by Baron Walckenaer (Tableau des Aranéides, p. 83, pl. 6. figs. 55, 56) upon a single spider received from New South Wales. Five species from the same region have lately come under my own eye; and of these, descriptions and sketches of characteristic portions of structure are given below.

Storena variegata. *Storena australiensis.*
—— *scintillans.* —— *maculata.*
—— *Bradleyi.*

The last two of these I had at first described as constituting a new genus; afterwards the first two species came under my notice, and in them I recognized at once the exact type of Walckenaer's description; between these and the last two no generic distinction could be discovered, though each two were the types of a distinct group within the genus; lastly, *S. Bradleyi* came before me, and puzzled me much: incapable of generic separation from *S. australiensis* and *S. maculata*, except in a modified relative position of the eyes, yet by that modification it seemed almost to come within the genus *Enyo*. Dr. Ludwig Koch appears to have included several species (also from New South Wales), generically identical with the above three species, in the genus *Enyo**: my impression, however, is that they will eventually be found to be quite distinct from *Enyo*. Dr. Koch includes "*Storena*" in the family Drassides, of which he fixes *two* terminal tarsal claws as the leading character, whereas "*Enyo*" has *three*, and has thence been included in the family Theridides. Now in those two of the species here described (*Storena variegata* and *S. scintillans*) which seem to be undoubtedly of Walckenaer's typical *Storena* the terminal tarsal claws are certainly *three* in number, though the third is very minute and difficult to be seen. *S. Bradleyi*, *S. australiensis*, and *S. maculata* have also three terminal tarsal claws.

In his description of a new species of *Storena* (*S. Græffei*), also an Australian species, Dr. L. Koch does not specially remark upon its tarsal claws, though, from including it in his work 'Die Arachniden-Familie der Drassiden,' p. 192, he leaves it to be inferred that he could only discover *two*.

The at present little known but closely allied genus *Lachesis* (Savigny) seems scarcely to be generically distinct from *Storena*, and is also apparently closely allied to *Enyo*. Of both *Lachesis* and *Enyo* some species in my collection, from Syria, Palestine, and India, have yet to be worked out; the comparison of these with allied species already received, and with others expected, from Australia, will perhaps facilitate a more certain and permanent arrangement of the species now included in these several genera. At present the Australian species known to me must remain provisionally as here described.

Storena variegata, n. sp.

♀. Adult. Length $3\frac{1}{2}$ lines.

Cephalothorax oval, broader behind than in front, smooth, shining, rounded before; caput slopes forward, so that the profile line of the whole cephalothorax is a continuous curve; fore part of caput has some bristly hairs upon it; normal grooves and indentations but slightly defined; colour a uniform dark chocolate-brown.

Eyes eight, not very unequal in size, in three transverse rows on fore part of cephalothorax; the lower row consists of two eyes wide apart; close above this is the central row of four; this row is rather curved, the curve directed backwards;

* *Enyo braccata, E. picta*, in "Beschreib. neuer Arachniden u. Myriap." aus den Verhandlungen d. k. k. zool.-bot. Gesell. in Wien, Jahrgang 1865, pp. 859–861.
Enyo annulipes, ibid., Jahrgang 1867, p. 194.

the two middle eyes are slightly the largest of the eight, and nearer to each other than each is to the lateral one on its side: above the central row, and further removed from it than from the lower one, is the third row of two eyes, near together and smallest of the eight; height of clypeus rather greater than the space between the lower and third rows of eyes.

Legs not very long, strong, tapering, furnished with hairs, and a few spines on those of the two hinder pairs. Relative length 1, 4, 2, 3, but very little difference between 1 and 4; femora of first pair stronger than those of the rest. Colour brightish orange-brown; femora, outer sides of genua, and undersides of tibiæ striped and suffused with deep chestnut-brown; tarsi end with three claws, the two upper ones curved and pectinate, the under one simple, small, and inconspicuous.

Palpi short, strong, furnished with hairs; colour yellowish, humeral joints chestnut-coloured.

Falces strong, conical, inclined backwards towards sternum, about equal in length to height of facial space, rather paler in colour than cephalothorax; fang small.

Maxillæ rather strong, straight, oblong, rounded at extremities on outer sides, inclined to labium.

Labium about one-third shorter than the maxillæ, much broader at base than at apex, which is round-pointed: these parts are paler in colour than the falces.

Sternum somewhat heart-shaped, but little longer than broad, smooth, shining, furnished with hairs, and of a dark chestnut-brown colour.

Abdomen oval, very convex above, but very sparingly furnished with hairs, nearly black, marked and variegated both above and below with pale-yellow and whitish markings; these form a concurrent double longitudinal series of broken chevrons in the medial line of the upper side; the markings on the sides are irregular, but they concentrate into a largish bright-yellowish-white patch on either side near the fore extremity; on the underside the yellow markings form two broadish longitudinal converging lines, which reach halfway towards the spinners; between these and the extremities of the lines are three roundish pale-yellow spots in a triangle whose apex is directed backwards. Spinners yellowish brown, short, and not very strong; those of inferior pair strongest.

A single specimen in a small collection of spiders received from the Swan River, New South Wales.

Storena scintillans, n. sp.

♀. Adult. Length 3 lines.

This species is very similar in form and general appearance to *S. variegata*, but it differs remarkably in various respects. The *cephalothorax* is more bluff and rounded before; the normal furrows and indentations are scarcely defined, the caput and thorax being imperceptibly confluent: in colour the cephalothorax is of a deep red-brown; its surface is rugulose and reflects metallic sparkling tints of a beautiful violet and dark green in different lights. The clypeus is much rounded in profile, and its height exceeds the space between the fore and hind rows of eyes; these are very similar in disposition to those of *S. variegata*, and are very nearly equal to each other in size; the middle row is slightly curved, the curve directed forwards. The *legs* are less strong than in *S. variegata*, their relative length the same, but those of the hinder pair are rather longer in proportion to those of the first pair; their colour is a dark red-brown, femora darkest; the extremities of the tibiæ of those of the first pair (extending to about one-third of their length) are of a clear yellow; the legs are furnished with hairs and some short stoutish spines on those of the third and fourth pairs; several of these spines form a sort of ring round the fore extremities of their metatarsi, and near them, on the inner side, is a tuft of hairs. Each tarsus ends with three claws; the two upper ones curved and pectinate, the lower one very small and not easy to be seen. The *palpi* are strong, similar to the legs in colour, and furnished with hairs and spines. *Falces* strong, more inclined to the sternum than in *S. variegata*; their colour is red brown, front surface rugulose. *Maxillæ* also more inclined to labium, which is likewise longer in proportion to the maxillæ than in *variegata*: colour red-brown, paler at the extremities. *Labium* similar. *Sternum* heart-shaped, of a deep red-brown; in appearance slightly rugulose or punctulose. *Abdomen* oval, rather more convex above than in *S. variegata*, furnished very sparingly with hairs, which are mostly of a short bristly nature; surface smooth, shining, of a deep black reflecting metallic tints of an invisible green; on the upperside are five pale markings mottled with yellowish-white spots; one of these markings, small and inconspicuous, is on either side near the fore extremity, another on either side just past the middle, they form two short curved lines, the curves directed backwards; the fifth marking is small, but conspicuous, and placed just above the spinners; on each side of the abdomen are two oblique lines, one short and commencing just below the curved lines above mentioned; the other (midway between that and the fore extremity of abdomen) is much longer and broader, and extends into a largish patch beneath, where it almost joins the opposite and corresponding patch: from between these patches, at this point, runs a short narrow longitudinal line of the same colour towards the spinners, which are no more conspicuous than in *S. variegata*: the external sexual organs are rather prominent, smooth, and of a yellowish red-brown colour.

A single specimen of this very distinct and beautiful species was contained in the Swan-River collection, with the specimen of *S. variegata*.

Storena Bradleyi, n. sp.

♂. Adult. Length $2\frac{1}{2}$ lines.

This species bears a near resemblance in form to *Storena maculata*; the height, however, of the clypeus is less; there is also a modification in the relative position of the eyes, which distinguishes it at once from all the other species known to me; by this modification the relative length and breadth of the space occupied by the eyes is altered.

Cephalothorax of a clear yellow red, reflecting metallic tints of a violet colour upon the caput and other portions in a strong light. Two or three strongish erect black bristles are in the medial line of the upper part of caput; this line is continued over the clypeus, where the bristles turn upwards: the height of clypeus is double that of the space between the anterior and posterior eyes.

Eyes on black spots, occupying a space broader than long (in *S. maculata* and *S. australiensis* this space is longer than broad). The chief difference in the relative position of the eyes in the present species arises from those of the third row being brought down nearer to those of the middle one, and in the two central eyes of the middle row being also brought down so as apparently to belong more properly to the *first* row; thus the eight eyes might be with propriety described as in *two* curved rows, the curves directed backwards, that of the foremost row being but slight, that of the hinder one much stronger. The four eyes of the hinder row are nearly of equal size, but much larger than those of the front row, of which last the external eyes are very small, and rather less than the two centrals; these are nearer to each other than each is to the lateral on its side; the space between the externals of the front row is near about equal to that between each and the hind central on its side.

Legs long, moderate in strength; relative length 4, 3, 1, 2. but little difference between those of the first, second, and third pairs, those of the fourth pair being considerably the longest, almost double the length of the spider,—those of first pair yellow-red, femora deepest in colour; those of second pair similar, but the femora still darker than those of first pair; while the femora, genua, and tibiæ of the third and fourth pairs are of a deep blackish red-brown. All the femora reflect metallic tints of a violet colour in different lights. The legs are all furnished sparingly with hairs and spines, and each tarsus ends with three curved claws of a similar nature to those of the species already described.

Palpi very similar in general appearance to those of the species next to be described (*S. australiensis*), short, red-yellow in colour; digital joints red-brown, reflecting violet tints like the femora of the legs; radial joints shorter and smaller than the cubital, and prominently produced in an obtuse form on their outer sides, the produced portions having their bases furnished with a tuft of bristly black hairs; one or two longer and strongish prominent black bristles also issue from the inner side of each radial joint; a similar bristle issues from the upper sides of the *cubitals*, and several from those of the *humeral* joints: digital joints very large, as long as the whole of the rest of the palpi; they are of a circular form flattened on the outer sides, with their extremities produced into a point much bent downwards; they are furnished with hairs, and have two or three short, strong, claw-like spines at the extreme points; these spines are rather abruptly bent at their extremities.

The *palpal organs* are well developed, and consist of several yellowish and red-brown corneous processes, one of which, near their base, is prolonged into a rather prominent filiform spine, which, curving round inwards beneath the base of the digital joint, has its acute point in contact with the inner margin of the same, at about one-third of the distance from its extremity.

Falces strong, about equal in length to the height of clypeus, inclined backwards to sternum, and similar in colour to cephalothorax.

Maxillæ strongly inclined to labium, and rounded on their outer sides; a tuft or short fringe of short, black, bristly hairs at their extremities.

Labium broadest at its base and roundish-pointed at apex, which nearly reaches the extremities of the maxillæ; these parts are similar to the falces in colour.

Sternum heart-shaped, of a deep reddish black-brown, reflecting tints similar to those on the cephalothorax, &c.

Abdomen short, oval, very convex above, almost black, clothed sparingly with fine pale hairs; five markings of a cream-yellow are conspicuous on the upperside, two of these are on either side towards the fore part, the hinder one of each two being oblique and much the largest, the fore ones being mere dots and nearer together than the hinder ones; the fifth is a short strong medial line, reaching for some little distance above the spinners. The upper and under sides of the abdomen are divided by a strong line (or sometimes an interrupted, narrow, oblong band) of a similar colour, on either side; these bands nearly unite in front, and terminate at about one-third the length of the abdomen from the spinners; these are prominent, those of the inferior pair being much the strongest.

Three males (two adult, one immature) of this species were received from Mr. H. Burton Bradley, of Sydney, New South Wales. Mr. Bradley has most kindly sent me these and other spiders of great interest; and I take the liberty of conferring his name upon the present species, in acknowledgment of his courtesy. *S. Bradleyi* is unmistakeably and nearly allied to *S. australiensis* and *S. maculata.* The difference above noted in the position of the eyes approaches nearly to that of the genus *Enyo*, to which genus, had the specimens of *S. Bradleyi* occurred in Europe or the adjoining countries, I should have considered it to belong, though it would have been quite an abnormal species, inasmuch as in the typical *Enyo* the two central eyes of the front row are invariably, and, in fact, disproportionately the largest of the eight.

Storena australiensis, n. sp.

♂. Adult. Length $2\frac{1}{2}$ lines.

Cephalothorax oval (when looked at from behind and above), blunt or roundish-pointed before, broad and rounded behind. *Caput* massive; normal grooves and furrows but slightly defined. *Clypeus* broad and high, its height exceeding the length of space occupied by the eyes; behind the occiput is a slight dip in the profile line; surface smooth and shining; colour deep brown, approaching to black on caput, whence it tones down to dark red-brown on the hinder (or thoracic) portion; a few slender bristles curving upwards on fore part of caput and on clypeus.

Eyes very unequal in size, in three transverse rows on summit of caput; six of them form a regular but not equilateral hexagonal figure, and the remaining two are nearly in its centre. The foremost of the three rows consists of two very small eyes high above the lower margin of clypeus; the next row has four eyes, and is curved, the curve directed backwards; the lateral eyes of this row are much the largest of the eight, the two central ones the smallest and near together; the hind row consists of two eyes, not so large as the laterals of the middle row.

Legs tolerably long, moderate in strength; greatest length in the metatarsi, especially those of the two hinder pairs, furnished with long and rather slender spines, particularly on tibiæ and metatarsi; femora, genua, and tibiæ of first two pairs dark black-brown; metatarsi and tarsi pale brownish; hinder half of femora of third pair, and nearly all of femora of fourth, bright reddish; the remaining joints of third and fourth pairs similar to the corresponding ones of first and second—if anything, rather darker; legs of fourth pair much the longest. Relative length 4, 2, 3, 1. Owing to the specimen from which this description was made being dry and pinned, the claws terminating its tarsi could not be satisfactorily observed; but they appeared to be (like those of the next species described) three in number,—two upper ones curved and pectinated, the inferior one very small and simple.

Palpi moderately long; cubital and radial joints short, the former nodiform, the latter produced *slightly* on *inner* side, and to a *considerable length* on *outer* side; this latter produced portion is strong, and curved downwards and backwards; extremity of the production bifid, one limb of the bifid part enlarged at its extremity, and stouter, though shorter, than the other: digital joint very long, and furnished with hairs; its extremity is curved, and projects considerably beyond the palpal organs; these are highly developed and complicated, consisting of several corneous pieces and lobes, with which some curved spines are connected.

Falces moderate in length, not very strong, much inclined backwards to maxillæ, which, with the labium and sternum, could not be examined, owing to the circumstance, before mentioned, of the specimen being dried and pinned.

Abdomen too much shrunk out of all shape to be accurately described: it appeared to be of an oval form, very convex above, thinly clothed with hairs, and of a dark black-brown colour, with some faint markings of a rusty yellow towards the hinder part of the upper side.

A single adult ♂ in the Hope Entomological Collection at the University Museum, Oxford.

Hab. Australia.

I am indebted to the kindness of the Curator of the Hope Collection (Prof. Westwood) for the opportunity of describing this very distinct spider, which, after much hesitation, I have assigned to the genus *Storena*, Walck.

Storena maculata, n. sp.

An immature ♂, closely allied in general appearance and structure to *S. australiensis*, was received from the Swan River, New South Wales, in a small bottle of spiders collected there for me, through the agency of Mr. Samuel Stevens, in 1864. It is (although immature) rather larger than *S. australiensis*, being $2\frac{3}{4}$ lines in length, and may be at once recognized by the design upon the upper side of the abdomen: this consists of sundry spots and markings of a clear bright cream-white upon a dark rich maroon-brown ground. Eight nearly round spots form two slightly curved longitudinal lines on the fore part; each alternate spot is very small: these lines are succeeded by two larger spots or patches; the foremost of these is of a semicircular, and the hindmost one of an oblong form. A belt of the same colour girds the fore half of the abdomen, dividing the upper from the lower side, and to this belt, on either side, succeeds an oblong patch, the fore end of which rather overlaps the end of the belt; the underside is dull yellowish tinged with maroon, and softening gradually into that colour on the sides. Normal grooves and furrows on cephalothorax distinctly but not very strongly marked. The legs did not differ much in length, and those of the third pair appeared to be slightly longer than those of the first and second; their colour was yellow-brown deepening into dark red-brown on the extremities of the femora, the basal portion of which, together with the coxal joints, was clear yellow; they were furnished with hairs and spines, and each tarsus terminated with three curved claws, the two upper ones pectinated, the under one simple and much the smallest. The *falces* appeared to be stronger and more inclined backwards than in *Storena australiensis*, and they were furnished with many dark, stiff, prominent, bristly hairs. The height of the clypeus, as well as also the relative sizes of the eyes, appeared to differ. The palpi presented the same general appearance as to the relative proportions of the different joints; but, being immature, the structure of the radial and digital joints, as well as of the palpal organs, was undeveloped. The colour of the radial and digital joints was yellow, that of the rest dark red-brown; colour of sternum (which was of an oval form pointed behind) yellow-brown. *Spinners* short, compactly grouped; inferior pair much the strongest and longest.

Family **Thomisides**?

Nov. gen. Stephanopis.

Characters of Genus.

Eyes eight, unequal in size, forming a corona or circlet around the upper part of a cephalic eminence which varies in height; outer eyes of the four in front of eminence largest of the eight.

Maxillæ moderately long, nearly straight, inclined towards labium, which is longer than broad and rounded at its apex.

Falces long, strong, and inclined backwards towards labium.

Cephalothorax and *abdomen*, together with the legs and palpi, variously furnished with tubercles and tuberculate spines, giving the spider a very singular and hirsute appearance.

Legs apparently laterigrade, relative length 1, 2, 4, 3.

Stephanopis altifrons, n. sp.

♀. Adult? Length 4 lines.

Cephalothorax broad behind and flattened, elongated and narrowed towards the fore part; *caput* elevated in a sloping direction forwards into a strong laterally rounded eminence, the summit of which has a large tubercle on either side, ending in a short bluntish spine; several bluntish tuberculate spines also in front and on sides of eminence. *Clypeus* prominent, cleft; each projection formed by the cleft is tuberculate, and furnished with short bristly prominent spines. The whole surface of cephalothorax rugulose, and more or less furnished with tuberculate spines. Colour deep brown approaching to black, mixed with bistre. Clypeus pale hoary yellow.

Eyes forming a ring round upper part of frontal eminence; they are unequal in size, and may be described as in two curved rows, of which the fore one is shortest and embraces the fore half of the eminence, while the hinder one girds the hinder half; those of hinder row are about equidistant from each other, and do not differ much in size. Lateral eyes of front row large, and largest of the eight; middle ones smallest, and very minute; the eyes of this row are also about equidistant from each other.

Legs moderately long; relative length 1, 2, 4, 3; those of first pair stronger than the rest; all furnished with tubercles, bristles, and short spines, and thinly clothed with short, pale, sessile hairs; tubercles most conspicuous on tibiæ, especially on those of first and second pairs, whose tibiæ and metatarsi have two parallel rows of strong spines, directed forwards, on their undersides. Colour yellowish, mottled and suffused irregularly with deep brown-black; tarsi and metatarsi more regularly banded with similar colours.

Palpi moderate in length and strength, similar to the legs in colour and armature.

Falces long and strong, similar in colour to the legs, except that their extremities are paler than the other portion; they are much inclined backwards towards the maxillæ.

Maxillæ moderately long, nearly straight, but much inclined towards the labium, which is rather longer than broad, slightly rounded at its apex, near which it is rather narrower than at the base.

Sternum large, oval, narrowest at its fore extremity, thickly clothed with short hairs. Colour of maxillæ, labium, and sternum yellowish brown, the latter having a long-oval longitudinal patch of a darker colour in its centre.

Abdomen—upperside of same colour as cephalothorax; underside more mottled with yellowish; strongly rugulose, hinder part broader than the front, thickly furnished with bluntish tuberculate spines and bristles, similar to those on the legs. The length of the abdomen is about equal to that of the cephalothorax, and the broadest part is rather broader; fore margin notched.

A single specimen (♀) of this singular-looking spider is in the Hope Collection, University Museum, Oxford. Being dried and pinned, it was not possible to make a satisfactory examination of it; nor could it be ascertained whether the specimen had attained maturity. At a single glance, however, it proclaimed itself to be an undescribed species of a genus not hitherto characterized. The hasty and imperfect sketch accompanying this description may perhaps help to give some general idea of its appearance.

Hab. South Australia.

Stephanopis nigra, n. sp.

♀. Adult? Length $5\frac{1}{2}$ lines; relative length of legs 1, 2, 4, 3.

This species, closely allied to *Stephanopis altifrons*, resembles it in general form and length of legs, but is longer; its cephalic eminence, however, is altogether rather less elevated, though more prominent between the eyes; the size of the two lateral eyes of the front row is also slightly smaller in proportion to those of the hinder row. The tubercular rugulosities and spines are generally stronger and more pronounced, especially upon the palpi. The colour of this species is a uniform coal-black.

A single specimen (♀), dry and pinned, in the Hope Coll. Oxford.

Hab. "North part of New Holland."

Stephanopis clavata, n. sp.

♀. Adult. Length $3\frac{3}{4}$ lines; relative length of legs 1, 2, 4, 3.

Nearly allied to both the foregoing species, the present differs from them both in colour and armature. The central pair of eyes in the front row are lower down, and thus more removed out of the straight line of the two laterals. The form of the abdomen is a more regular oval. Cephalothorax yellow-brown, marked with darker lines of same colour. Some small, pale, scale-like hairs are disposed in longitudinal lines towards the fore extremity; cephalic eminence much less elevated than in *S. altifrons*. The armature of the cephalothorax consists of short, strong, tuberculate spines. The *abdomen* is of a bright brown-yellow, thickly studded with small yellowish tuberculate spines, among which are many paler ones, longer and of a larger size; some of them are clubbed at their extremities; of these some are black, and give a speckled appearance to the surface of the abdomen. Legs similarly armed, but the spines are not quite so strong. Colour of the legs like that of cephalothorax, with irregular oblique bands of a paler hue, formed by small scale-like hairs; these are most conspicuous on the tarsi and metatarsi, and the alternate spaces are red-brown. Sexual organs large and conspicuous; but in the dry specimen their exact form could not be ascertained.

A single ♀ in Hope Coll., Oxford, without label, but supposed to be from Australia.

Stephanopis lata, n. sp.

♀. Adult? Length $3\frac{1}{2}$ lines; relative length of legs 1, 2, 4, 3.

Closely allied to *S. altifrons*, this species differs from it in the tuberculate rugulosities being in general less acutely spinous and bristly, also in having a good deal of red-brown in its colouring, as well as in being proportionally shorter and broader—in this last respect, and in the fore extremity of the abdomen being truncate, presenting a more marked Thomisiform appearance; the elevation of the caput is also far less high and prominent, and the clypeus less projecting; the legs are longer and stronger; and the size of the front lateral eyes is proportionally less; also the front centrals are lower down and more out of the straight line (as in *S. clavata*):—

A single ♀ of this spider (which may be easily distinguished from either of the foregoing species by the differential characters above given) is in the same collection as those species, and is labelled "Van Diemen's Land."

Stephanopis (?) *camelina*, n. sp.

♀. Adult. Length $4\frac{1}{2}$ lines; relative length of legs 1, 2, 4, 3.

Cephalothorax short, broad, contracted laterally, and truncate before, nearly circular behind; thoracic portion higher than caput, into which it runs gradually; caput but very slightly prominent in ocular region; colour yellow-brown, deeply suffused with dark red-brown, margins broadly yellow: it is thickly studded with small shining tubercles; some of these on the thorax are arranged in oblique lines corresponding to the normal furrows: lower margin of clypeus, looked at from the front, describes an arc of a circle; fore corners of ocular region slightly raised above the surrounding surface.

Eyes in two curved, transverse rows, forming a rather longer transverse oval than in the species before described, but differing less in their relative size; external eyes of front row largest, middle ones smallest of the eight: each lateral eye of hinder row very nearly in a straight line with the two outer ones on its side of the front row.

Legs—those of the two fore pairs long and nearly equal in length; strong: femora (especially on their undersides) furnished with small tubercles; those on the undersides largest, and forming two longitudinal rows; many of these tubercles have a small bristle issuing from their summit; possibly similar bristles may have been accidentally rubbed off from the other tubercles. The tibiæ and tarsi have their undersides armed with two longitudinal rows of semisessile spines issuing from tubercles: terminal claws strong; those of the two hinder pairs much shorter and less strong than the rest; some small tubercles beneath the femora of the two hind pairs, and bristles on the tibiæ and tarsi, take the place of the spines on the fore legs. Colour of the legs yellowish; the tibiæ, tarsi, and metatarsi of the two fore pairs suffused with brownish, and the femora with dark brown.

Palpi short, moderately strong, furnished with hairs and bristles.

Maxillæ and *labium* were obscured in great measure, owing to the specimen being dry and pinned; but, as far as visible, these parts were similar in structure to those of the species already described.

Sternum oval, of a yellowish colour, and furnished sparingly with small tubercles.

Abdomen large, much broader and deeper behind than in front, and projecting over base of cephalothorax; on the hinder portion are five elevations—a central and four corner ones;

these latter are small, and of a blunt conical form; the central one is large, projects backwards, and is enlarged at its extremity, which has a small subconical elevation at each fore corner and a slightly raised longitudinal ridge down its centre: upperside of the whole abdomen furnished thinly with small, circular, shining, red-brown tubercles; colour of upperside reddish brown, darkest down the middle, and nearly black between the two conical projections on either side; underside paler, and with a broad yellowish band down its centre.

An adult ♀ of this spider is in the Hope Collection, Oxford, labelled "Amazons; Bates, 1861." It presents a remarkable difference in general appearance from the four Australian species above described; and it is only after great hesitation that I have provisionally included it in the same genus: the disposition and relative size of the eyes, and (as far as they could be observed) the structure of the maxillæ and labium, seemed to designate a generic affinity with those species; and possibly the difference in general appearance may be some day bridged over by the discovery of intermediate forms. The specimen being dry, its *colours* can hardly be depended upon.

Genus Asemonea (Camb. MS.).

Lyssomanes (Hentz), Boston Journ. Nat. Hist. vol. v. p. 198, pl. 17. fig. 3.

Lyssomanes tenuipes, n. sp.

♂. Adult. Length 2 lines.

Cephalothorax oval, depressed, and sloping back from caput, immediately behind which is a slight dip or depression; caput slightly raised and produced forwards, forming a platform occupied by the eyes, from among which a few coarse hairs project: colour black-brown.

Eyes eight, in four transverse lines on front and summit of caput—two in each line; those of first line very large, contiguous, and occupying the whole breadth of the fore part of caput; those of second line very much smaller, a little on the outside of, and about their own diameter distant behind, those of first line; those of third and fourth lines small, and forming a square close behind the second line; the length of these lines little more than half that of the second: the eyes of the third line are the smallest of the eight.

Legs long, slender, and, as far as they could be observed, not greatly differing in length; the only armature apparent consisted of two longitudinal rows of long slender spines beneath the tibiæ of the two foremost pairs, and a few still finer ones on other parts. Colour of the legs dull pale yellowish brown.

Palpi moderate in length; digital joint large; palpal organs highly developed, of great size and complicated structure. Any minute description was rendered impracticable, owing to the specimen being gummed upon a piece of card—a circumstance which also prevented any observation of the maxillæ, labium, and sternum; the falces also were almost entirely hidden: they appeared, however, to incline strongly backwards towards the maxillæ.

Abdomen so much shrunk as to make it difficult to describe it with any accuracy; apparently it was long, narrow, oval in form, of a blackish colour, clothed with white hairs on the sides, and some greenish-yellow, metallic-lustred, scale-like hairs on the upperside; two of the spinners were apparently much longer than the rest, and curved strongly upwards.

A single adult ♂ in the Hope Collection, Oxford, received from Ceylon, where it was captured by Mr. G. H.K. Thwaites. It is probable that, upon a revision of the Salticides, the genus *Lyssomanes*, established by Mr. Hentz, in his 'History of American Spiders' (*loc. cit. sup.*), will sink into a subgenus of the genus *Salticus*.

Family **Salticides**.

Genus Salticus.

Salticus coccinelloïdes, n. sp.

♀? Adult? Length 1 line.

Excepting the legs, the whole of this curious little spider is of a jet-black colour, with a semicorneous integument, which is shining and marked thickly with minute punctures. Cephalothorax, looked at from above, nearly square, and arched on all sides; normal furrows, defining caput and thoracic segments, quite obsolete; the profile of the abdomen and cephalothorax describes almost a semicircle; the fore margin of the abdomen slightly covers or overlaps the hinder part of the cephalothorax; and from the structure of these parts it seems probable that, when alive, the spider has the power of raising its cephalothorax so as to throw it almost completely back beneath the semicorneous integument of the abdomen.

Legs short, pale yellowish in colour, apparently not greatly differing in length, those of third pair shortest. The specimen, however, being dry, it was impossible to be certain upon this point.

Palpi so concealed as to be incapable of description, and, in fact, to leave the sex of the spider doubtful.

Eyes in three rows, occupying the greater area of the cephalothorax; their position is similar to that of the *Saltici* in general, viz. two large ones in front, a small one on either side, a little retreating from the line of the large ones; these four form the first row; those of second row two in number, one not far behind each outer eye of first row; those of third row (also two in number) quite on sides of caput, and thus wider apart than the outer eyes of the first row, and further from those of the second row than these are from those of the first row.

Two specimens of this minute species are in the Hope Collection, Oxford (*Hab.* Novo Friborgo). They bear no small resemblance to small beetles of the family Coccinellidæ, since, without close examination, it is difficult to see any division between the cephalothorax and abdomen; the concavity of the fore margin of the abdomen is a curious and unusual structural peculiarity. Upon any general revision of the very numerous family "Salticides," the present species should form the type of a new subgenus; for the present, however, I have thought it best to describe it under the generic name *Salticus* only. It is nearly allied to a well-marked group of the genus *Salticus* which C. Koch has described as a genus (*Rhanis*); this group, however, has no claim to more than subgeneric separation from the genus *Salticus*.

Salticus bicurvatus, n. sp.

♂. Adult. Length $2\frac{3}{4}$ lines.

Cephalothorax elongate. Caput divided from thoracic portion by a strong constriction, leaving the former nearly circular. Thorax oval, narrowest behind, where it is truncate. Caput and thorax of equal length. Colour black and shining.

Eyes in three rows, each of the two forming the middle row nearer to the exterior one on its side of the first row than to that of the hinder row.

Legs rather long, slender; a few fine hairs and spines beneath tibiæ and tarsi of first and second pairs; relative length 4, 1, 3, 2, but little difference between first and fourth and third and second respectively: colour reddish brown, tarsal joints darkest.

Palpi short, not very strong. Being curled up beneath the dried specimen, it was impossible to observe the structure of the radial and digital joints or of the palpal organs; the same cause also precluded any observation of the maxillæ and labium.

Falces very prominent, long, strong, and massive, rather longer than cephalothorax; their inner face flat; extremities straight and rounded on outer side; when looked at in profile, much arched above. Fangs as long as falces, sinuous, or containing a double curve; central part thinner and weaker than the portion on either side; extremities pointed and curved; behind this curved point a portion of the face of the fang is bluntly serrate. Colour of both falces and fangs (excepting the extremities of the latter and base of the former, which are rather lighter-coloured) dark black-brown and shining; inner face of the falces slightly wrinkled in a transverse direction; two rows of minute teeth *beneath* the falces, and several larger ones near the insertion of the fangs.

Abdomen joined to cephalothorax by a short cylindrical pedicle; oval in form, rather pointed in front, truncate behind. Colour glossy black.

A single specimen of this species in the Hope Collection, Oxford, captured in Ceylon by Mr. G. H. K. Thwaites. It is closely allied to *Salticus manducator* (Westwood) (described and figured in Guér. Mag. de Zool. 1841, Arachnides), but differs from that species in the falces and fangs: the former are rather larger in *S. bicurvatus*, and the latter have a double curve (as above described). The denticulation beneath the falces also differs in the two species.

Salticus plataleoïdes, n. sp.

♂. Adult. Length, to extremity of falces, 6 lines, to insertion of ditto $3\frac{1}{2}$ lines.

The entire spider is of a dull brownish-yellow colour, excepting the tips of the falces, which are black on the outer sides, and the upperside of the caput, which is of a bright rufous colour. The basal half of the falces has an opaline lustre in different lights, and their extremities have a rufous hue.

The cephalothorax is similar in form to that of *S. bicurvatus*; but the caput is more of an oblong shape. Eyes of second row nearer to those of first row than in *S. bicurvatus*, i. e. about one-third of the distance between the first and third rows; and they are inside of the straight lines between the exterior eyes of these rows.

Legs long, slender; extremities of tibiæ and tarsi sparingly furnished with hairs; their relative length was apparently 4, 1, 3, 2. The pedicle joining the abdomen to the cephalothorax biarticulate, and as long as the thorax.

Falces of great length, projecting in nearly the same plane as the *cephalothorax*; basal half very slightly and transversely rugulose, and shining in some lights with an opaline hue, flat on their inner face; extremities much and abruptly enlarged on upper and outer sides for about one-third of their length, giving to the spider (when the falces are close together) much the appearance of the Spoonbill (*Platalea leucorodia*). The enlarged extremities have a reddish hue in some lights, and their outer extremity, above the insertion of the fang, is deep black-brown. The fang, being folded back in its position of rest, was nearly hidden; but apparently it was almost straight and not quite as long as the falces.

Abdomen apparently rather slender-oval in form, and truncate at its hinder extremity.

Palpi short and slight. Owing to the specimen being dry, they could not be extended so as to expose the structure of the extreme joints and the palpal organs.

A single specimen of this singular-looking spider is in the Hope Collection at Oxford.

Hab. Unknown.

Since writing the above, I have received twelve specimens of this species from Mr. G. H. K. Thwaites, of Ceylon,—nine males and three females. These, being in spirit, admit of a more accurate examination than the dry specimen above described. As far as the above description goes, however, its correctness is confirmed by the examination of Mr. Thwaites's specimens; but the following additional particulars are worth noting:—

The spiders themselves, although adult, differ greatly in size, some being larger than that above described, and others at least one-third smaller. The falces also vary considerably in their relative length in different specimens, in one rather exceeding the length of cephalothorax and pedicle connecting it with the abdomen, in another only just equalling the length of the cephalothorax. The falces are armed on their inner sides with two longitudinal rows of sharp teeth; the inferior row consists of about sixteen, nearly equally dividing the whole length of the falx; the superior row consists of but five, unequally dividing the fore half of the falx, but stronger than those of the inferior row. The fang equals the falx in length, and is slightly curved at its extremity. The abdomen (which was shrunken and shapeless in the dry specimen) was of a long oval form, widest behind, and strongly constricted at about one-third of the length from its fore extremity, almost dividing it into two segments; on either side of the constricted portion is an oblique pale patch.

Palpi about two-thirds the length of the falces, or rather more in some specimens; radial joint long, double the length of the cubital, enlarging gradually towards its extremity, which has a small, sharp, black-pointed projection on its outer side; digital joint small, oval in form; palpal organs simple and not very prominent, consisting of a simple corneous lobe, with a small, pointed, black, circularly curved spine towards their fore extremity.

The cephalothorax has three long fine bristles directed forwards on either side of the upper part of the caput, indicating the position of the exterior eyes of the first row, and of the eyes of the second and third rows.

The sternum is long and narrow oval in shape, with a strong curved indentation on either side towards the anterior extremity, and the hinder extremity much produced.

Maxillæ long, enlarged at their extremities, which are a little divergent. Labium oblong; sides and apex emarginate; length about two-thirds that of maxillæ.

The adult female only differed from the male in the palpi and falces; these latter are no longer than the length of the ocular region of caput, and more approaching a vertical position; the digital and radial joints of the palpi form one long, oval, flattened piece.

Genus Eresus (Walck.).

Eresus bicolor, n. sp.

♂. Adult. Length $3\frac{1}{2}$ lines.

Cephalothorax broad oval, rather depressed behind; caput much elevated and rounded at its summit; fore margin, when looked at from above, squarely truncate. Excepting two triangular patches in front, which enclose the four central and the two front lateral eyes, the caput is thickly clothed with pure-white hairs; these patches, as well as the thorax, are jet-black, the latter broadly margined with pure-white hairs also.

Eyes not very unequal in size, forming a small square within a large one; the posterior side of the large square formed by the four outer eyes is shorter than its anterior side; but of the inner square the anterior side is the shortest.

Legs long, those of first pair very strong, and much the longest of the eight; relative length 1, 4, 2, 3; femora of first pair black; tibiæ nearly so, and both furnished with black hairs; the rest of the joints are of a dark reddish brown, some of them being broadly annulated with a paler hue. The genual joints, extremities of femora, and fore half and extremities of tarsi thickly furnished with pure-white hairs; the two hinder pairs have all the joints more or less annulated with bands of white hairs, the alternate spaces being reddish brown varying to black.

Palpi short, moderately strong, of a deep reddish brown-black; cubital joints furnished with white hairs; digital joints large; palpal organs apparently bulb-shaped at their base, with a strong corneous projection towards their outer extremities. The specimen, however, being dry and pinned, its palpi were too much concealed to admit of a satisfactory examination.

Falces black; a small, raised, corneous ridge of deep shining red-brown near their base on the outer side; long and strong, slightly curved from each other, vertical.

The maxillæ and labium could not be well examined, owing to the specimen being pinned.

Abdomen oviform, projecting considerably over the base of the cephalothorax; it is black, furnished with hairs, of which a few are fine erect ones; four longitudinally connected patches of white hairs occupy the medial line of the upperside; the first, near the cephalothorax, is of a long isosceles triangular form, rounded at its hinder extremity, which forms the base of the triangle; the next is a transverse oval patch; the third similar in form, but smaller; the fourth is quite small, and somewhat of a diamond shape; the connexion between these patches is by a narrow neck of white hairs; the last of the patches is succeeded by a small independent spot, formed also by white hairs. The underside of the abdomen is dotted with white hairs having a tinge of pale yellowish red-brown.

Sternum thickly furnished with coarse whitish hairs.

A single adult ♂ of this very conspicuously marked *Eresus* is in the Hope Collection, Oxford.

Hab. "Damara Land, South Africa."

Eresus tibialis, n. sp.

♂. Adult. Length $3\frac{1}{2}$ lines.

Cephalothorax black, sparingly furnished with hairs, a broad band on the lateral margins furnished thickly with coarsish sessile hairs of a dull yellow colour; and a fringe of similar hairs extends from the lower margin of the clypeus over the base of the falces. In form the cephalothorax of this species nearly resembles that of *E. bicolor* and many others of the genus.

Eyes in the normal position of a small square within a large one; those of the hinder side of the medial square are *much* larger than those of the fore side; the fore side of the outer square is longer than the hinder side; but in respect to the inner or medial square it is just *vice versâ*, the posterior side being the longest.

Legs long and strong; those of the first pair have the first five joints remarkably stout, the genuals unusually long, and the tibiæ very large, tumid, shining, and thickly clothed with long black hairs. The colour of the legs is red-brown; the femora of the second, third, and fourth pairs, together with the tibiæ of the first, are much the darkest, nearly black; the uppersides of femora, genua, and tibiæ of the three hinder pairs are furnished with longitudinal lines of coarse, yellow, sessile hairs; relative length 1, 4, 3, 2.

Palpi stout, but not very long, similar to the legs in colour; some coarse yellowish hairs form a ring at the extremities of the cubital and radial joints; digital joint large. But the palpal organs were too much concealed in the dry specimen for satisfactory observation.

Falces nearly straight, rather projecting, and a little hollowed on inner sides, strong, equal in length to the height of the facial space; fang red-brown, not very long nor strong.

Maxillæ and *labium* too much concealed to render their structure visible: apparently they were of a dark red-brown colour, furnished with a few coarse yellowish hairs.

Sternum long oval, black, with a broad longitudinal central band of yellowish hairs; this band was rather dilated in the middle.

Abdomen oval, broader at posterior than at anterior extremity, of a dark brown-black colour; the fore half of the upperside, as well as a space above the spinners, and the underside were thickly clothed with coarse yellowish hairs.

An adult ♂ of this species, remarkable for the tumidity of the tibiæ of the first pair of legs, is in the Hope Collection, Oxford.

Hab. "Mysore, India."

EXPLANATION OF THE PLATES.

Plate IV.

Storena variegata.

Fig. 1. Spider in profile, much enlarged, without legs.
Fig. 2. Fore-right view of cephalothorax and falces.
Fig. 3. Portion of tarsus of first pair of legs, showing the three terminal claws.
Fig. 4. Position of eyes, from front.
Fig. 5. Spider in profile, magnified.
Fig. 6. Natural length of spider.

Storena scintillans.

Fig. 7. Spider in profile, without legs, much enlarged.
Fig. 8. Position of eyes, from front.
Fig. 9. Tarsus and portion of metatarsus of leg of hinder (fourth) pair.
Fig. 10. Spider in profile, magnified a little.
Fig. 11. Natural length.

Storena Bradleyi.

Fig. 12. Spider in profile, much enlarged, without legs.
Fig. 13. Position of eyes, from front.

Fig. 14. Spider in profile, magnified a little.
Fig. 15. Abdomen and cephalothorax (without legs), from above.
Figs. 16, 17, 18, 19. Left palpus in different positions.
Fig. 20. Natural length of Spider.

Storena australiensis.

Fig. 21. Fore-right view of cephalothorax and falces.
Fig. 21 *a*. Natural length of spider.
Fig. 22. Cephalothorax in profile.
Fig. 23. The same, from above.
Figs. 24, 25, 26. Right palpus in different positions.

Storena maculata.

Fig. 27. Fore-right view of cephalothorax and falces.
Fig. 28. Abdomen, from above.
Fig. 29. Cephalothorax and abdomen in profile.
Fig. 30. Portion of tarsus of leg of fourth pair, showing three terminal claws.
Fig. 31. Position of eyes, from front.
Fig. 32. Natural length.

PLATE V.

Stephanopis altifrons.

Fig. 33. Fore-right view of cephalothorax and falces.
Fig. 34. Cephalothorax, somewhat in profile.
Fig. 35. Cephalothorax and abdomen, from above and behind.
Fig. 36. Cephalothorax, from above and in front.
Fig. 37. Position of eyes, from front.
Fig. 38. Natural length of spider.
Fig. 39. Underside, showing maxillæ, labium, and sternum.

Stephanopis nigra.

Fig. 40. Natural length of spider.

Stephanopis clavata.

Fig. 41. Natural length of spider.

Stephanopis lata.

Fig. 42. Cephalothorax and abdomen, from above and behind.
Fig. 43. Natural length of spider.

Stephanopis camelina.

Fig. 44. Spider in profile, without legs.
Fig. 45. Fore-right view of portion of cephalothorax and falces, showing position of eyes.
Fig. 46. Fore-right view of spider, without legs.
Fig. 47. View of abdomen, from behind.
Fig. 48. Cephalothorax and abdomen, from above and behind.
Fig. 49. Natural length of spider.

Lyssomanes tenuipes.

Fig. 50. Spider, without legs, in profile.
Fig. 51. Position of eyes, from front.
Fig. 52. Natural length of spider.

Salticus coccinelloïdes.

Fig. 53. Spider in profile.

Fig. 54. Cephalothorax and abdomen, from above and behind, with the former elevated.
Fig. 55. The same, with cephalothorax depressed forwards, as in fig. 53, *i. e.* in natural position of rest.
Fig. 56. Spider of natural size.

PLATE VI.

Salticus bicurvatus.

Fig. 57. Spider magnified.
Fig. 58. The same, in profile, without legs.
Fig. 59. Right falx, showing double row of minute teeth underneath.
Fig. 59 *a.* Left falx.
Fig. 60. Natural length of spider.

Salticus plataleoïdes.

Fig. 61. Spider without legs.
Fig. 62. Portion of ditto, in profile.
Fig. 63. Spider, of natural size.
Fig. 64. Underside, showing maxillæ, labium, sternum, and left palpus.
Fig. 65. Right falx, from inner and underside.
Fig. 65 *a.* Natural length of spider.

Eresus bicolor.

Fig. 66. Spider, from above, with only portion of leg of first pair.
Fig. 67. The same, in profile, without legs.
Fig. 68. Cephalothorax (caput) and falces, from front.
Fig. 69. Natural length of spider.

Eresus tibialis.

Fig. 70. Leg of first pair, showing enlarged tibial joint (*a*).
Fig. 71. Natural length of spider.

XIV.—*Note on a Fossil Lycopodiacean Fruit.* By M. BRONGNIART*.

THE study of the fossil plants of the older strata possesses a peculiar interest in consequence of the singularity of their forms, which most frequently separates them in a very striking manner from those which live at present on the earth. With the exception of the ferns, the resemblance of which has always been recognized, the plants of the Carboniferous formation differ so much from those which have inhabited the earth at more recent periods, and from those which now inhabit it, that very careful comparisons have been required to connect them with the families of the existing world. Nevertheless, from the commencement of my investigations upon this subject, I have indicated the relations of several arborescent plants of this period to the Horsetails or Equisetaceæ and to the Lycopodiaceæ.

* Translated by W. S. Dallas, F.L.S., from the 'Comptes Rendus,' Aug. 17, 1868, tome lxvii. pp. 421–426.

As regards the latter, I had referred to the large stems and branches which constitute the genus *Lepidodendron*, certain spikes or cones of fructification which appeared to me to be cones of those gigantic Lycopodiaceæ, and had given to them the name of *Lepidostrobus*. Subsequently these relationships were completely confirmed by the researches of Dr. Joseph Hooker upon several specimens of *Lepidostrobus** contained in the nodules of carbonate of iron from the English coal-measures, the internal structure of which had been sufficiently well preserved to allow the form of the sporangia borne by the scales of these cones, and the nature of the spores which they contained, to be much better appreciated than I had been able to do.

Another remarkably well-preserved specimen, the origin of which, however, was unknown, had been previously described by our illustrious associate, Robert Brown, under the name of *Triplosporites*. The profound investigation which he made of this specimen in 1847, and the additions which he made on publishing his memoir in 1851†, after the examination of a fine specimen which I showed him in 1849, left no doubt in his mind as to its intimate relations with *Lepidostrobus*, from which he hesitated to regard it as generically distinct.

But the specimen described by Robert Brown‡, as well as that of the Museum of Strasbourg (one-half of which has been given to the Museum at Paris, and was communicated to him by me), only presents small portions of these cones; that described by R. Brown evidently corresponds to the apex of one of the cones: that which I had examined appeared to come from the base; but the perfect specimen which forms the subject of this notice proves that it belongs rather to the middle part of one of these spikes of fructification. In fact the lower part of cones of this kind presents very remarkable differences of organization, which must materially modify the characters ascribed to these fossils, and seem to indicate that there are between them and *Lepidostrobus* greater differences than had been supposed, at least if the organization of these latter fruits could be sufficiently appreciated in the specimens described by Dr. Joseph Hooker.

The numerous but often very imperfectly preserved specimens studied by that excellent observer are most frequently

* Memoirs of the Geol. Survey of Great Britain, vol. ii. p. 440.

† "Some Account of *Triplosporites*, an undescribed Fossil Fruit," Trans. Linn. Soc. vol. xx. p. 3. (Read to the Society June 15, 1847.)

‡ This specimen was derived from the collection of Baron Roger; and a transverse section, preserved in the collection of the Marquis de Dré, is at present a portion of the collection of the museum.

only very limited portions of these spikes; some, however, appear to have been preserved throughout their whole extent, and there is nothing to indicate any difference of structure between the base and the apex. Throughout, the scales bear sporangia of the same form, and apparently enclosing bodies of the same nature; this at least is indicated by the figures and descriptions published by the learned English botanist.

These characters, therefore, seem to approximate the *Lepidostrobi* to the true *Lycopodia*, of which all the sporangia are similar and contain identical spores.

The family Lycopodiaceæ includes two other genera, which are very different in this respect, *Selaginella* and *Isoëtes*, which, on the same stalk or in the same spike, in one word, on the same axis, present sporangia of two kinds, some containing very small spores destined to produce antheridia and to perform the function of fecundating organs, and the others larger spores, which will germinate after being fecundated. These two kinds of organs, which cooperate in reproduction, have been designated by the names of *microspores* and *macrospores*.

Nothing in the specimens described either by R. Brown or by Dr. J. Hooker would indicate this double nature of the sporangia or of the spores; but a very complete and generally well-preserved specimen of a spike identical in its upper part with the *Triplosporites* of R. Brown has just thrown a new light upon this subject, and shown in these fossils modifications analogous to those which we observe in the living Lycopodiaceæ.

This remarkable specimen was found in a drift deposit at the entrance of the valley of Volpe, in the Haute-Garonne, by M. Dabadie; it was communicated to me by M. Lartet, to whom it had been confided by M. Dabadie; and the author of this interesting discovery has been kind enough to allow me to have it sawn through its long diameter, and to retain one-half for the museum. This specimen, which was carefully modelled before being cut through, is entirely silicified: the organization of the various parts is well preserved in many points; nevertheless its anfractuosities and crystallized portions do not allow it to be examined equally well in all parts.

It presents the form of a cylindrical cone or strobile, 0·12 metre in length and 0·055 metre in breadth, showing on the outside the apices of the scales of which it is composed; these form twenty-seven perfectly regular longitudinal rows, and are arranged in accordance with a very much flattened helix, the generative spiral of which would be expressed by the fraction $\frac{2}{27}$, an arrangement which approaches that observed in the leaves of many living Lycopodiaceæ*.

The scales or bracts which form this spike spring perpendicularly from the axis, and are even a little reflexed; they have exactly the organization so well described by R. Brown in his *Triplosporites*, and to which it seems to me useless to revert; as in his specimen they are bent up towards the extremity and terminated at the surface of the fossil by an hexagonal disk, which would, as in *Lepidostrobus*, be produced into a foliaceous appendage, which has been destroyed.

Upon the narrow pedicels of these scales are inserted oblong sporangia, rounded at the extremity as in *Triplosporites*; those which occupy the apex and middle part of the spike are filled with an innumerable multitude of little spores, formed by three or sometimes four united spherical cells, apparently separating in some cases into simple globular spores.

In the lower third of the same spike we observe sporangia similar in form and mode of insertion to the preceding, but distinguished at once by their large, simple, spherical spores, the diameter of which is ten or twelve times that of the cells of which the little spores are composed. They are very distinct to the naked eye, their diameter being 0·6 millim., and enable the sporangia to be at once distinguished from those containing the microspores.

These large and perfectly spherical spores have a thick smooth wall; they most frequently contain scattered globular granules, the nature of which is difficult to determine, but which appear to be connected with a state of immaturity; some, filled with an opaque matter, seem to be more advanced in their development.

This spike, therefore, like those of the Lycopodiaceæ of the genera *Isoëtes* and *Selaginella*, presents sporangia of two kinds:—those near the summit of the spike containing microspores, that is to say, antheridia; the others, situated towards the base of the spike, containing macrospores or germinative spores.

The form and mode of insertion of the sporangia, their great size, the considerable number of macrospores which they contain, and the absence of any trace of a regular line of dehiscence cause these organs especially to resemble those of *Isoëtes*; but in the latter these sporangia are inserted upon the very base of the leaves, which spring from a very short and bulbiform stem. In the fossil plant, on the contrary, these sporangia are borne by a kind of bracts or squamiform leaves united into a

* I have indicated this mode of arrangement of the leaves of Lycopodiaceæ in the 'Histoire des Végétaux fossiles,' tome ii. p. 11.

spike, which, probably, like those of *Selaginella*, terminated the branches. Here, therefore, we have a peculiar combination of characters, namely, sporangia analogous to those of *Isoëtes* united into a spike similar to that of the Lycopodiaceæ, but much larger.

The great size of these organs is, in fact, one of the striking characters of these spikes; it is in proportion to the arborescent stature of the *Lepidodendra*, compared with that of the living Lycopodiaceæ, but it is none the less remarkable, for most commonly the organs of reproduction do not follow the growth of the vegetative organs: the largest tree ferns have sporangia no larger than the smallest species, just as the flowers of our largest trees are often even smaller than those of the humblest herbaceous plant. In these plants of the primitive world growth was simultaneous in both systems of organs.

Thus the *Lepidodendreæ*, or arborescent Lycopodiaceæ, had spikes of fructification comparable in size to the cones of firs and cedars, and containing very voluminous sporangia, even larger than those of *Isoëtes*, which they approach in form and structure.

A final question remains to be solved. Have the true *Lepidodendra*, the fruits of which, or *Lepidostrobi*, were investigated by Dr. J. Hooker, only a single kind of spores? or did the imperfect state of his specimens prevent the recognition of the nature of the spores contained in the sporangia of the lower part of the spikes of fructification? The form of the spores of these *Lepidostrobi*, which is quite different from that of the microspores of *Triplosporites*, would lead me to think that these plants are not congeneric, and that the genus *Triplosporites* of Robert Brown should be maintained.

The three known specimens of this plant do not establish its real geological position; the origin of that described by R. Brown, and of that of the Strasbourg Museum, is entirely unknown; the one that I have just described was found in the transported material of a valley in the Pyrenees, far from the beds in which it must have been originally deposited; nevertheless we cannot doubt, from the nature of the plants which it most nearly approaches, that it belongs to some bed contemporaneous with the Carboniferous or Old Red Sandstone formation.

Robert Brown in his memoir has given no specific name to the plant which he described; but the confirmation of its generic value, and the probability that we shall find other forms of the same genus, induce me to consecrate the memory of his excellent observations by designating this species by the name of *Triplosporites Brownii*.

I must remark in conclusion that the very perfect specimen that I have just described probably represents a spike of fructification which had not reached its last degree of development. Two facts seem to indicate this: 1, the microspores, in nearly all the sporangia which contain them, are immersed in the midst of a granular opaque matter, in which they show by transparency, and which has the appearance of the cellular plasma that surrounds these organs before their maturity; and, 2, the vessels, which form very distinct bundles in the axis of the cone, only present transverse striæ or scarcely distinct rings, and not the strongly marked streaks of adult scalariform vessels.

This want of maturity has perhaps been favourable to the integrity of these fossils; but it is possible, and even probable, that the microspores and macrospores, when their development is complete, would present some differences which must not be regarded as arising from a really distinct organization. Some of the spores composing the triple microspore already appear disposed to become isolated, and would probably acquire the trigonal form indicated by J. Hooker for the spores of *Lepidostrobus*. Some of the macrospores also seem to present in their interior a more complex organization, which would indicate a tendency towards the form with a trigonal apex of the macrospores of *Isoëtes*.

Fresh specimens, even mere fragments, but at a different degree of development, will perhaps hereafter complete our knowledge of this subject; but from this day forth the existence of these gigantic Lycopodiaceæ, showing a still more complete relationship to certain existing forms of this family, is established indubitably.

BIBLIOGRAPHICAL NOTICE.

Observationes circa Pezizas Fenniæ. Scripsit William Nylander. Accedunt tabulæ II. lithographicæ.

The above treatise has been called forth by the work of Karsten entitled 'Expositio Pezizarum sibi cognitarum Fenniæ,' concerning which Prof. Nylander observes that the characters given are, for the most part, mere transcripts of those of Fries in the 'Systema Mycologicum,' with the addition of some occasional and vague remarks on the fruit. The author considers M. Karsten to have neglected the means he had at his disposal of verifying the species he describes, in not consulting collections of published specimens, such as those of Mougeot, Desmazière, and Rabenhorst, and states that he has himself acquired a more accurate knowledge of the subject from studying the specimens contained in the Museum of the Society for the elucidation of the Fauna and Flora of Finland than from the work of Karsten, which, however, has had the effect of leading him to a careful examination of those species. He remarks that it is of much importance to science generally, as well as to the Finnish flora, that everything vague and uncertain should be eliminated, and more clearly defined notions acquired. Dr. Nylander considers the genus *Peziza* to have been more neglected than other genera of fungi, owing particularly to the difficulty of determining species, from the loose and unsatisfactory way in which they have been hitherto described.

The only existing monograph is that contained in the second volume of Fries's 'Systema Mycologicum,' where all microscopic analysis is omitted. Other difficulties arise from the rarity of many of the species, some occurring only in particular years and seasons, others in places difficult of access, many of their more marked characters being also lost in the process of drying for the herbarium. Hence arises, says the Professor, a necessity for more satisfactory definitions than at present exist, to enable the student to recognize the plants he meets with; and he hopes that the treatise under consideration may furnish descriptions which will aid the inquirer in overcoming the difficulties inherent in the subject, so far as the species contained in the 'Observationes' are concerned. After stating the number of species contained in Karsten's Synopsis to be 100, viz. 92 *Pezizæ* and 8 *Ascoboli*, several of which are not present in the Finland Museum, he notices some which are given by Karsten under wrong names, and adds others, from the collection in the Museum, omitted by that writer, giving figures of a few of the sporidia.

The chief value of Dr. Nylander's work consists in accurate measurements of the fruit of each species, with notes of the forms of the asci and paraphyses, and the appearances they present when treated with iodine. He also gives a few synonyms, remarking on the difficulty attending this part of the subject from the cursory way in which names have been assigned to the various forms, and shows the detriment arising to science from characters carelessly and loosely drawn up, and unaccompanied by minute analysis, and, on the other hand, the great value of clear and exact definitions of the various types. The Professor divides his materials into two grand series—the first containing the larger terrestrial species (*Aleuria*, Fries), the second the intermediate and minute forms. His first series is subdivided into such as have cylindrical asci with simple, elliptic fruit, showing no reaction under iodine, and others having globose fruit. Then follow those whose asci turn blue with iodine, which also present two sections, characterized by the form of their fruit. To these succeed the moderate-sized and minute kinds, subdivided into those having simple curved fruit (*Encœlia* and *Dermatia*, Fries), and others with elliptic sporidia and cups either naked or setose and sessile (*Humaria*, Fries); a third section follows, with spherical or subglobose fruit; to these succeed such as have pilose or villous cups and oblong or fusiform sporidia (*Lachnea*, Fries), first with stipitate and next with sessile cups; then come those species which arise from a subiculum or mycelioid stratum, divided into those with smooth cups and a flat disk (many of the *Helotia* of Fries), first, with distinctly stipitate, and, secondly, with shortly stalked cups; those with convex apothecia follow (*Helotia*, Persoon and Fries), then those with sessile, flat, or concave cups (*Mollisia*, Fries), and either seated on a subiculum or free, subdivided into those with furfuraceous (*Lachnea*, Fries) and those with smooth apothecia; they are either brightly coloured or hyaline (*Orbilia* and *Calloria*, Fries) and have paraphyses with claviform tips, or pallid and blackish, with simple fruit (*Mollisia*, Fries), or, again, have firm lichenoid cups and, frequently, septate fruit (*Patellea* and *Patellaria*, Fries).

Such is, in a few words, the nature of the sections and subsections which the learned author adopts. Experience alone, perhaps, will show whether his system will prove easier to the student than that of Fries: at first sight it certainly appears so; at all events there can be no doubt of the value of his concise and lucid descriptions of species and accurate measurements of the fruit. His aim has been to give, in as few words as possible, such characters as will enable the student to determine the specimen before him, avoiding, on the one hand, the vagueness of the older writers, and, on the other, the diffuseness and prolixity of later authors. It is to be regretted that there is no scale of measurements common to the scientific world; for the trouble of rendering in every instance fractions of French into those of English measures is so great as to render the work under discussion far less useful to an English botanist than it might otherwise have been. The dimensions of the fruit given by Dr. Nylander accord generally with those given by Messrs. Berkeley and Broome in the 'Annals of Natural History.' In a few cases, however, he appears to have different things in view: for instance, *Peziza brunnea*, A. & S., is described with spherical fruit; Corda, quoted by Dr. Nylander, in Sturm's 'Deutschland's Flora,' iii. ii. p. 68, t. 28, figures it as elliptic, and says "die Sporen sind eyförmig," &c.; so that the plant of Nylander must be different both from Corda's and also from that of Desmazière (Cr. Fr. ed. 1. 1312). The figure of Albertini and Schweinitz is also very unlike that of Corda.

Peziza asperior, Nyl., comes near to *Peziza trechispora*, B. & Br.; but the sporidia are "globose or subglobose;" in fig. 2 they are globose.

Peziza polytrichi, Schum. Dr. Nylander has evidently a different thing in view from the plant of the 'Annals of Natural History' for May and June 1854, No. 768, which is referred to *P. humosa*, Fr., in the 'Annals' for August 1866.

P. leucoloma, Hedw., is also said to have globose sporidia: in the plant of 'Engl. Flo.' they are bluntly elliptic. Nylander's plant would seem therefore to be distinct.

P. alboviolascens, A. & G.—The Professor remarks, in a note, p. 28, "Thecas sporas continentes ei nondum in speciminibus Anglicis, Gallicis, et Germanicis quæ examinare licuit inveni." It has always appeared to us that this plant is a *Cyphella*; and we believe it to be identical with *C. Curreyi*, B. & Br.

Peziza subferruginea, Nyl. = *P. araneosa*, Sow.—Whatever Bulliard's plant may be, it cannot be identical with Sowerby's, as it agrees with it neither in characters nor in its place of growth.

Peziza geminella, Nyl., is remarkable for its 2-spored asci.

Peziza macrospora (Bagl.), Nyl. p. 66, seems to come very near to *Patellaria proxima*, B. & Br., the fruit corresponding closely.

Thirty-one new species of the genus *Peziza* are described, viz.:—*P. caligata*, Nyl.; *P. fluctuans*, Nyl. = *P. perlata*, Karsten; *P. furva*, Nyl.; *P. canina*, Karsten; *P. luteo-pallens*, Nyl.; *P. articulata*, Karsten; *P. fulvescens*, Nyl.; *P. asperior*, Nyl.; *P. improvisa*, Karsten; *P. juncifida*, Nyl.; *P. æruginella*, Karsten; *P. æruginascens*, Nyl. = *P. æruginosa* auctorum; *P. subferruginea*, Nyl.; *P. subspadicea*, Nyl.; *P. alniella*, Nyl.; *P. geminella*, Nyl.; *P. eucrita*, Karsten; *P. aureliella*, Nyl.; *P. subfurfuracea*, Nyl.; *P. hymeniophila*, Karsten; *P. luteo-rubella*, Nyl.; *P. rubinella*, Nyl.; *P. hyalinula*, Nyl.; *P. epipora*, Nyl.; *P. pteridina*, Nyl. = *P. pteridis*, Karsten; *P. lividula*, Nyl.; *P. atratula*, Nyl. = *P. atrata*, Fr.; *P. subcrenulata*, Nyl.; *P. amphibola* (Mass.), Hepp; *P. macrospora*, Bagl.; *P. variella*, Nyl.

Dr. Nylander describes some other fungi which come near the *Patellaria*-section of *Peziza*, hitherto only distinguished generically with difficulty, and gives characters, derived from the fruit, tending greatly to remove that objection, if they hold good throughout. The genus *Tympanis*, he observes, is characterized by dimorphism in the asci, the same apothecia containing asci filled with innumerable minute, curved sporidia, and others occupied by a few (eight to twenty-four) larger ones. A similar fact occurs, however, in certain *Nectriæ*, as *N. cucurbitula*, Fr. and *N. inaurata*, B. & Br. M. Tulasne considers (Carpologia, iii. p. 87) *N. aquifolia*, B., and *N. inaurata*, B. & Br., to belong to one species; but it seems to us that the differences in the fruit, as well as in the perithecia, are amply sufficient to pronounce them distinct. *N. cucurbitula*, Fr., would appear to come much closer to *N. inaurata*, B. & Br., than would *N. aquifolia*, B. Dr. Nylander traced both forms of asci from an early stage to maturity, without perceiving any tendency in the minute curved bodies to unite and so form the larger kind of fruit, as De Notaris seemed to think, but each maintained its own form to the last. He also found spermagonia with spermatia. A fourth form of fruit occurred to Messrs. Berkeley and Broome in the case of *Tympanis saligna*, an account of which was published in Hooker's 'Journal of Botany,' 1851, vol. iii. p. 319, where fruit was found like that of *Diplodia*, unless it was founded on incorrect observation, as is suggested by M. Tulasne in the third vol. of his 'Carpologia,' p. 154.

The following new species of *Tympanis* are described:—*Tympanis confusa*, Nyl. = *Patellaria atrata*, Fr.; *T. spermatiospora*, Nyl.; *T. amphiboloides*, Nyl., and v. *hypopodiza*, Nyl.; *T. hypopodia*, Nyl.

The author has pursued the same method in his exposition of the *Pezizæ* of Finland as in his 'Lichenographia,' expressing in as few words as possible the essential characters of every species. He considers that each part of their structure should be taken into account, with especial regard to their mutual differences, but that our knowledge of the *Pezizæ* is too limited at present to enable us to make use of the spermagonia as a means of systematic arrangement, a few scattered observations not sufficing to that end. He observes, however, that in cases of doubtful affinity an acquaintance with these bodies is of great value. The chief aim in descriptions should be that the various types may be easily distinguished, falling at once into their proper places.

A synoptic table of the Finnish *Pezizæ* follows, demonstrating the care taken by the author to render his treatise as complete and useful to the student as possible. Notices of a few species of *Ascobolus* are also added. This genus, he observes, differs but little from *Peziza*, the characters relied on as essential not being constant. Dr. Nylander proposes others, such as the fuscous-violet colour of the mature sporidia, and a peculiar reaction under iodine not apparent in *Peziza*, those bodies in *Ascobolus* assuming a more intense violet, whilst the asci turn pale blue, as in certain species of the former genus. The character of clavate or cylindrical asci he considers of little value, both forms often occurring in the same specimen, as the sporidia happen to form one or two rows—a remark in which we are disposed to concur. The distinct operculum of the asci is only found in a few species, and therefore not to be relied on. Only three species appear to be represented in the Finnish Museum, —*A. furfuraceus*, P., *A. glaber*, P., and *A. immersus*, P. In a note under *A. glaber*, P., he corrects the error of Coemans, who has cited *A. Kerverni*, Crouan, under that name. *Ascobolus macrosporus*, Crouan, is quoted as a synonym of *A. immersus*, P., which it does not much resemble so far as Persoon's figure is concerned, answering better to the description. Fries's characters of *A. porphyrosporus*, Fr., would induce us to bring it under the same species. We have no means of comparing *A. rufopallidus*, Karsten, with *A. vinosus*, B., nor his *A. lapponicus* with *A. glaber*, P., as given by Rabenh. (F. E. exsicc. No. 778), nor *A. difformis*, Karsten, with *A. testaceus*, B. & Br.; but it is not improbable that they are synonymous. *A. carneus*, P., according to Finnish specimens, has larger fruit than *A. granuliformis*, Crouan, to which species we have been hitherto disposed to refer it.

Notes on a few Sphæriacei are given in an Appendix. *Sphæria mammata*, Wahl. = *Sphæria* (*Hypoxylon*) *multiformis*, Fr. *S. duplicella*, Nyl., is new. *S. vicinula*, Nyl., and *S. pruniformis*, Nyl., *S. sorbina*, Nyl., and *S. dacrymycella*, Nyl., have been published in the 'Flora.'

A full index of species, varieties, and synonyms completes the work.

In concluding our notice of Prof. Nylander's treatise we will only add that it is a record of observations quite essential to every botanist who wishes to study the genus *Peziza*, containing also numerous remarks bearing on the proper method to be pursued in investigating natural history in general; and as such we would recommend it strongly to all who are interested in that study.

MISCELLANEOUS.

On the Generic Name Alcyoncellum, *and in reply to Dr. Gray's "Observations on Sponges and on their Arrangement and Nomenclature," 'Annals and Magazine of Natural History,' March* 1868. By Dr. J. S. Bowerbank, F.R.S., F.Z.S., &c.

I quite agree with Dr. Gray that there is considerable confusion in the early descriptions of *Alcyoncellum* as a genus. Messrs. Quoy and Gaimard, although they copy De Blainville's description of the calcareous specimen, apparently in a very careless manner, evidently had their own siliceous one in their minds as the type of the genus, the heading to which is *Alcyoncellum speciosum*, nob.; and if we accept their specimen as the type of their *Alcyoncellum*, there is no reason why it should not maintain its position. On the contrary, there are very cogent reasons why the calcareous type of the 'Manuel d'Actinologie' should not be accepted as the type of the genus *Alcyoncellum*. On the first occasion of my referring to pl. 92. fig. 5, I concluded that the specimen represented was in reality a *Grantia*, from the central cloacal cavity, its radiating cells, and its triradiate calcareous spicula; but I did not urge these points at that time, as there did not then appear any likelihood of referring to sponges which could be mutually agreed upon as satisfactory specimens of De Blainville's calcareous type of the genus. This difficulty has been overcome. On the occasion of my last visit to the British Museum, Dr. Gray showed me a box containing a considerable quantity of what he termed *Alcyoncellum gelatinosum*; and subsequently, on my writing to him, he kindly sent me a small specimen of the sponge, a portion of which I immediately mounted in Canada balsam and found it to be identical in structure with similar branched calcareous sponges that I obtained many years since from the mouth of the Murray River, Australia, and of which I had mounted portions shortly after I had received them. I find the sponge registered thus:—"*Grantia virgultosa*, Bowk. MS. From Fremantle, Australia, by Mr. G. Clifton, and also from Murray River, by Ray." 1856. On comparing the specimens mounted from the sponges from the above localities with those from Dr. Gray's specimen, they appear in every respect identical, and they agree perfectly with the figures in plate 92. fig. 5 in the 'Manuel d'Actinologie.' Having thus determined this important preliminary part of the question, let us now see what pretensions the calcareous type of the genus has to maintain its position in the scientific arrangement of the Spongiadæ.

The genus *Grantia* was published in Fleming's 'British Animals,' p. 524, in the year 1828.

The 'Manuel d'Actinologie' bears the date, on the titlepage, of 1834; and there is a notice, in p. viii of the introduction, stating that its production extended through the time between the years 1830 and 1834. The article "Zoophyte," it is stated by Dr. Gray, was "published in the 'Dictionnaire des Sciences Naturelles,' vol. ix., and bears date 1830." We have therefore two years precedence of the genus *Grantia*, to which the specimen of calcareous sponge which is the type of *Alcyoncellum gelatinosum* of the 'Manuel d'Actinologie' decidedly belongs; and unless it be determined that genera founded on manifest errors are, rightly or wrongly, to maintain their places in science, the calcareous type of the genus in question must give place to the siliceous one of Quoy and Gaimard.

The same course of argument applies to the genus *Euplectella*, also founded in error, as any one who will refer to the original paper descriptive of the type specimen, in the 'Transactions of the Zoological Society,' vol. iii. p. 203, will plainly see.

It would lead to inextricable confusion of dates if we were to accept as the date of a work the year in which it was said to have been commenced. The criterion of date is that on the titlepage; and this is the only one that we can accept as the date of a genus first published in a volume—or, in the case of a paper, that on which it was publicly read in an established Society.

I take this opportunity of replying to some assertions made by Dr. Gray, in his paper "Observations on Sponges and on their Arrangement and Nomenclature," published in the 'Annals' for March 1868. On page 167 he states, "It is to be observed that though I have Dr. Bowerbank's own authority for regarding *MacAndrewia azorica* as identical with *Dactylocalyx Prattii*," &c. I distinctly deny having ever, in writing or orally, given Dr. Gray to understand that I for a moment considered his *MacAndrewia* and my *Dactylocalyx Prattii* as being the same species; and the remainder of the paragraph, of which I have quoted the first portion, certainly does not in any way prove Dr. Gray's very erroneous assertion. Again, in page 168, Dr. Gray says, "I have Dr. Bowerbank's authority for considering the latter [*D. Prattii*] a synonym of *M. azorica*, he, when examining the specimens in the British Museum, having brought to me, as a good example of his *Dactylocalyx Prattii*, the specimen I described and figured, not recognizing it as the sponge to which he had already given two other names (I believe the Indian habitat is a mistake); so that this sponge has been referred to two genera and regarded as three species by Dr. Bowerbank." The assertions of Dr. Gray in the above quotation are just as unfounded as the first one. Long before the interview alluded to by Dr. Gray, I was too well acquainted with the structural characters of both his *MacAndrewia* and my *Dactylocalyx Prattii* to allow me for one moment to consider them otherwise than as distinct species, having carefully examined the structures of both specimens, and having the results of my examinations mounted in Canada balsam, long before the interview with Dr. Gray at the British Museum, the examination of the Doctor's *MacAndrewia azorica* having been effected in 1860, very shortly after the publication of the species in the 'Proceedings of the Zoological Society.' The only reference that was made to the two specimens was, that I pointed out to Dr. Gray that the specimen of his *MacAndrewia azorica* was in as perfect a state of preservation as my *Dactylocalyx Prattii*; but I never for one moment inferred that they were the same species. How Dr. Gray could have fallen into such misapprehensions I cannot possibly imagine. As to the locality of *D. Prattii*, I can only say that the sponge was presented to me by my friend the late Mr. S. P. Pratt, with a drawer full of other sponges; and when I called his attention to the specimen, and wished to know its locality, he told me the whole of them were sent to him by his son from the East Indies, where he then held a high official appointment. I may also state that among the siliceo-fibrous sponges in the gallery of the British Museum there is a specimen labelled "Siliceous Sponge from Formosa, by Swinhoe, 65. 12. 15." It is in a fine state of preservation, and is undoubtedly the same species as the type specimen of *D. Prattii*, agreeing with that sponge in all its structural characters.

Dr. Gray accounts for some of my supposed errors by stating that "I suspect that these errors arose from Dr. Bowerbank's habit of working from microscopic preparations often made by his friends Mr. Tyler and Mr. Lee, as well as by himself, from fragments which they obtained from various collections, under different names, without Dr. Bowerbank taking the trouble to compare the specimens from which they were obtained." This mode of accounting for my supposed sins of omission and commission is very benevolent and very ingenious of the learned Doctor; only it does not happen to be true. I have never figured a single specimen that has been prepared or mounted by either my friend Capt. Tyler or Mr. Lee. The former I have freely supplied with specimens to mount for his own information; and I had not the pleasure of knowing the latter gentleman until some years after the publication of my papers on the Anatomy and Physiology of the Spongiadæ in the 'Transactions of the Royal Society.' All my figured specimens, excepting two or three, are from sponges in my own possession or in the cabinets of public institutions, and have been mounted by myself.

I will not follow Dr. Gray through numerous other hasty assertions; but there is one in page 172 which it may be as well to note. The author writes, "Both Geodiadæ and Spongilladæ are well defined recognized groups: the latter lives only in fresh water, and is green, all other sponges being marine and *never green*." Has the Doctor really never seen specimens of our commonest British sponge, *Halichondria panicea*, growing on the rocks between high- and low-water mark, and often of a deep green colour, and varying from that through every shade of green to yellow? Numerous Australian sponges are also decidedly green-coloured in their living state.

There is an amusing inconsistency in the learned Doctor's style of criticism. He blames Prof. Thomson for having concocted a new method of arrangement and new names, having only a book-knowledge of his subject, forgetting that he himself formed his own new system of arranging the Spongiadæ principally from having cut up the plates of the copy of the 'British Sponges' which I had presented to him, and rearranged the figures in them to suit his own fancy, without having seen a single living or dead specimen of the sponges the names of which he quotes; and, in consequence of this mode of proceeding, he has fallen into a series of errors, many of which I have pointed out in my "Notes on the Arrangement of Sponges, &c." in the 'Proceedings of the Zoological Society' for February, 1868, but which are too numerous to reiterate on the present occasion.

Burrowing Annelids.

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

Gentlemen,—In Dr. W. C. M'Intosh's paper on the boring of certain Annelids, in the 'Annals' for October 1868, p. 276, several Annelids are mentioned as burrowing, although I showed, several years ago, that two of the genera enumerated undoubtedly belong to the subkingdom Mollusca, and two of the Serpulids mentioned never burrow.

The genera *Stoa* and *Spiroglyphus* are provided with a *multispiral* lid, which never is found in any Annelid. I have examined many specimens in spirit, which place it beyond doubt that these two genera belong to the Vermetidæ *.

I hope that this much-read journal will contribute to the exclusion of these two genera from the Annelids.

Abildgaard only states that he got two Serpulids from a surgeon, who extracted them from holes in the "marble rocks" and "chalk stones" below water on St. Croix. As the surgeon, on inquiry, asserted that they did not live in calcareous tubes, Abildgaard called them stone-borers.

I have examined numerous specimens of *Spirobranchus* (*Cymospira*) imbedded in coral, but I have never been able to discover any dissolving power of the Annelid. All specimens have been overgrown by the coral; but it seems that the *Serpula*, in the struggle for existence, is never completely imbedded before its death. Nor have I ever seen, in groups of *Serpulæ*, dissolved parts as in Vermetidæ. I doubt whether any tubiferous Annelid (*Serpula*) can burrow. I may add that Swammerdam (Biblia Naturæ, 1735, vol. i. p. 182, tab. ix. f. 15–17) has given an excellent account of an Annelid burrowing in *Littorina littorea*.

I am, Gentlemen,
Your most obedient Servant,
Dr. O. A. L. Mörch.

Copenhagen, Frederiksborggade,
November 29, 1868.

Contributions to the Fauna of the Gulf-Stream at great depths. By L. F. de Pourtales, Assist. U. S. Coast Survey.

The author introduces his paper, describing the species observed by him, with the following remarks.

The study of the constitution and of the inhabitants of the bottom of the sea is a field of research which has attracted the attention of

* Mörch, "Review of Vermetidæ," Proc. of the Zool. Society of London, 1861; and Journal de Conchyliologie, vols. vii. and viii. 1860, "Notice sur le genre Vermet."

naturalists in comparatively recent times. What Humboldt did with regard to the distribution of life at different heights in the atmosphere was done by Edward Forbes for the different depths of the ocean. The former's diagrams of the zones of vegetation on the slopes of the Andes are considered indispensable in every atlas of physical geography. But what one man could do where his glance embraced miles of country in height and breadth, and where the type of vegetation could frequently be recognized as far as the eye could reach, an investigator, even as zealous as Forbes, could but sketch in broad though happily drawn lines for the marine animals.

Much has been done in this direction since Forbes's death, particularly in England, where dredging has become a favourite occupation of many naturalists; the Scandinavian seas have also been explored with much success, chiefly by the Norwegian naturalists; but much more remains to be done in a field in which the areas to be explored can, as Jeffreys remarks, be reckoned in square degrees, whilst the research extends only over several square yards.

It is particularly in the greater depths, in the so-called abyssal region, that our knowledge is deficient. This is easily understood, since on many coasts the sea is comparatively shoal for a considerable distance from land, and the outfit for deep-sea dredging is beyond the means of all but a few private individuals. Government expeditions are generally fitted out for other duties, and can rarely devote their time to operations occasioning a delay of many hours. Furthermore, owing to the scantiness of the material, the impression generally prevailed, until recently, that animal life was soon reduced to a minimum with an increase of depth, or at least reduced to the lowest forms; so that the incentive of a rich harvest seemed denied to those who would have undertaken such researches.

Excepting the investigations of Dr. Stimpson on the coast of New England, the dredge has been as yet very little used along our shores. The character and constituents of the bottom are, however, pretty well known, thanks to the care of the late Superintendent of the Coast Survey, Professor A. D. Bache, who, during his whole administration of that work, required the hydrographical parties to preserve the specimens brought up by the lead. From eight to nine thousand specimens have thus been accumulated at the coast-survey office, from a region comprised between the shore and the outer edge of the Gulf-stream, and reaching nearly to 1500 fathoms. But of course, aside from the Foraminifera and Diatomaceæ, for the study of which this material has proved of high interest, not much was contributed to our knowledge of the animals of the higher classes, the instrument used being only adapted to procure a small quantity of sand or mud.

The present Superintendent of the Coast Survey, Professor B. Peirce, has lately directed the resumption of the investigations of the Gulf-stream, so successfully inaugurated by his predecessor, but interrupted for several years by the war. Besides observations of the depth, velocity, and direction of that current, and the temperature and density of the water at different depths, the researches will be extended to the fauna of the bottom, of the surface, and of the intervening depths. Not only will an insight be thus obtained into a world scarcely known heretofore, but that knowledge will have a direct bearing on many of the phenomena of that great current. Thus a new light may be thrown on its powers of transportation from shallow to deeper water, or along its bed, on its action in forming deposits in particular localities, or on its possible influence on the growth of coral reefs on its shores.

The first campaign on this plan was organized in 1867, the field of research being in a section between Key West and Havana, incidentally with the purpose of sounding out the line for the telegraph-cable, shortly afterwards laid between these two points. The Coast-Survey steamer 'Corwin' was assigned to the work; and here I wish to express my thanks to my colleague, Assistant H. Mitchell, charged with the physical part of the campaign, and to Captain Platt and his officers for the interest they showed in my work, and for their valuable practical aid.

The expedition was unfortunately interrupted by the breaking out of yellow fever on board; so that the dredgings were few in number. However, short as the season's work was, and few as were the casts of the dredge, the highly interesting fact was disclosed, that *animal life exists at great depths, in as great diversity and as great abundance as in shallow water.*

The identifications of the species have been made by me at the Museum of Comparative Zoology at Cambridge, in the rich collections of which I have found abundant material for comparison; facilities of every sort were afforded me by Professor Agassiz, for which I wish to express my heartfelt thanks, as also for this opportunity of prompt publication.

The first dredgings were made on May 17th, on the Florida side of the Gulf-stream, about five miles S.S.W. of Sand Key, in depths varying from 90 to 100 fathoms, on a bottom of calcareous mud. The following list comprises the animals obtained:—

Articulates.—A number of small Crustacea were brought up, which have not yet been determined. They belong to the following or allied genera:—*Dromia, Ilia, Mithrax*? (a mutilated specimen), *Pagurus, Euphausia,* and *Orchestia.*

The tubes of several species of Annelids were obtained, but the animals were in most cases too defective for identification. The largest and best-preserved is *Morphysa floridana,* nov. sp. There are also tubes of one or more species of *Serpula.*

The Gephyreans are represented by *Sipunculus corallicola,* Pourt. (Proc. Am. Assoc. 1851).

Mollusks not determined specifically. These are mostly immature specimens or fragments of dead shells, and belong to the following genera:—*Murex* (dead), *Turbo*? (operculum), *Leda* (living), *Astarte* (living), *Tellina* (dead). Of Pteropods dead shells of the following species:—*Hyalea tridentata, Hyalea trispinosa, Cuvieria columella, Cleodora lanceolata.* The shells of this order are very common in deep-sea soundings. The Bryozoa are represented by *Vincularia margaritacea,* nov. sp.

Radiata.—Of Echinoderms were obtained an *Ophiurian* (an arm, undetermined) and a number of specimens of *Comatula Hagenii*, nov. sp.

A *Zoanthus*, rather small, was obtained also, but, not having been noticed when alive, it would be somewhat uncertain to determine.

Hydroids: *Antennularia triseriata*, nov. sp.; *Thoa pulchella*, nov. sp.; *Th. capillaris*, nov. sp.

The Foraminifera had nearly all been washed out of the dredge; only the following were noticed:—*Textularia conica*, D'O. (very large); *Operculina* (*Spirillina*) *incerta*, D'O.; *Rotalina cultrata*, D'O.; and *Globigerina rubra*, D'O.

The total for this locality is therefore twenty-nine species, to which a few ought to be added for the undetermined fragments of Annelids.

No dredgings were had in mid-channel; this part had been reserved for the return trip; but the unfortunate interruption of the cruise prevented the execution of the project, at least for this season.

The next casts were obtained off Havana in 270 fathoms, on May 24th and 29th, on both days as nearly as possible on the same spot, as the little that was obtained at the first date had given much promise.

The results of the two casts are combined below:—

Articulates.—The Crustacea are not determined, but are of or near the following genera:—*Stenopus, Axia, Callianassa, Orchestia*, and *Idotea*, all living. Annelids: *Marphysa tibiana*, n. sp., and *M. antipathum*, n. sp. Tubes and fragments of four or five other species.

Of the *Mollusks* the Gasteropods and Acephala have not yet been determined, with one exception.

The following genera are represented:—*Mitra*?, *Fusus, Turbo, Emarginulina, Dentalium, Nucula*, and *Spondylus*, all dead; *Pedicularia decussata*, Gould, and a very small *Anomia*, both living. The Pteropods and Heteropods were all dead; they are:—*Hyalea trispinosa, affinis*, D'Orb., *gibbosa*, Rang, and *uncinata*, Rang; *Creseis spinifera*, Rang; *Cleodora pyramidata*, Pér. & Les.; *Spirialis rostrata*, Eyd. & Soul.; and *Atlanta Peronii*, Les. Of Brachiopods we obtained *Terebratula cubensis*, n. sp., and *Terebratulina Cailleti*, Crosse; both living and apparently abundant. The Bryozoa are:—*Farcimia cereus*, n. sp.; *Vincularia margaritacea*, n. sp.; *Cellepora reticulata*, n. sp.; *C. sigillata*, n. sp.; *Canda retiformis*, n. sp.; *Canda cornigera*, n. sp.; *Idmonea flexuosa*, n. sp.

Radiata.—Echinoderms are represented by the following species:—*Spatangus* (dead, fragments); *Fibularia* (dead); *Cidaris annulosa*, Gray (probably, young, living); *Tripneustes ventricosus* (living, very young); *Asterias*, sp. (very young, living); *Ophiurians*, at least three species immature and difficult to determine; *Comatula brevipinna*, n. sp., living; *Pentacrinus*, sp. (fragments of stem, among which some appear quite fresh).

Of Zoantharia the following were brought up:—*Antipathes humilis*, n. sp.; *Antipathes filix*, n. sp.; *Acanthogorgia aspera*, n. sp.; *Gorgonia exserta*, Ellis; *Swiftia exserta*, Duch. & Mich.; *Hyalonema* (spicules); *Caryophyllia formosa*, n. sp.; *Deltocyathus Agassizii*,

n. sp.; *Stylaster complanatus*, n. sp.; *Errina glabra*, n. sp.; *Errina cochleata*, n. sp.; *Crypthelia Peircei*, n. sp.; *Distichopora sulcata*, n. sp.; *Heliopora? tubulata*, n. sp.; *Heliopora? carinata*, n. sp.; *Isis?* (base of stem); *Sarcodictyon rugosum*, n. sp.

Hydroids: *Thoa pulchella*, n. sp.; *Tubularia crinis*, n. sp. Foraminifera: *Lagena striata*, Mont., rare; *Nodosaria pyrula*, D'O., rare; *Dentalina communis*, D'O., rare; *D.* (*agglutinans?*); *Lingulina carinata*, D'O.; *Textularia trochus*, D'O., common, very large, also abundant in shoaler water; *T. agglutinans*, D'O., rare; *Nonionina scapha*, rare; *Nonionina umbilicatula*, Montg., rare; *Cristellaria crepidula*, F. & M., rather common; *Orbiculina adunca*, D'O., rare and only in a worn state; its proper habitat is in the littoral zone; *Amphistegina gibbosa*, D'O., rare, and only young specimens; it is very common throughout the Gulf of Mexico in deep water; *Globigerina rubra*, D'O., very abundant, also in the *Orbulina* form; *Gl. Dutertrei*, D'O., common; *Pullenia obliquiloculata*, P. & J., rather common; *Pullenia coarctata*, n. sp., rather common; *Sphæroidina dehiscens*, P. & J., not common; *Rotalina cultrata*, D'O., very common; *Rot. truncatulinoides*, D'O., common; *Rot. Poeyi*, D'O., rather common; *Rotalina*, two other species in single and imperfect specimens; *Biloculina*, sp.; *Triloculina Brongniartiana*, D'O., rare; *Quinqueloculina bicostata*, D'O., rare.

Many of the specimens of Foraminifera are filled up with a yellow mass, like the first stage of transformation into greensand; but the process seems to stop here.

Of sponges quite a number were obtained, at least a dozen species, which have not yet been determined. Some of the detached spicules are remarkable for their size—one, for instance, of the slender rectangulated sexradiate type of Bowerbank measuring more than half an inch.

The vegetable kingdom was represented in this dredging by a single specimen of a minute alga, *Centroceras clavulatum*, Agardh, which Harvey says was found abundantly at low-water mark at Key West. In its branchlets was entangled a chain of a species of *Biddulphia*. Other Diatoms are rather scarce and have not yet been determined. We therefore find here, also, a confirmation of the remark made in European seas, that vegetable life does not extend to depths as great as are reached by animals, and that, therefore, the greater number of deep-sea animals must be carnivorous.

The dredge contained also a number of nodules of a very porous limestone, similar in colour and texture to the limestone forming the range of low hills along the shore of Cuba, but composed apparently of the remains of the same animals which were found living. Thus our *Deltocyathus*, *Caryophyllia*, the various Pteropods were recognized in the stone, and found also in various stages of fossilization. The interstices between the larger forms are generally filled up with Foraminifera.

On May 25th the dredge was sent down in 350 fathoms, outside of the locality occupied on the 24th and 29th. It brought up only a few dead corals—*Caryophyllia formosa*, *Deltocyathus Agassizii*, *Diplohelia profunda*, the latter in numerous specimens,—also a fragment of the siliceous skeleton of a sponge, forming a regular network somewhat like that of *Euplectella* as figured by Bowerbank, but lacking the spines.

The soundings made during the cruise seem to indicate a kind of submarine terrace, on which the dredgings of the 24th and 29th were made. The cast of the 25th was probably made on the edge of it; and the dredge no doubt touched bottom only for a short time, after which the ship drifted off into water too deep for the line attached.—*Silliman's American Journal,* November 1868.

Deep-sea Dredgings in the region of the Gulf-Stream. By L. F. de Pourtales.

I sent you a few days ago a small pamphlet * containing some of the results of the deep-sea dredgings made by me in connexion with the exploration of the Gulf-stream by the Coast Survey. If you think it worthy of notice in the 'Journal of Science,' I have thought it would add to the interest to mention the much more complete results of this year's campaign, which were the subject of a brief communication I made to the late meeting of the National Academy at Northampton. As the specimens have not all been determined as yet, I can give here but a short outline.

The dredgings were made outside of the Florida reef, at the same time as the deep-sea soundings, in lines extending from the reef to a depth of about 400 to 500 fathoms, so as to develop the figure of the bottom, its formation and fauna. Six such lines were sounded out and dredged over, in the space comprised between Sand Key and Coffin's Patches. All of them agree nearly in the following particulars. From the reef to about the hundred-fathom line, four or five miles off, the bottom consists chiefly of broken shells, and very few corals, and is rather barren of life. A second region extends from the neighbourhood of the hundred-fathom line to about 300 fathoms; the slope is very gradual, particularly between 100 and 200 fathoms; the bottom is rocky and is inhabited by quite a rich fauna. The breadth of this band varies from ten to twenty miles. The third region begins between 250 and 350 fathoms, and is the great bed of Foraminifera so widely extended over the bottom of the ocean.

The second region is the most interesting, from the variety of animals inhabiting it. The bottom rock, of which many pieces were brought up, is a limestone, still in progress of formation from the débris of the shells, corals, &c. growing and dying on its surface. In this fauna the vertebrates are only represented by a very few small fishes, and those not deeper than 100 fathoms. But all the branches of invertebrates are represented; I will mention the most characteristic. Of the Mollusks, the most common is *Terebratula cubensis*, mihi, and a new species of *Waldheimia*, both of large size. Of the former, more than a thousand specimens, and several hundred of the latter, were collected. Gasteropods are rarer and mostly small, the largest being the *Voluta junonia*, which was

* The article above noticed.

obtained living several times, and dead frequently. Acephala are rather rare and small, but Bryozoa are abundant. Articulates (Crustacea and Annelids) are well represented. But the great richness of this region lies in the Radiata. Of Echinoderms, the most common is a *Cidaris* (nov. sp.), besides which there are several new species of Echinidæ and very interesting Asteridæ and Ophiuridæ. Holothuriæ are rather rare, except a new *Psolus*. Of corals, I have eighteen new species, belonging principally to the families of Turbinolidæ and Oculinidæ; the Eupsammidæ are also represented by two or three species, the Fungidæ (a true *Fungia*) and the Milleporidæ by one each. The Madreporidæ and Astræidæ are entirely absent. There are also two or three species of *Antipathes*, eight or nine of Gorgonidæ, several of Actinidæ (some of them very abundant), Hydroid polyps, sponges, and Foraminifera. As a general rule, everything is of small size. There are no seaweeds. Some animal remains are found whose presence is accidental, such as sharks' teeth, bills of Cephalopods, shells of Pteropods, &c., which have evidently come from near the surface, and also a considerable number of bones of the manatee, most frequently pieces of ribs; for the occurrence of the latter I am not able to account, as the manatee does not inhabit the open sea, and there are no currents to bring the floating carcasses from its usual haunts in the shallow bays.

From the third region the dredge brought up fewer though no less interesting specimens, the chief of which is a new Crinoid belonging to the genus *Bourgueticrinus* of D'Orbigny; it may even be the species named by him *B. Hotessieri*, which occurs fossil in a recent formation in Guadeloupe, but of which only small pieces of the stem are known. I obtained half a dozen specimens between 230 and 300 fathoms, unfortunately more or less injured by the dredge.

The deepest cast made was in 517 fathoms; it gave a very handsome *Mopsea*, a crab, an Ophiurian, and some annelids.

The difference of the deep-sea faunæ of the opposite coasts of Cuba and Florida is very marked, although the distance is so small; of all the corals, for instance, described by me from the coast of Cuba, only two or three, and those in fragments, were found off the Florida reef.

The descriptions of the new species, with plates, are in preparation, and will be published, by the kindness of Prof. Agassiz, in the next number of the illustrated Catalogue of the Museum of Comparative Zoology of Cambridge.

I am glad, also, to be able to say that Prof. Peirce, Superintendent of the Coast Survey, has directed me to continue these researches during the coming winter.—*Silliman's American Journal*, Nov. 1868.

Zoological Results of Dredgings in the Bay of Biscay. By P. Fischer.

The shore of south-western France inclines in a gentle slope towards the west, and forms a vast submarine terrace, bounded by deeps of more than 200 fathoms. The edge of this terrace, which is very distant from the coast opposite Noirmoutier (between 7° and 8° W. long.), approaches it about the opening of the basin of Arcachon (between 5° and 4° W. long.), and presents itself at a short distance from St. Jean de Luz and Spain. The depth of the terrace at its middle part is from 45 to 60 fathoms, and from 90 to 100 fathoms near its western limit.

I have received a great number of specimens from dredgings and soundings performed on different parts of the terrace; all of them were taken several leagues out to sea (the maximum 36 leagues), and at depths of 40 to 80 fathoms, under the directions of MM. de Folin, A. Lafont, and some captains of ships. Thanks to these supplies, I have been able to determine the species of animals which live at these depths at considerable distances from the coast.

The Mollusca form the majority, and most of them had never been indicated as French, such as *Neæra costellata*, Desh.; *Psammobia costulata*, Turt.; *Lepton nitidum*, Jeffr.; *Leda tenuis*, Phil.; *Arca pectunculoides*, Scacchi; *Lima subauriculata*, Mont.; *Scissurella crispata*, Flem.; *Cyclostrema nitens*, Phil.; *Rissoa soluta*, Forbes; *Eulima bilineata*, Alder; *Mangelia borealis*, Lovén; *Mangelia elegans*, Scacchi, &c.

It was impossible, in fact, to obtain these species along our coasts; in England and Norway they are dredged at a small distance from the shore, and at great depths. The existence of the submarine terrace compels us to seek several leagues out to sea for the deep-sea fauna; hence the apparent poverty of the French coasts.

English authors have remarked that a certain number of quaternary mollusca, or inhabitants of great depths in the Mediterranean, are only met with again in the British seas, without presenting intermediate stations; from this they have concluded that, immediately before the present epoch, and at the close of the tertiary period, the Mediterranean communicated with the ocean by means of an arm traversing Aquitaine and Languedoc. This hypothesis, which is not supported by any geological fact, seeing that the numerous tertiary lacustrine deposits of these countries have never been covered by the sea since their first emergence, is still further invalidated by the result of the dredgings of the littoral terrace, which clearly proves the continuity of *habitat* of the species formerly regarded as localized at such distant points.

Besides Mollusca, the deposits of the terrace contain the *débris* of Echinoderms, such as tests of *Echinocyamus*, spines of *Echinus*, *Spatangus*, and *Amphidetus*, and numerous ossicles of Starfish.

The Bryozoa, with the exception of branches of *Salicornaria*, are adherent to shells; but they live at less depths than 50 fathoms. I have recognized the following species:—*Hippothoa borealis*, D'Orb.; *Hippothoa divaricata*, Lamour.; *Tubulipora serpens*, Linn.; and several species of *Lepralia*, *Cellepora*, and *Discoporella*.

The Foraminifera are rather rare; there are:—*Miliolina bicornis*, Walk.; *Rotalia Beccarii*, Linn.; *Truncatulina lobatula*, Turt.; *Planorbulina vulgaris*, D'Orb., &c.

Lastly, I may cite some tubes of Annelida of the genera *Ditrupa* and *Serpula*.

One of the most curious zoological facts connected with the submarine terrace is the presence of an immense bank of living *Aviculæ* (*Avicula tarentina*, Lamk.), situated 4 leagues out to sea from the opening of the basin of Arcachon, at depths of 40 to 50 fathoms. This bank is prolonged to the south opposite to the light of Mimizan (Landes) and northwards opposite Hourtins (Gironde). Its length is estimated at 25 leagues, and its width at 1 league; it is not perfectly continuous, but is interrupted here and there. The fishermen of Rochelle, whom I have interrogated upon this subject, assert that it is met with again above the mouth of the Gironde, and that it may be traced towards the north-west as far as the rock of Rochebonne across the isle of Ré.

Many fishes approach the bank of *Aviculæ*; the fishermen, therefore, throw in their nets as near to it as possible; but it frequently happens that they lose them or are obliged to draw them in loaded with *Aviculæ*.

The formation of analogous banks is common among the byssiferous Mollusca (*Mytilus*, *Meleagrina*, *Dreissena*); the great strength of the byssus of the *Aviculæ* explains the great cohesion and the extent of their colonies.—*Comptes Rendus*, November 16, 1868, pp. 1004–1006.

Notice of a new and diminutive species of Fossil Horse (Equus parvulus), *from the Tertiary of Nebraska.* By Prof. O. C. Marsh, of Yale College.

In a small collection of fossil vertebrate remains, obtained by the writer during the past summer in the Tertiary deposits of Nebraska, there are several specimens of no little interest, as they indicate a new species of fossil horse, very much smaller than any hitherto known. These remains were collected at Antelope station on the Union Pacific Railroad, about 450 miles west of Omaha, where a few weeks before, during the excavation of a well, they had been thrown out from a depth of sixty-eight feet. This locality has since attained considerable notoriety from the fact that the remains then found were pronounced to be human by those who first examined them, and various accounts of the discovery have been published in the newspapers. This, in fact, induced the writer, when in the vicinity, to examine the locality and its fossils, an account of which he has already given elsewhere*.

The equine remains now to be noticed consist mainly of bones of the limbs; and among them is a hoof-phalanx, a coronary or second phalanx, parts of the first phalanx and metacarpals, as well as some of the smaller carpal and tarsal bones, and fragments apparently from other parts of the skeleton. All are in an excellent state of preservation, and part of them are so characteristic that they clearly indicate the near affinities of the animal to which they belonged.

The ungual or hoof-phalanx differs in form from that of the recent horse only in being somewhat more depressed, and in having

* National Academy of Sciences, Northampton Meeting, Aug. 1868.

the sides of the upper surface slightly less convex transversely, and the beak of the articular face a little less pointed. Its length, measured along the axis, is very nearly one inch; the shorter diameter of the articular face is five lines, and the longer, or transverse, ten lines. The coronary or middle phalanx, is proportionally more elongated than in the living species, and its proximal end rather more triangular. Its length along the axis in front is nine lines, the width of the articular face of the proximal end ten lines, and that of the distal end nine lines. The dimensions of all, or nearly all, of the remaining bones render it very probable that they belonged to the same individual, or at least to one of similar size, and specifically identical. They indicate an equine animal scarcely more than two feet, or possibly two and a half feet in height, although full-grown, as the ossification of the bones clearly proves. Additional parts of the skeleton, especially the teeth, would perhaps show generic characters different from those of the living horse; but in the absence of these, as the remains are evidently distinct from any hitherto described, the species may be named *Equus parvulus*. This makes seventeen species of fossil horses now known to have lived in North America, although until quite recently it was very generally believed that there was none indigenous to the continent.

The bones above described occur in a stratum of grey arenaceous clay, lying nearly horizontally, and apparently of later Tertiary age. The large number of vertebrate remains found together in the space of a few feet indicates a remarkable locality, which, unfortunately, cannot again be reached except by deep excavation; and hence it is greatly to be regretted that so many of the specimens should have been lost to science by being carried away as human relics. Among those secured by the writer, in addition to the equine fossils, were the remains of several species of ruminants, a phalanx of a carnivorous animal about the size of a lynx, and fragments of a land-turtle resembling somewhat the *Testudo neobrarensis*, Leidy, all of which will be more fully described in this Journal at an early day.—*Silliman's American Journal*, November 1868.

Siliceous Spicules in Alcyonoid Corals.

It has been very generally stated that siliceous spicules are only secreted and developed by the Protozoa.

Prof. Möbius, in his description of four new Gorgoniadæ in the Hamburg Museum, published in vol. xxix. of the 'Verhandlungen der Kaiserlichen Leop.-Carol. Akad. der Naturforscher' for 1861, describes *Solanderia verrucosa* as having a "calcareo-cellulose or cork-like axis, and the epiderm with *siliceous* spicules," and at fig. 6. pl. 1 he figures the hyaline "Kieselnadeln" or smooth siliceous spicules, having, as all and only such spicules have, a central canal. Prof. Möbius does not seem to be aware that there was any novelty in this structure. I doubt if *Solanderia verrucosa* is a typical *Solanderia*: it appears to be the same Coral that I described as *Homophyton Gattyiæ* in the Proc. Zool. Soc. 1866, p. 27, f. 2.—J. E. GRAY.

THE ANNALS

AND

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[FOURTH SERIES.]

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XV.—*Observations on the* Thalassicollidæ. By G. C. Wallich, M.D., F.L.S.

The true value and significance of characters derived from the degree of development of the sarcode-body of the Rhizopods, as distinguished from those which are derived from their mineral shells or skeletons, is perhaps nowhere more clearly exemplified than amongst the families which I have associated together in my second Order, namely the Protodermata, which are characterized by the presence of a definite nucleus, but are still not sufficiently differentiated to exhibit the contractile vesicle which appears, for the first time, amongst the Actinophryan and Amœban Rhizopods of the third Order, namely the Proteina*. Thus, viewing their siliceous portions apart from the animal body to which they afford support, it would be difficult to point out structures exhibiting a smaller amount of apparent resemblance; and hence it is hardly a matter for surprise that important differences of opinion should have arisen concerning the true morphological relations of the Polycystina, Thalassicollidæ, and Acanthometrina, which constitute the Rhizopoda Radiolaria of Müller's system. But I hope to be enabled to show that, however widely the mineral framework may differ in the four groups constituting the Protodermata, the uniform development and mode of disposition of the sarcode-mass places their affinity beyond a doubt.

The first accurate series of observations on the Thalassicollidæ was made by Huxley, and formed the subject of an admirable paper contributed to the 'Annals and Magazine of Natural History' in 1851 (2nd ser. vol. viii. p. 433 *et seqq.*). With one or two unimportant exceptions, the

* See a paper "On the Structure and Affinities of the Polycystina," read before the Microscopical Society in May 1865, and published in the August number of the 'Quarterly Journal of Microscopical Science.'

views therein published are those from which our knowledge of the true physiological relations of that family may be said to have been almost exclusively derived. But it is asserting too much to say that the Thalassicollidæ were previously unknown, inasmuch as they are not only amongst the most constant but the most numerous inhabitants of the surface-waters of both tropical and subtropical seas. Every voyager who has traversed such seas must have become familiar with their appearance, as I confess myself to have been for twenty years and more. But so far from detracting from the credit due to Professor Huxley's researches, this fact serves only to increase it. In short it was the difficulty of resolving the nature and relations of the organisms under notice that caused them to be entirely neglected, although they must have been constantly met with by other naturalists.

If we discard as untenable the separation of the isolated forms of *Thalassicolla* from those which are grouped together in a common gelatinous matrix, "like an animal *Palmella*"*, the soft body may be described as a mass of granular protoplasm, presenting a well-defined nucleus and contained within a membranous capsule, the latter being in turn protected by a more or less thick gelatinous exudation, whilst numerous sarcoblasts of varying size occur scattered through the endosarc, and occasionally a few may be seen suspended within the external gelatinous stratum. Again, if we compare those forms in which the siliceous framework is composite (that is to say, in which a number of spicular masses afford the required support by being crowded together, as they do in a Sponge or *Holothuria*) with those in which it is simple and consists of a delicate foraminated shell, we shall find that the relative positions of the hard and soft structures are nevertheless the same, and that the former, when present, invariably occur externally to the membranous capsule, and within the gelatinous investing layer.

Owing to the peculiar configuration of the Thalassicollidæ, and the facilities afforded by the composite forms for comparing a number of individuals under precisely similar conditions, they are admirably adapted for showing whatever changes take place in the protoplasmic substance as the age of the organism increases; for although it is very unusual to find any important difference in the degree of development attained by the various members forming one of the composite Thalassicollidæ, and there is every reason to believe that their growth is uniform, the constant recurrence of certain characters in conjunction with the evidence of immaturity derivable from small size

* Huxley on *Thalassicolla, l. c.* p. 434.

enables us to distinguish sueh characters as are normal from those that are accidental or occasional. In this manner we discern that the degree of granularity of the endosare, the number and situation of the sarcoblasts, the colour of the nuclear body, the density of the membranous ectosarc, and (in *Collosphæra*) the degree of consolidation of the spherical "shell" are one and all subject to a wide range of modification; and hence it follows that any attempt to establish speeies on distinctions arising out of these characters, unless we eould assure ourselves of their having arrived at the same stage in their life-history (a thing which is manifestly impossible), must inevitably lead to misconception.

Thus in specimens of *Sphærozoum punctatum** in which, owing to the small size of the individuals, it is reasonable to infer that mature growth has as yet not been attained, the contents of the membranous capsule appear like a viscid and semitransparent yellow fluid, almost devoid of granular particles. The same is observable in young Acanthometræ, and, as I have elsewhere shown, in the last-formed chambers of the Foraminifera and Polycystina. In like manner the eetosarc is more hyaline, and the shafts of the siliceous spicules (*acanthostypes*), although of their full dimensions as to length, are much more slender than in the adult specimens; whilst in speeimens of *Collosphæra* of nearly full size, but in which the appearanees just described lead to the inference that they are nevertheless immature, the spherical shell becomes corrugated under pressure, instead of being broken up into fragments, thus rendering it highly probable that many of the spinous and tubular growths met with in the shells of that genus may also be dependent on the age of the individual, or varying conditions in the supply of the siliceous material.

These facts appear to me to be of great importance, inasmuch as they are suggestive of the generic unity of *Sphærozoum* and *Collosphæra*, which has already been so strongly indicated by the similarity in the composition and disposition

* The name "*Sphærozoum*" was given by Meyen in 1834 to "a form of agastric animal which he describes as a spherical muco-gelatinous mass, constituted internally of globules, which, again, consist of vesicles" (Quarterly Journal of Microscopical Science, vol. iv. p. 73). Assuming the organism thus portrayed to be identical with the *Thalassicolla punctata* of Huxley, Müller retained the name on the plea of *priority*. The extreme vagueness of Meyen's description, however, renders it equally applicable to *Thalassicolla* and numberless "spherical muco-gelatinous masses" to be met with in abundance in the ocean, but which are certainly not members of the Rhizopodal group. The extension of the law of priority to such cases ought, therefore, to be rigidly *denied*, as holding out a premium to inaccuracy and slovenly investigation.

of the soft parts. Professor Huxley, who regarded them only as "varieties" one of the other, says, with reference to *Thalassicolla punctata*, "It is the connecting-link between the Sponges and the Foraminifera. Allied to the former by its texture, and by the peculiar spicula scattered through the substance of some of its varieties, it is equally connected with the latter by the perforated shell of the other kinds. If it be supposed that a *Thalassicolla* becomes flattened out, and that a deposit takes place not only round the cells, but between the partitions of the central 'vacuole,' it becomes essentially an *Orbitoides*;" whilst in a note from Dr. Carpenter, appended to the above observations, it is stated that "the cullender-like skeleton of certain Foraminifera is extremely like in its appearance to a fragment of the shell of an *Echinus*, or to the plates contained in the integument of a *Holothuria*; and we know that these begin with a network of spicules" *.

Accordingly, though unprepared to allow that the real connecting-link between the Foraminifera and the Sponges is to be found in *Thalassicolla*, or that the modification in form or the superaddition of a deposit as described would render it conformable to the type of any of the Foraminifera—in the first instance, because the mode of siliceous deposit characteristic of the Sponges is not met with in the Thalassicollidæ, but in the Dictyochidæ, as has already been shown by me elsewhere †, and, in the second, because the presence of a nucleus, and the much more highly differentiated condition of the rest of the sarcode-substance, attests the existence of a more advanced type in *Thalassicolla* than in the Foraminifera—there appears to me to be no sufficient reason for the generic separation of the two forms in question.

With reference to the distinction into the simple and composite forms of Thalassicollidæ, suggested by Müller but repudiated by other writers on analogical grounds only, I may mention that isolated free-floating individuals of the *Sphærozoum* and *Collosphæra* type are constantly to be met with; and it is quite evident that these are in a normal condition, and have not been separated from the parent matrix by violence during capture, inasmuch as they are to be found not only as free-floating organisms when the composite masses are apparently altogether absent at the surface of the ocean, but also within

* Huxley on *Thalassicolla*, Annals and Magazine of Natural History, ser. 2. vol. viii. p. 429.

† See my observations "On the Process of Mineral Deposit in the Rhizopods and Sponges," in the Annals and Magazine of Natural History for January 1864.

the digestive cavities of Hydrozoa of far too minute size to have been able to swallow them in the aggregated state*.

The most remarkable feature in *Thalassicolla nucleata* (Huxley) consists in the presence of the "delicate flattened branching fibrils," which are described as being "beset with exceedingly minute dark granules like elementary molecules, which are in active motion as if circulating *along* the fibrils, but without any definite direction"—and likewise in the occurrence of the "yellow cells" (sarcoblasts) amongst the deeper-seated vacuoles†. If we regard the "fibrils" here alluded to as pseudopodial filaments (and it is difficult to regard them in any other light, if the organism belongs at all to the Rhizopodal group), it is manifest that the cyclosis cannot be dependent on a contractile power resident in those portions of the structure of the typical forms that exhibit a similar phenomenon, but must be the result of a contractile power inherent in the gelatinous matrix by which the "fibrils" are surrounded, as stated by M. de Quatrefages to be the case in *Noctiluca miliaris*‡. On the other hand, according to Huxley, it would seem highly probable that the cyclosis, together with the division and inosculation of the fibrils in *Noctiluca*, are "abnormal states, and that in the natural and perfectly unaltered condition the fibres and fibrils are perfectly quiescent, and present nothing to be compared to the Protean movements of the *Amœbæ*"§, the conclusion he arrives at being that *Noctiluca* "is no Rhizopod, but must be promoted from the lowest ranks of the Protozoa to the highest." If the latter view be correct, the true position of *Thalassicolla nucleata* must still remain somewhat doubtful; for it is obvious that the granular circulation and the presence of the fibrils are in reality the principal characters upon which the Rhizopodal character of that organism can be assumed.

Although I have had ample opportunity of examining *Thalassicolla nucleata* in the tropical and subtropical seas on both sides of Africa, I have never been able to satisfy myself

* Specimens of composite Thalassicollidæ when preserved in spirits usually break up, and accordingly yield no reliable evidence, one way or the other, as regards the question under discussion. In spirit-specimens, and also in such as have been preserved on slides, I have now and then detected what appeared to be the spherical-shelled and the spicular forms within *the same* gelatinous envelope; but I regard the chances of misinterpretation as too great in such a case to admit of my stating that their juxtaposition is normal, however probable this may be.

† Huxley on *Thalassicolla, loc. cit.* p. 435.

‡ See observations by this distinguished French naturalist in Huxley's paper on *Noctiluca*, 'Quarterly Journal of Microscopical Science,' vol. iii. p. 51.

§ *Loc. cit.* p. 51.

of its true nature, the only approach to a transitional state being suggested, rather than proved, by the occasional detection of a specimen in which the central mass with its investing capsule appeared to have escaped through an irregular orifice in the external gelatinous matrix. According to my notes written at the time of observation, these empty matrices showed the fibrillated structure, but no vacuoles or cyclosis of granules. Hence, notwithstanding their occurrence amongst the perfect forms, and their uniformity as to external appearance and dimensions, it is possible, although hardly probable, that they may have formed part of other organisms.

Lastly, as bearing on the identity in nature of *T. nucleata* with *Noctiluca**, I may mention that, according to my experience, there are no examples of phosphorescence amongst living animals holding so low a position in type of organization as the Rhizopods. As a negative character this absence of phosphorescence is of some value for the following reason. Both amongst the minute luminous Crustaceans proper, Entomostraca, and Ascidians of the open sea, I have found it easy, by means of a fine paint-brush, to detach a portion of a phosphorescent *fluid* from the living animal, and to communicate a luminous streak to any object by passing the brush so charged over it. It would seem, therefore, to be a true specialized secretion, and would furnish an explanation why creatures of such simple organization as the Rhizopods do not exhibit the phenomenon in question.

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

On the Change of the Gonidia of Lichens into Zoospores. By MM. A. Famintzin and J. Boranetzky†.

In a thin vertical section of a Lichen the gonidia occupy the middle layer of the thallus, and are partly attached to the medullary filaments and partly free and scattered. When the section is placed in water, the gonidia readily detach themselves in abundance, and present a perfect resemblance to a unicellular Alga.

M. Sperschneider, in 1853, placed thin slices of the thallus of *Physcia ciliaris*, DC., on pieces of decomposing wood in a confined humid atmosphere. At the end of two months the filaments of the thallus became decomposed, but the gonidia

* See paper on *Thalassicolla*, ut suprà, pp. 441, 442.
† Translated from 'Ann. Sc. Nat.' ser. 5, vol. viii. p. 137.

remained alive, considerably increased in size, and multiplied by division. Some time after, minute punctiform bodies, of a beautiful green colour, appeared amid the decomposing thallus, which were gradually transformed into new thalli of *Physcia ciliaris.*

Our own researches on other lichens have fully confirmed those of M. Sperschneider in all particulars, except that we have not succeeded in recognizing the transformation of the free gonidia into new thalli.

Our own experiments were as follows:—Many thin slices of the thallus of *Physcia parietina* were placed on bits of bark of fir and lime which had been previously boiled in water for some minutes, and which were afterwards kept in a humid atmosphere. These bits of bark were placed in small salvers on the bottom of a large glass vase, into which we had poured a little water, and covered with a pane of glass. They were thus maintained in a moist state for many months.

Although this method was attended with good results, we preferred another, by which the gonidia were isolated. The entire thallus was, for many weeks, either immersed in water or kept continually moist by water dropping upon it. The filaments of the thallus decomposed rapidly, but the gonidia preserved their vitality. The entire mass was washed in pure water, and deposited on bits of lime-bark. The gonidia isolated by either of the above methods always exhibited the same changes.

Each gonimic cellule, whether enclosed in the thallus or isolated, presented a large central nucleus, as well as a large lateral vacuole. In this state it perfectly resembled a unicellular Alga called *Cystococcus*, described by M. Nägeli in his work 'Les Algues unicellulaires,' and figured on tab. 3, E. *e.* We succeeded in observing, at a later period, in these gonidia all the other phases of development of *Cystococcus* described by M. Nägeli, and have thus established the identity of this Alga with the isolated gonidia of *Physcia.*

During the first days the gonidia augmented their size, but preserved their spherical form; afterwards they underwent the changes corresponding to the metamorphoses observed in *Cystococcus* by M. Nägeli. The most remarkable of these changes consisted in the transformation of the contents of the gonimic cellules into zoospores. A portion only of the gonidia were thus changed, the rest became divided by partitions into a great number of cellules, which gradually became of a round form, and ultimately disunited by separation.

The formation of the zoospores is preceded by a change characteristic of the contents of the cellules. The outlines of the nucleus and of the vacuole were gradually effaced and finally disappeared entirely, whilst at the same time the entire contents of the cellule became of a very fine, homogeneous granular structure. Finally the membrane of the cellule became torn, and the contents issued forth like a small circumscribed sphere, and resembled a small cellule still attached to the mother cell. The protuberance rapidly increased in size, and soon attained the dimensions of the primitive cellule, so that the contents became twice their original size. The cellule was thus emptied and its contents transferred entirely into the protuberance, which, as it gradually increased, assumed the form of a sac. At this moment the division of the contents into zoospores became evident, and we distinguished on its surface a very thin membrane, which was speedily ruptured, and through the aperture of which the zoospores issued one after the other. Generally the membrane was speedily dissolved, but sometimes it remained intact for a long time after.

The zoospores are elongated, narrowed at the anterior part, and furnished at this end with two cilia directed forward. By means of iodine, we could easily recognize in the middle of each zoospore a nucleolate formation, the nature of which we are unable to explain. The zoospores moved in the water for a certain length of time, and then became motionless. We are still unable to explain their ulterior development; and all our knowledge only establishes that the motionless zoospores augment in size without any change of form, and finally attain to two or three times their primitive diameter.

The most delicate and at the same time most important point of these researches was to establish incontestably that the zoosporal cellules were really the gonimic cellules, and not some other organism which had been accidentally developed in our apparatus. We believe that the following facts demonstrate this fully:—

1. We obtained the zoospores by means of gonidia sown on the surface of bits of bark previously boiled in water, and consequently cleansed from living organisms. Direct observation has demonstrated, moreover, that our seed-beds did not contain any other green organism besides the gonidia which we had deposited in them, and that they were only polluted by some filaments of a *Hyphomycetes* which had probably been transported on the bark or existed in the water in which the lichen had been macerated.

2. The changes which we have described were observed not only in a very great number of free gonimic cellules, but also in gonidia still attached to the medullary filaments. From these latter we have repeatedly observed the zoospores to

escape; and under the action of iodine the membrane of these cells was coloured violet, whilst the extremity of the filament to which they were attached was of a pale yellow.

3. We have equally obtained zoospores from gonidia united into a considerable mass. Some, indeed, of these cellules were already empty, the zoospores having escaped, whilst, on the other hand, others had undergone no change.

4. Lastly, we have found, on the bark of a birch tree in the garden of the University [of St. Petersburg], green patches exclusively formed of free gonidia, completely destitute of thallus. These cellules also produced zoospores perfectly identical with those of the gonidia which we had sown.

The formation of zoospores by sowings requires always many weeks, as the following experiments demonstrate:—

First experiment.—Vertical sections of a thallus of *Physcia* were placed, March 13, on fir-bark. The issue of zoospores was first observed April 19.

Second experiment.—On March 21 a bit of lime-bark with a lichen growing on it was fixed on the exterior of a large glass vessel filled with water, which was made to fall on it drop by drop by means of a cotton wick curved siphon-like. On April 1 the filaments of the lichens were disintegrated. On April 3 we transferred the gonidia, as well as the mucous mass of decomposed filaments, to two bits of bark. On April 20 the zoospores appeared.

Third experiment.—The lichen was immersed until the complete disintegration of the filaments, and on April 3 the gonidia were placed on gravel, on the earth, and on bits of rotten wood. Those on the two former became decomposed by too much moisture; but those on the latter succeeded well, and on May 15 the zoospores were observed.

The gonidia which did not produce zoospores separated into a great number of motionless spherical cellules, amongst which we distinguished two forms—one presenting a protuberance at the commencement of the division, the others preserving to the end their regular spherical form.

We also submitted these two lichens to similar experiments, except that, instead of vertical sections of the thallus or of gonidia already isolated, we used the soredia from the surface of the thallus, and sowed them either on bark or bits of decayed wood. Their gonidia presented precisely similar results to those of the *Physcia*, both in their form and their ulterior development.

These observations authorize us to propound the following propositions:—

1. Not only Algæ and Fungi, but Lichens also, are provided with zoospores.

2. Zoospores have been discovered in three very different genera of Lichens, viz. *Physcia, Cladonia*, and *Evernia*; and as these genera were selected undesignedly, it is probable that zoospores exist in all other lichens furnished with chlorophyll.

3. We have demonstrated the identity of free gonidia with the unicellular Alga *Cystococcus* of Nägeli; consequently this is not a distinct genus, but only a phase of development of a lichen.

4. The culture of the freed gonidia of *Physcia*, *Cladonia*, and *Evernia* led us to expect that other lichens would afford forms corresponding with rudimentary Algæ. Our researches prove this to be well founded. Vertical sections of the thalli of *Peltigera* and of *Collema*, cultivated on moist earth, showed the filaments in disintegration, the augmentation in size of the gonidia, and their transformation into glomerules composed of spherical cellules. The gonimic cellules of *Peltigera* and *Collema* continued to live when separated from the thallus: those of *Peltigera* were identical with an Alga called *Polycoccus*; those of *Collema* produced organisms similar to *Nostoc*. Consequently these three genera of Algæ, hitherto regarded as different and distinct, are in reality only the gonidia of lichens in a state of development when separated from the thalli which produced them.

XVII.—*On the* Ehretiaceæ. By John Miers, F.R.S., F.L.S., &c.

Ehretia.

This genus, as arranged by DeCandolle, is very heterogeneous, and requires redistribution, as it contains several distinct groups easily recognized by good characters, especially by those founded on their carpical structure. After the examination of all the plants within my reach, referred to *Ehretia*, from the New World, I propose to retain in the genus only those species which are proximate to *E. tinifolia*, Linn. Many of those belonging to the Old World will probably be found, upon critical examination, to be foreign to the genus. I have not had leisure to analyse them; but among those which I have examined, some distinct forms have been noticed. A few from Australia and Asia have a fruit containing four nucules, each 2-celled and 2-seeded, with a particular organization; others, again, have a bifid style, each obcuneiform branch bearing two distinct sessile stigmata; but the placentation of the ovary is that of *Ehretia* and *Rhabdia*.

The greater number of the Neogean species of *Ehretia* enumerated by DeCandolle enter into the genera *Bourreria* and *Crematomia*: these are distinguishable at a glance from *Ehretia* by their much larger, tubular, fleshy calyx, terminated by five teeth with thick tomentous margins, which are valvately closed in æstivation, and afterwards sometimes adhere so strongly together as to be separable with difficulty.

The *Ehretia spinosa* of Jacquin, judging from the characters he assigned to it, appears to differ in no way from *Rhabdia*, except in the pointed extremities of its deeply bipartite style: this plant constituted the second species of Don's unrecognized and incongruous genus *Lutrostylis*, the type of which, the *Ehretia fasciculata* of Kunth, is of very different structure, and will presently be noticed; his third species was the *Ehretia montevidensis* of Sprengel, which, from Sellow's original specimen in the Berlin Herbarium, has proved to be the *Citharexylon barbinerve* of Chamisso.

It has already been mentioned that there exists in the organization of the ovary and fruit of the *Ehretiaceæ* a point of structure which has escaped general observation: this is, the placentation of the ovary, and the existence of a gynobasic or central column which furnishes the nutrient vessels for the growth of the ovules; the course of these vessels may always be traced through apertures existing in the nucules where they terminate in the funicular points of suspension of the seeds. Hence the frequent geminate connexion of the distinct nucules in pairs in this family, a connexion effected either through a chink on one side only of each cell, sometimes near the summit (as I have already shown in *Rhabdia*, *ante*, vol. ii. p. 432), or sometimes, through the intermedium of a pseudo-cell, from a large opening above the base, as is seen in *Bourreria*: these modifications furnish good characters, which mark the different genera of the *Ehretiaceæ*, and which serve at once to distinguish this family from the *Cordiaceæ*, *Heliotropiaceæ*, and *Borraginaceæ*.

The following is a reformed diagnosis of the genus under consideration:—

Ehretia, Linn.—*Calyx* parvus, persistens, subcampanulatus, imo crassiusculus, fere ad basin 5-partitus, laciniis subovatis aut subulatis, margine membranaceis et ciliatis, æstivatione imbricatis. *Corolla* gamopetala, hypogyna, membranacea, tubo sæpius calycis longitudine aut paulo longiore, limbi lobis 5, oblongis, tubo paulo longioribus, revolutim expansis, æstivatione valde imbricatis. *Stamina* 5, alterna; *filamenta* compressa, subulato-filiformia, tubo affixa, exserta; *antheræ* ovatæ, 2-lobæ, imo ad medium divaricatæ, locellis sine connectivo adnatis, membranaceis, rima longitudinali lateraliter dehiscentibus. *Ovarium* conico-oblongum, *disco* parvo insitum; *semiseptis* 2, parietalibus, oppositis, utrinque bilamellatim reflexis, marginibus ovulum amplectentibus; *columna* centralis, transversim compressa, sublibera, lamellis parallela, axi vacua, vasa nutritoria intra pseudo-locellos emittens; inde pseudo-4-loculare, *ovulis* totidem summum versus appensis. *Stylus* erectus, exsertus, apice breviter aut minime bifidus, *stigmatibus* 2 parvulis subclavatis terminatus. *Drupa* globosa, subcarnosa, calyce persistente circumdata, 2-pyrena, *pyrenis* 2-locularibus, osseis, extus convexis, intus concavis, hinc sub apice lateribus *foramine* parvo loculum ingrediente utrinque perforatis, *loculis* 1-spermis. *Semen* teres, in quoque loculo e foramine appensum; *integumenta* tenuissima, papyracea; *embryo* in albumine parco rectus, teres, *radicula* supera.

Arbusculæ (*rarius* arbores) *Neogeæ, plerumque Mexicanæ; folia alterna, oblonga, integra vel serrata, glabra aut tuberculato-scabrida, petiolata:* paniculæ *corymbosæ, multiramosæ, terminales:* flores *parvi, albidi.*

1. *Ehretia tinifolia*, Linn. Amœn. v. 595, Syst. 192, p. 906, i. 309; Jacq. Amer. 45; Sw. Obs. 87; Willd. Sp. i. 1077; DeCand. Prodr. ix. 503;—Ehretia arborea, *P. Br. Jam.* 168, tab. 16. fig. 1;—Ceraso affinis (*in parte*), *Sloane, Jam.* ii. 94 (*nec icone ibi referta*);—ramulis tenuibus, teretibus, glabris; foliis ovato-ellipticis aut oblongis, utrinque sensim angustatis, subacutis, aut obtusule acuminatis, imo obtusis, planis, glaberrimis, supra subnitidis, planis, reticulatim nervosis, submembranaceis aut crassioribus, subtus pallidioribus, nervis tenuibus paulo prominulis, in ramis infimis multo majoribus et semper planis; petiolo subtenui, sulcato, glabro, limbo 14-plo breviore: panicula terminali, ramosa, multidivisa, ramulis tenerrimis, compressis, glabris, sæpe laxe expansis; floribus parvis, albidis.—In Antillis: *v. s. in herb. Mus. Brit.*, Jamaica (Sloan. hb. vol. vii. fol. 6 cum icone ex vivo, specim. typ.); Jamaica (P. Browne); ib. (Shakespear); Cuba (Linden, 1983); *in herb. Hook.*, Cuba (Wright, 1360, 1366).

All botanists have referred to Sloane as the earliest authority for this species, and the typical plant in his herbarium confirms this; but they have all overlooked the fact that Sloane collected two species, which are still preserved, one in fol. 5, the other in fol. 6, of his herbarium: the latter is accompanied by his own coloured drawing, taken "ex vivo," in fruit; but the plant corresponding with it is in flower. When Sloane published his work, he gave a figure in pl. 203. fig. 1, which is an exact tracing from his first specimen; but he added to it the fructiferous raceme, copied from his drawing, which does not exist in the specimen. It is evident, however, that his description in vol. ii. p. 94 does not refer to the first, but to the second specimen, with cerasiform leaves, and named by him "*Ceraso affinis*;" for the dimensions he gives of the leaves of this "*Bastard Cherry*" are $2\frac{1}{2}$ inches long, 1 inch broad, which agree with the second plant, but not at all with the first. P. Browne's description and drawing of this same species, above quoted, conforms in the size and shape of the leaves with Sloane's second plant; and it is manifest that Linnæus's *Ehretia tinifolia* is identical with the same form, as he quotes Browne as his authority. Jacquin and Swartz must have had the same plant in view when they gave more copious characters to the species. We have thus the true *E. tinifolia* identified in an unmistakable manner.

It is described as a tree 16 to 20 feet high, growing commonly in the lowlands of the eastern portion of Jamaica; its leaves are $2\frac{1}{2}$–$3\frac{1}{2}$ inches long, 1–$1\frac{3}{4}$ inch broad, on a somewhat slender petiole 2–3 lines long. In Linden's plant the leaves are thin in texture, in Wright's they are thicker in substance. The terminal panicle is $1\frac{1}{2}$–2 inches long.

2. *Ehretia sulcata*, nob.;—Ceraso affinis, *Sloane* (*in parte*), *Jam.* ii. tab. 203. fig. 1 (*non descript.*); Trew, Ehr. t. 25;—ramulis crassioribus, teretibus, striatis, rubescentibus, glabris; foliis oblongis aut ovato-oblongis, apice sensim angustioribus, obtusule acuminatis vel obtusis, canaliculatim recurvulis, imo rotundiusculis aut valde obtusis, in petiolo brevissime decurrentibus, ubique glaberrimis, coriaceis, supra pallide viridibus, ad costam latam nervosque rubellos flavidosve sulcatis, in vetustioribus valleculatis, interspatiis tunc plus minusve cônvexis, marginibus integris vix revolutis, subtus concoloribus, nervis prominentibus; petiolo lato, crassiusculo, supra valde sulcato, glabro, limbo 12-plo breviore: panicula corymbosa, terminali, ramosissima, ramis tenuibus, compressis, glabris.—In Antillis: *v. s. in herb. Mus. Brit.*, Jamaica (in hb. Sloan. vol. vii. fol. 5); *in hort. Kew. cult.*, Jamaica (Houston); *in herb. Hook.*, Jamaica (Purdie), Cuba (La Sagra), ib. Havana (Greene).

In describing the preceding species, I have explained how this has been confounded with it. Its leaves are much larger, more coriaceous, broader, more rounded at base, have a much broader and reddish midrib, more distant and much more divaricated nerves seated in hollow furrows, often leaving the spaces between them very convex; the petiole is much broader, thicker, and more deeply channelled. The leaves are $3\frac{1}{4}$–$5\frac{1}{2}$ inches long, $1\frac{3}{4}$–$3\frac{1}{2}$ inches broad, on a petiole 4–5 lines long. Trew figures separately a leaf from the older lower branches, which is 8 inches long and $4\frac{1}{4}$ inches broad.

It is a tree 20–30 feet high, growing in the more westerly portions of the island of Jamaica.

3. *Ehretia longifolia*, nob.;—ramulis tenuibus, angulato-striatis, pulverulento-glaucis; foliis elongato-oblongis, sub-lanceolatis, lateribus in medio parallele rectis, dehinc utrinque attenuatis, cum acumine obtusulo, imo in petiolo decurrentibus, integris, supra glabris, subnitidis, læte viridibus, nervis tenuissimis, divaricatis, arcuatim nexis, subimmersis, reticulatis, subtus fere concoloribus, sub lente minute scabridulis, nervis venisque prominulis, marginibus vix revolutis; petiolo semitereti, subglabro, limbo 20-plo breviore: paniculis terminalibus, racemosis, folio paulo brevioribus; ramis imo nudiusculis, bracteolatis, alternatim multidivisis, ramulis tenuibus, compressis, glaucis vel minute strigoso-puberulis; floribus parvis, albis, suaveolentibus.—In Antillis et Mexico: *v. s. in herb. Hook.*, Jamaica (Lane), ib. (Macfadyen); Oaxaca (Galeotti, 7194).

A very distinct species: it forms a handsome tree, with leaves 5–6 inches long, $1\frac{3}{4}$–$2\frac{1}{2}$ inches broad, on a petiole 3 lines long.

4. *Ehretia elliptica*, DC. Prod. ix. 503;—ramis teretibus, glabris, lenticellatis, ramulis hirtellis; foliis ellipticis, utrinque obtusis, apice paulo angustioribus et calloso-mucronatis, integris, in junioribus submembranaceis, supra nitentibus, planis, minute tuberculatis et scabrido-pilosis, in vetustioribus rigide coriaceis, fuscis, tuberculis nunc valde auctis et subconfluentibus, creberrime albo-rugosis, asperrimis, convexiusculis et in nervis valde sulcatis, marginibus subrevolutis, subtus brunneis, opacis, subglabris aut obsolete scabris, nervis prominentibus, scabridulis, in axillis barbatis; petiolo canaliculato, scabrido-piloso, limbo 12-plo breviore: paniculis racemosis, terminalibus, ramosis, scabrido-pilosis; floribus breviter pedicellatis; calyce ad basin 5-partito, rigide piloso, lobis acutissimis, erectis, corollæ tubo ante stamina intus plicato laciniisque oblongis reflexis calycem æquantibus, filamentis subulatis, medio tubi ad plicaturas geniculatim insertis, longe exsertis, stylo his æquilongo,

apice bifido, stigmatibus parvis, obtusis; drupa pisiformi, nuculis 2 generis structura.—In Mexico: *v. s. in herb. Mus. Brit.*, Rio Grande (Berlandier, 2330); *in herb. Hook.*, Matamoras (Berlandier, 939, 2369 in flore, 2320 in fructu, 900 in flore et fruct.).

A very rough-looking plant, with cano-scabrid approximated leaves, $1\frac{1}{2}$–$2\frac{1}{2}$ inches long, $\frac{7}{8}$–$1\frac{1}{4}$ inch broad, on a petiole $1\frac{1}{2}$–2 lines long. The panicle is little more than an inch long; the calyx is $1\frac{1}{4}$ line long; the tube of the corolla is $1\frac{1}{2}$, the lobes $1\frac{3}{4}$ line long; the drupe is 2 lines in diameter, enveloped by the calyx; the style is cleft for one-sixth of its length.

5. *Ehretia scabra*, Kth. et Bon. in Walp. Ann. i. p. 524;—ramulis teretibus, hispidulo-scabris; foliis oblongis, mucronato-acutis, imo in petiolo decurrentibus, integris, supra scabris, subtus glabris, petiolo limbo 12-plo breviore: corymbis terminalibus, subdichotomis, scabro-hispidulis; calyce 5-partito, laciniis lanceolato-subulatis, hispidulis; corollæ lobis patentibus, staminibus exsertis; stylo apice bifido.—E Mexico? (*non vidi*).

This description is given by Kunth of a plant cultivated in Berlin, supposed to be of Mexican origin: it is very near the preceding species, apparently differing only in the shape and size of its leaves, which are 4–$4\frac{1}{2}$ inches long, 19–20 lines broad, on a petiole 4 lines long.

6. *Ehretia ciliata*, nob.;—ramis nudiusculis, nitidis, lenticellatis, subcompressis, ramulis ultimis brevibus, divaricatis, foliiferis; foliis ellipticis, imo obtusis, apice subacutis, mucronatis, integris, planis, supra pallide viridibus, opacis, utrinque scabridule pilosis, nervis immersis, subtus paulo pallidioribus, in axillis nervorum subbarbatis; petiolo tenui, piloso, limbo 10-plo breviore: corymbis in ramulis ultimis terminalibus, folio longioribus, pilosulis, alternatim pluriramosis; floribus subapproximatis, pedicellatis; calyce profunde 5-partito, laciniis acutissimis, erectis, extus aspero-pilosis, intus pilosulis; corollæ lobis oblongis, tuboque calyci æquilongis; staminibus medio tubi insertis, exsertis; stylo breviter bifido, ramis crassiusculis.—In Texas: *v. s. in herb. Hook.* (Lindheimer, 665).

In this species the leaves are $1\frac{3}{8}$–$1\frac{3}{4}$ inches long, 7–9 lines broad, on a petiole 2 lines long: the panicle is about 7 inches long; the calyx, tube, and lobes of the border are each 2 lines long.

7. *Ehretia latifolia*, DC. Prodr. ix. 503;—ramis tenuibus, subteretibus, rugoso-lenticellatis, striatis, glabris; ramulis subcompressis, subpubescentibus; foliis late ovatis, imo subrotundis et circa pétiolum breviter subito attenuatis, apice brevissime et obtusule apiculatis, planis, margine serratis aut serrulatis, dentibus mucronulatis, submembranaceis, supra subnitidis, læte viridibus, tenuiter nervosis, e tuberculis minimis sparsis adpresse scabridulo-pilosis, subtus pallidioribus, subglabris aut in nervis venisque transversis prominulis tantum pilosulis, reticulatis, in axillis nervorum paulo barbatis; petiolo subtereti, subtenui, fere glabro, limbo 6-plo breviore: panicula corymbosa, terminali, folio dimidio breviore, ramis divaricatis, scabrido-hirtellis; calyce profunde 5-partito, extus ruguloso, intusque glabro, lobis oblongis, obtusis, margine ciliatis; corollæ lobis oblongis, rotundatis, tuboque calyci æquilongis; staminibus medio tubi insertis, longe exsertis; stylo apice breviter bifido; ovario drupaque pisiformi structura generis.—In Mexico: *v. s. in herb. Hook.*, Sangolica (Broteri 1022); Oaxaca (Galeotti, 3099).

A very distinct species, with leaves 3–4½ inches long, 1½–3 inches broad, on a petiole 6–9 lines long; the calyx is 1 line long, the tube and lobes each of the same length.

8. *Ehretia exasperata*, nob.;—ramulis teretibus, rugoso-lenticellatis, junioribus scabridis; foliis oblongis, utrinque sensim obtusis, a medio ad basin paulo angustioribus, marginibus remotiuscule sinuatis aut irregulariter grosse crenatis, fragiliter coriaceis, supra viridibus, subnitentibus, tuberculis albis piligeris crebre asperatis, in nervis longe intra marginem arcuatim nexis sulcatis, subtus pallidioribus, rigide scabridis, nervis prominentibus, in axillis barbatis; petiolo latiusculo, sulcato, hispido-pilosulo, limbo 18-plo breviore: paniculis terminalibus, divaricato-ramosis, rigidule hirsutulis; calyce ad basin 5-partito, laciniis oblongis, acuminatis, scabride hirsutulis; drupa 2-pyrena.—In Texas: *v. s. in herb. Hook.*, San Felipe (Drummond, 296).

A species approaching *E. elliptica*, but very distinct from it. The axils are about ¾ inch apart; the leaves are 3–3½ inches long, 1¾–2 inches broad, on a petiole 2 lines long; the panicle is 2½ inches long, the calyx 1¼ line long, the drupe 2¼ lines in diameter.

[To be continued.]

XVIII.—*On the Homologies of the Dental Plates and Teeth of Proboscidiferous Gasteropoda.* By JOHN DENIS MACDONALD, M.D., F.R.S., Staff Surgeon, R.N.

[Plate XIII.]

ALL unisexual Gasteropoda furnished with a lengthy proboscis retractile from the base, have also large single spherical otoliths in the ear-sacs. The odontophore is ribbon-like, holding a fixed relation to the extremity of the proboscis, whether retracted or protruded; and their lingual dental characters indicate their division into two natural groups easily distinguished from each other.

In the first group the dental plates are arranged in seven longitudinal series, and the teeth are in general recurved from the anterior border of the plates—a character which is especially observable in the central and first lateral series, even where the two outer members are in the form of simple curved fangs. The buccal plates are generally well developed, and exhibit some diversity of form and structure. Very little need be said of the homologies of the dental plates and teeth of this group; for, with very few exceptions, resulting from suppression of one or two of the outer rows in the pleuræ, the odontophore is septiserial, and the corresponding parts in all the genera may be readily recognized. Even in cases of suppression, as in *Criocella* and *Lamellaria*, the remaining dental organs are unequivocally fashioned like those of the more perfect neighbouring genera. The recurvature of the dental processes, expressed by the word *Campylodonta*, is the most essential character of this section of Proboscidifera.

In the second group, which is eminently carnivorous, the dental processes of the central plates, and frequently also of the first lateral series, point directly backwards, without recurvature properly so called; and this being the distinguishing feature of its members, I have applied to them the name of *Orthodonta.* The eyes are variously situated on the outer side of the tentacula, viz. near the tip, in the middle, at the base, or on an external depressed lobe-like process. In some the propodium is largely developed, either simple, as in *Harpa*, or divided into two lateral portions by a median sulcus, as in *Oliva.* But in most of the families the propodium is marked off from the mesopodium by a more or less deep transverse groove dilaminating the anterior border of the foot.

The *Orthodonta* admit of division into two parallel sections, distinguished respectively by the uncinate or the comb-like character of the lateral teeth. Though the prevailing form of dentition is triserial, its derivation from one of a higher number is indicated by the occurrence of five members in the tongue of *Clavatula* in the combed section, and in the tongue of *Olivella* in the uncinate. On the other hand, the lateral teeth, which are barely traceable in *Harpa*, are altogether suppressed in *Cymba* and *Marginella*, while the lateral fangs alone are present in *Mangelia* and *Pleurotoma*. The examples of suppression here noticed cannot be looked upon as equivalent to primary types, though they may be quite characteristic of the families in which they occur. The above remarks will be better understood on carefully comparing the annexed outline drawings of the leading forms of dentition occurring amongst the *Orthodonta*. (Pl. XIII.)

The lingual sac of *Conus* (fig. 1) presents a sigmoid flexure about its middle, the teeth in the fore part being in general directed forwards.

The fangs are separately erected or depressed (I have not accurately determined this point) by a special bundle of muscular fibres, arising by a fine point in front of the articulation of each, and being inserted by a kind of tendon a little below a trochanter-like process at their base, reminding one of the mode of insertion of the triceps muscle into the olecranon process of the ulna. This arrangement, however, cannot warrant the assertion that the teeth in the *Toxifera*, so-called, are inserted into the fleshy proboscis.

Notwithstanding the remarkable difference existing between the long spiral shell of *Terebra* and the depressed, almost involute, spiral form of *Conus*, the anatomy of the respective animals is remarkably similar, exhibiting an obvious natural affinity; and the dentition of both is modelled upon the same characteristic plan.

The genuine *Pleurotomæ*, which are notched in the outer lip, will be found, on accurate comparison with *Bela*, *Mangelia*, or such shells as are grooved at the suture, to present characters sufficiently well marked to suggest their separation.

The lingual cartilages of *Pleurotoma* form two comparatively large rounded masses, upon and between which the odontophore lies evenly, without the sigmoid flexure of *Conus* or *Bela*, but, on the contrary, it may be readily laid out quite flat for microscopic examination. The odontophore of *Pleurotoma* has very much the same relative proportions as that of *Mitra*; but the teeth are in two rows, long, smooth, rounded, tapering and gracefully curved (as it were, to inaugurate the uncinate series).

The Columbellidæ (Pl. XIII. fig. 11), including the beautiful little shells of the genera *Nitidella* and *Conidea*, seem to link the true Pleurotomes with the Olives. No dentition can be more characteristic than theirs, or less likely to be confounded with any other. The lateral teeth become shorter, more strongly curved, and falcated in a manner peculiar to the family, while the central area only presents a series of unarmed plates. These, however, shadow forth their composite nature by a narrowing in the middle, suggesting their homology with all three central plates of *Clavatula* blended together. In *Olivella* (fig. 12) the corresponding plates are furnished with a row of fine teeth along the posterior border, and the more simple uncini are flanked externally by a single row of thin quadrilateral plates. In *Oliva* (fig. 13) the uncini are quite simple, without notches or foliations, and closely resemble their homologues in Turritidæ (fig. 17) and Muricidæ (fig. 18). In the Harpidæ (fig. 14), Volutidæ (fig. 15), and Marginellidæ (fig. 16) they are altogether suppressed.

I have placed *Clavatula* (Pl. XIII. fig. 4) by itself as the type of a provisional family until further information is obtained by the study of the numerous little shells in this alliance occurring in tropical seas. Much is to be anticipated also from the examination of an equally numerous group referable to the Olive type.

In the odontophore of *Clavatula* (fig. 4) we find the most interesting combination of the dentition of *Mangelia* or *Bela* (fig. 3) with that of *Cyrtulus* (fig. 5), explaining to us certain homological relationships which would be difficult to comprehend without its aid. Thus its fangs may be traced backwards to *Pleurotoma* (fig. 10), and thence through the uncinate series to the hooks of *Murex* or *Concholepas* (fig. 18), while its side combs may be followed through the pectinate series to the lateral teeth of *Buccinum* (fig. 9), from which it must be apparent that the hooks of *Murex* and the lateral teeth of *Buccinum* are not homologous organs, and therefore cannot be convertible.

Being well aware of the existence of certain fusiform species having neither plaits nor folds upon the columella of the shell, but with lateral combs in the odontophore, I conclude that these would form with *Cyrtulus* (Hind) a well-marked family. The Muricoid species, such as *Fusus proboscidalis*, should be carefully excluded, and only the Cyrtuloid members (e. g. *Colus raphanus*) retained. My reason for proposing the family name *Cyrtulidæ* is founded on the study of the anatomy of Mr. Hind's *Cyrtulus serotinus* ("Cyrtule du soir" of the French), the type of the genus; and I hold its name to be still intact, though it has been unhesitatingly absorbed into Swainson's *Clavella*, no sufficient data having been advanced for such a proceeding*. The tongue of *Clavella distorta* is unequivocally Buccinoid, and the shell is now even taken as the type of the genus *Triumphis*. It is quite gratuitous to say that *Fusus longævus* of Solander and *Cyrtulus serotinus* of Hind are members of the same genus. It may be very pleasant to discover a living species of a genus fossil as far back as the Eocene period; but where is the proof of such a position? The naming-difficulty is nowhere more remarkably illustrated than in the members of this family, for which I have chosen the name *Cyrtulidæ*.

Fasciolaria (Pl. XIII. fig. 6) and *Mitra* (fig. 7) form the types of two distinct families: the former, with its lengthy ribbon and narrow median series, differs remarkably from the latter, in which the odontophore is short and broad; moreover the shell-characters are sufficiently distinctive.

Conchologists in general assume that *Turbinellus* and *Cynodonta* belong to the same family; but the proof of this has never been made plain. *Cynodonta* (fig. 8) alone appears to have undergone examination; and a family is certainly required for its reception, as it is not conformable with any other already established.

In *Harpa* the propodium is largely developed; but it is simple or without the median fissure above which characterizes all the Olividæ proper. The head and tentacula are remarkably small as compared with the great mass of the foot. The proboscis is in keeping with the head and very small, and the odontophore is so minute as to be readily overlooked by inexperienced observers.

The lateral plates are quadrilateral, bearing a broad triangular tooth; but both are so delicate and rudimentary as to require a nice adjustment of the light to render them visible at all. The central plates are also quadrilateral, but concave in front and convex behind, bearing a large conical tooth in the middle, with a very small one on either side, near its base. It would appear that the diminutive size of the whole ribbon, or the rudimentary nature of one or more of its elements, anticipates as it were some decided change in the plan of the dentition of the next succeeding family. Thus the rudimentary pleural teeth of *Harpa* indicate the alliance of that genus with some other in which those teeth are more highly developed; and in keeping with this reasoning, if no pleural teeth are at all present in the Volutidæ and Marginellidæ, we cannot affirm on this ground alone that their lingual dentition is typically uniserial.

* The young *Cyrtulus* is a veritable Lamarckian *Fusus*.

EXPLANATION OF PLATE XIII.

Fig. 1. Dentition of *Conus*: *a*, one fang, with its muscle remaining intact; *b*, extremity of the other fang, more highly magnified, to show the barbed processes more distinctly.
Fig. 2. Dentition of *Terebra*.
Fig. 3. „ *Bela*.
Fig. 4. „ *Clavatula*.
Fig. 5. „ *Cyrtulus*.
Fig. 6. „ *Fasciolaria*.
Fig. 7. „ *Mitra*.
Fig. 8. „ *Cynodonta*.
Fig. 9. „ *Buccinum*.
Fig. 10. „ *Pleurotoma*.
Fig. 11. „ *Columbella*.
Fig. 12. „ *Olivella*.
Fig. 13. „ *Oliva*.
Fig. 14. „ *Harpa*.
Fig. 15. „ *Melo*.
Fig. 16. „ *Marginella* (from memory).
Fig. 17. „ *Costellaria*.
Fig. 18. „ *Concholepas*.

XIX.—*Notes on the Fleshy Alcyonoid Corals* (Alcyonium, *Linn.*, *or* Zoophytaria carnosa). By Dr. J. E. Gray, F.R.S., V.P.Z.S., &c.

This group of Corals was named *Alcyonium* by Linnæus and Pallas, but has been more lately subdivided into several genera. The polypes are social, generally with elongated tubular bodies, which are united to one another into a more or less fleshy crust or lobulated or branched coral. The inner substance between the tubular bodies is sometimes rather fleshy and permeated with vessels. The polypes and the flesh are often strengthened with various-shaped calcareous, sunken or superficial spicules; but there is no central axis as in the horny or stony Alcyonoid Corals.

In one genus at least (*Paralcyonium*) the lateral younger polypes are short, and there is direct communication between their bodies and the central cavity of the older or mother polype; and in some other genera, as *Sympodium* and *Erythropodium*, which form only a thin crust, the body of the polype is short, as in the animals that form a thin bark on the central axis, *e. g.* in *Gorgonia* and *Corallium*.

The part of the polype at the base of the tentacles, and the tentacles themselves, are often armed with a series of spicules generally placed obliquely in two parallel series; they protect the polype when it is protruded: in some these spicules are so numerous as to prevent the complete contraction of the polype.

The skin of the body and the fleshy substance between the bodies of this group of polypes are also studded with various-shaped calcareous spicules, the fusiform being the most common. The spicules were observed and studied by J. Ellis, and by various physiologists since his time, especially by Prof. Kölliker, in his 'Icones Histiologicæ;' but they require to be studied with more care and in a more philosophic manner, so as to divide the forms into different groups by observing the modifications which the spicules of each species undergo when being developed, and also in a larger number of kinds, before they can be used for the distinction of the genera and species.

Lamarck, in his Monograph on *Alcyonium*, first published in the 'Annales du Muséum,' and then in the 'Hist. Nat. des Anim. s. Vertèb.' (ii. 412), described many species that I have not been able to identify or place in this synopsis. Though most of them are described from specimens then in the Museum of the Jardin des Plantes, they are not further described or in any way referred to in Milne-Edwards and Haime's 'Coralliaires,' founded on specimens in that collection; so it is to be feared that the types have been lost. Some of them, like some of the *Alcyonia* figured by Esper and other zoologists, were, very likely, sponges. Considering the number of species that Ehrenberg and Quoy and Gaimard collected, and the very few localities from which the specimens described have been received, there must be very many species of these animals to be discovered, if they were only sought for in other localities. They are very easily preserved; so there is very little excuse for their not having been more collected and studied.

Section I. DERMOCORALLIA.

The coral crust-like, attached by the lower surface, or lobed and branched, with polypes on the whole of the exposed surface.

A. *The coral crust-like, attached by the lower surface. The body of the polype short.*

Fam. 1. **Antheliadæ.**

Coral crust- or skin-like, spreading, and attached by the lower surface. Polypes produced above the surface of the coral, not retractile. Spicules fusiform or cylindrical, spinous or tubercular.

This family is somewhat like Xeniadæ, and chiefly differs in producing buds only at the base of the cells; in this way the coral is expanded outward, and forms an incrusting plate.

Anthelia.

Savigny, MS.; Lamarck, A. s. V. ii. 407; Lamx.; Blainv.; Dana, Zooph. 602; M.-Edw. & Haime, Corall. i. 109; Kölliker, Ic. Hist. 132.

Polypes not retractile, not branched by budding; the tentacles only retractile. Polype-body subcylindrical, prominent, from an expanded basal plate.

1. *Anthelia glauca*, Sav. Egypte, t. 1. f. 7.
   Hab. Red Sea.

2. *Anthelia strumosa*, Ehr.
   Hab. Red Sea.

3. *Anthelia pupurascens*, Ehr., Sav. Egypte, t. 1. f. 5.
   Hab. Red Sea.

4. *Anthelia Filippi*, Kölliker, Ic. Hist. 132, t. 18. f. 41, 42.
   Hab. Guadaloupe.

5. *Anthelia lineata*, Verrill, t. 6. f. 9.
   Hab. Hongkong.

6. *Anthelia Dujardinii*, Dana. (*Xenia Dujardinii*, Templeton, Trans. Zool. Soc. ii. 25, f. 3–7.)
   Hab. Isle of France.

Fam. 2. **Sympodiadæ.**

Polype and tentacles completely retractile into the skin-like or crustaceous coral.

1. Massarella.

Coral irregular-shaped, attached to the horny axis of a *Gorgonia*; outer surface hard, crustaceous, smooth; internal cork-like. Polypes completely retractile.

1. *Massarella coralloides*; B. M. (*Gorgonia coralloides*, Pallas, Zooph. 192; Esper, t. 32. *Sympodium coralloides*, Ehr. C. r. M. 61.)
   Hab. ——?

2. *Massarella rosea.* (*Sympodium roseum*, Ehrenb.)
   Hab. West Indies.

3. *Massarella vera.* (*Sympodium verum*, Duchass. & Michel. Suppl. 104.)
   Hab. West Indies.

See *Anthozoanthus parasiticus*, Desh., Schleiden, Das Meer, t. 4, said to be a *Lobularia* on a *Gorgonia.*

2. Eunoella.

Coral crust-like, thin. Polypes large, convex when contracted.

Eunoella gorgonoides. (*Alcyonium gorgonoides,* Ellis & Soland. Zooph. 101, t. 9. f. 12. *Sympodium gorgonoides,* M.-Edw. *Sertularia gorgonia,* Pallas.)
Hab. West Indies.

3. Sympodium.

Ehrenb. Corall. 61; M.-Edw. & Haime, Corall. i. 110; Kölliker, Ic. Hist. 141, t. 19. f. 7–9.

Coral expanded, fleshy, skin-like. Polype-cells small, papillose, not spined; polype and tentacles retractile, leaving a small superficial wart. Spicules fusiform or short, subcylindrical, tubercular or spinous.

1. *Sympodium fuliginosum,* Ehrenb., Savigny, Polyp. t. 1. f. 6.
Hab. Red Sea.

2. *Sympodium cœruleum,* Ehrenb.
Hab. Red Sea.

3. *Sympodium poriferum,* Verrill, Proc. Boston S. N. H. 1866.
Hab. Panama.

4. Erythropodium.

Kölliker, Icon. Hist. 141 (1866), t. 12. f. 10, 11, t. 9. f. 6.

Coral incrusting, membranaceous; flesh of the coral studded with dark-red, large, subcruciate or subcylindrical tubercular spicules. Polype completely retractile into the cell, leaving only a slight convex edge. Tentacles nearly cylindrical, pectinate.

Erythropodium caribbæarum, Kölliker. (*Xenia caribbæarum,* Duchass. & Michel. Corall. Antilles, t. 1. f. 8–10.)
Hab. West Indies.

5. Ojeda.

Duchass. & Michel. Corall. Antilles, 14, Supp. 104.

Coral like *Sympodium.* "Spicules, which resemble small nummulites, are so minute as to be only seen by the aid of the microscope; the edges are deeply cut out; resembling a small many-rayed star, nummulitiform."

Ojeda luteola, Duchass. & Michel. Corall. Antilles, 14.
Hab. West Indies.

B. *The coral crust-like, convex, with more or less erect lobes. The polypes to the edge of the crust or the base of the stem, with long cylindrical tubular bodies; polypes retractile.*

Fam. 3. **Lobulariadæ.**

Coral with a hard, crustaceous, smooth external coat. Polypes retractile.

* *Polype-cell flat, not raised above the surface of the crust.*

1. Lobularia.

† *Coral crust-like, with a few rounded lobes or cylindrical blunt branches.*

1. *Lobularia digitata*, Lamk. (*Alcyonium digitatum*, Linn. *A. lobatum*, Pallas. *A. exos*, Spix. *A. palmo*, Esper, t. 9, dry. *A. lacunosum*, Esper, t. 14, dry. *Lobularia grandiflora*, Chamisso? *Halcyonium palmo*, Ehr., var. *Alcyonium cydonium*, Müller. *Lobularia conoidea*, Lamk. *Cydonium Mülleri*, Fleming.)
Hab. North Sea, Mediterranean. B.M.

A. cydonium, Esper, t. 25. f. 1, 2, 3, looks like the section of a dry specimen of this coral.

2. *Lobularia massa.* (*Alcyonium massa*, Müller, Z. D. t. 81. f. 1, 2. *Massarium massa*, Blainv. *Sympodium massa*, Ehrenb.)
Hab. North Sea.

3. *Lobularia glomerata.* (*Alcyonium glomeratum*, Johnston. *A. rubrum* and *A. sanguineum*, Hassall, Couch, Cornish Fauna, t. 13. f. 1.)
Hab. Coast of Cornwall (Couch).

4. *Lobularia carnea.* (*Alcyonium carneum*, Verrill, Bull. Mus. Comp. Zool. 35. *A. digitatum*, Stimpson.)
Hab. North Sea.

5. *Lobularia rubriformis*, Ehrb. (*Alcyonium rubriforme*, Dana, Verrill, Mem. Boston S. N. H. i. 4.)
Hab. North Sea.

6. *Lobularia Verrillii.* (*Alcyonium* ——, n. s., Verrill, Rep. Essex Institute, 1865, p. 191.)
Hab. Sea of Okhotsk (Verrill).

7. *Lobularia mollis.* (*Alcyonium molle*, Esper, t. 18 B, in spirits. *A. granulatum*, Esper, t. 24, dry.)
Hab. ——, on a *Fucus*. B.M.

8. *Lobularia rigida.* (*Alcyonium rigidum*, Dana.)
Hab. Feejee Islands (Dana).

9. *Lobularia Ceïcis.* (*Alcyonium Ceïcis*, Duchass. & Michel. Corall. Antilles, 14, Suppl. 104.)
Hab. West Indies.

10. *Lobularia æquinoctialis*, Duchass. Rad. Antilles, 21.
Hab. West Indies.

11. *Lobularia capitata.* (*Xenia capitata*, Duchass. & Michel. Corall. Antilles, 16, t. 1. f. 22, Suppl. 105.)
Hab. West Indies.

12. *Lobularia brachyclados*, Ehrenb. (*Alcyonium brachyclados*, Dana.)
Hab. Red Sea.

13. *Lobularia leptoclados*, Ehrenb.
Hab. Red Sea.

†† *Coral produced into acute finger-like lobes or branches; base compressed.*

14. *Lobularia flava.* (*Alcyonium flavum*, Quoy & Gaim. Voy. Astrol. t. 23. f. 6, 7.)
Hab. Vanikoro.

15. *Lobularia flabella*, Quoy & Gaim. Voy. Astrol. t. 23. f. 18–20.
Hab. Australia.

††† *Coral creeping; branches simple, erect, lamellar.*

16. *Lobularia muralis.* (*Alcyonium murale*, Dana, Zooph. t. 58. f. 3.)
Hab. Tongatabu.

2. Sphærella.

Coral hard, coriaceous, globular or subglobose, affixed by a slender peduncle, growing in clusters. Polypes scattered over the whole surface, quite retractile.

Sphærella tuberculosa. (*Alcyonium tuberculosum*, Quoy & Gaim. Voy. Astrol. t. 23. f. 4–8.)
Hab. Tongatabu.

3. Chlorozoa.

Coral soft, divided into finger-like lobes, deep green. Polypes very small, irregularly disposed. Tentacles petal-like, ovate, lanceolate, connected by a membrane like a veil, and lacerated or ciliated at the tip. (See Quoy & Gaim. Voy. Astrol. t. 23. f. 22, 23.)

Chlorozoa viridis. (*Alcyonium viride*, Quoy & Gaim. Voy. Astrol. t. 23. f. 21–23.)
Hab. Vanikoro.

** *Polype-cell with a raised edge.*

4. Rhodophyton, Gray, P. Z. S. 1865, p. 706.

Coral fleshy, with a hard crust, branched to the base. Polype-cell with a raised edge. Polypes half-retractile.

Rhodophyton Couchii, Gray, P. Z. S. 1865, p. 706 (fig.).
Hab. Cornwall (Couch). B.M.

5. Amicella.

Coral thick at the base, branched, tree-like. Polype-cell rather prominent, covered with eight valves, each marked with two rows of spicules. Polypes quite retractile. "Tentacles simple, clavate" (Quoy).

Amicella amicorum. (*Alcyonium amicorum*, Quoy & Gaim. Voy. Astrol. t. 22. f. 13–15. *Nephthea amicorum*, Blainv. *Ammothoa amicorum*, M.-Edw.)
Hab. Tongatabu.

Section II. PODOCORALLIA.

The coral pedunculated, the lower portion stem-like, barren, the upper lobed or branched, with the polypes on the surface. The polypes with an elongated tubular body.

A. *Coral with a coriaceous or crustaceous minutely granular outer surface, with more or less numerous internal spicules. Polypes retractile or semiretractile.*

Fam. 4. **Alcyoniadæ.**

The coral fleshy, divided into lobes or branches above, bearing the polypes on all sides. Stem more or less coriaceous externally. Polypes retractile.

1. Alcyonium.

Coral erect; base thick, smooth, barren; upper part divided into subcylindrical lobes. Polype-cells even. Polypes small, retractile.

Kölliker says *A. palmatum* has a rudimentary axis. (See Icon. Hist. t. 12. f. 4.)

* *Coral fleshy.*

1. *Alcyonium palmatum*, Pallas. (*A. exos*, Gmelin, Esper, t. 2; Ellis, Phil. Trans. 1763, t. 20. f. 9. *Lobularia palmata*, Lamk. *L. digitata*, Chiaje.)
   Hab. Mediterranean. B.M.

2. *Alcyonium Sarsii.* (*A. palmatum*, var., Sars, Kölliker, Icon. Hist. 132.)
   Hab. North Sea.

3. *Alcyonium aurantium*, Quoy & Gaim. Voy. Astrol. t. 22. f. 16–18. (*Lobularia aurantiaca*, Lamk.)
   Hab. New Zealand. B.M.

** *Coral crustaceous.*

4. *Alcyonium stellatum*, M.-Edw. Ann. Sc. Nat. iv. 1835, t. 16; Corall. i. 116, t. 1 *a*. f. 2.
   Hab. Coast of France.

2. Danella.

Coral soft; stem thick, barren, not dilated at the base; branches slender, cylindrical, ascending. Polypes small, on the branches; spicules very abundant in all parts of the stem.

* *Coral coriaceous, branches blunt.*

1. *Danella conferta.* (*Alcyonium confertum*, Dana, Zooph. t. 57. f. 7.)
   Hab. Feejee Islands.

** *Coral soft, branches acute.*

2. *Danella flexibilis.* (*Alcyonium flexibile*, Quoy & Gaim.)
   Hab. Vanikoro.

3. *Danella fegeensis.* (*Alcyonium flexibile*, var., Dana, Zooph. t. 57. f. 6.)
   Hab. Feejee Islands (Dana).

3. Amocella.

Coral fleshy, smooth, arising from a more or less extended, compressed, horizontal base, with thick, erect, smooth, sterile stems divided above into lobes or branches, covered on all sides with retractile polypes.

1. *Amocella pauciflora*, Savigny, Egypte, t. 1. f. 8. (*Lobularia pauciflora*, Ehrenb. *Ammothoa virescens*, part., Audouin. *Alcyonium pauciflora*, Dana.)
   Hab. Red Sea.

2. *Amocella polydactyla.* (*Lobularia polydactyla*, Ehrenb.)
 Hab. Red Sea.

3. *Amocella? trichanthema.* (*Alcyonium trichanthemum*, Dana, Zooph. t. 56. f. 1.)
 Hab. Feejee Islands.

Fam. 5. **Sarcophytidæ.**

The coral discoidal or hemispherical, pedicelled; stem and under surface barren, rather coriaceous, granular. Polypes on the upper surface of the frond, retractile.

1. Sarcophyton, Lesson.

Coral agaric-shaped, soft, fleshy, externally soft; stem cylindrical, formed of cylindrical tubes.

1. *Sarcophyton glaucum*, Verrill. (*Alcyonium glaucum*, Quoy & Gaim. Voy. Astrol. t. 22. f. 11, 12.)
 Hab. Tonga (Quoy); Feejee (Verrill). B.M.

2. *Sarcophyton lobatum*, Lesson, Voy. Bélanger, t. 2. Tentacles simple?
 Hab. ——?

3. *Sarcophyton agaricum*, Stimpson, Verrill.
 Hab. Japan.

2. Areocella.

Coral rather rigid, stipitate, very broadly expanded, sinuate on the edge; upper surface areolated, areolæ hexagonal, each surrounded by a series of small tubercles. Polype in centre of each areola.

Areocella lata. (*Alcyonium latum*, Dana, Zooph. t. 56. f. ?, t. 58. f. 7. *Sarcophyton latum*, Verrill.)
 Hab. Tongatabu, Feejee Islands.

3. Cladiella.

Coral half-ovate or obconical, in clusters, below tapering to a small base, barren, above flat. Polypes retractile.

1. *Cladiella sphærophora.* (*Lobularia sphærophora*, Ehrenb. *Alcyonium sphærophora*, Dana.)
 Hab. Red Sea.

2. *Cladiella brachycladia.* (*Alcyonium brachycladium*, Dana, t. 57. f. 8.)
 Hab. Tongatabu.

Fam. 6. **Bellonelladæ.**

Coral capitate; stem thick, with a coriaceous granular outer surface, grooved, showing the tubular form of the bodies of the polypes above; head hemispherical. Polype-cells cylindrical, with a plaited mouth. Polypes retractile.

Chiefly differs from *Xeniadæ* in the stem being more coriaceous and the polypes retractile into the tubular projecting cells.

BELLONELLA.

Gray, P. Z. S. 1862, p. 35, figs. 3, 4.

Coral cylindrical, simple, with a convex head, with subcylindrical, truncated, divergent polype-cells on the upper, nearly flat surface, with eight grooves on the edge when the tentacles are enclosed. Tentacles pinnate.

1. *Bellonella granulata*, Gray, P. Z. S. 1862, p. 35, fig.
Hab. Bellona Reefs. B.M.

2. *Bellonella? capitata.* (*Lobularia capitata*, Duchass. & Michel. Corall. Antilles, 21.)
Hab. West Indies.

Fam. 7. **Xeniadæ.**

Gray, Ann. & Mag. Nat. Hist. 1859, iv. 443.

Coral soft and fleshy; stem simple or slightly branched, smooth or minutely granular. Polypes clustered on the rounded ends of the branches, not retractile; skin of the stem and polypes to the end of the pinnules strengthened with spicules.

1. XENIA, Savigny = CREPITULARIA, Valenc.

Coral creeping, fleshy; stem erect. Internal spicules few.

1. *Xenia umbellata*, Savigny, Egypte, Polypes, t. 1. f. 3.
Hab. Red Sea (Savigny). B.M.

2. *Xenia fuscescens*, Ehrenb.
Hab. Red Sea.

3. *Xenia cærulea*, Ehrenb.
Hab. Red Sea.

4. *Xenia samoensis*, Kölliker, I. H. 133, t. 12. f. 1, 2.
Hab. Samoa Island.

2. LORIDELLA.

Coral erect; stem thick, with a contracted base; surface coriaceous, with imbedded fusiform spined spicules. "Tentacles with lobes on all sides" (Quoy).

1. *Loridella subviridis.* (*Cornularia subviridis*, Quoy & Gaim. Voy. Astrol. iv. 256, t. 22. f. 5–7.)
   Var., Quoy & Gaim. *l. c.* t. 22. f. 8–10.
   Hab. Feejee.

2. *Loridella florida.* (*Actinantha florida*, Lesson, Voy. Coq. 85, t. 1. f. 3 = *Xenia florida*, Dana.)

3. *Loridella elongata.* (*Xenia elongata*, Dana, Zooph. 606, t. 57. f. 5.)
   Hab. ——?

4. *Loridella rosea.* (*Xenia cærulea*, var., Dana, Zooph. 605, t. 57. f. 3.)
   Hab. Feejee.

3. Wardella.

Coral simple; stem simple, with very numerous smooth internal spicules forming a thick spongy web. Polypes not retractile.

Wardella indivisa. (*Xenia indivisa*, Sars, Kölliker, I. H. 133.)
Hab. Naples (Sars).

B. *Coral cellular; the surface of the coral and outer side of the polype-cells covered with opaque, rugose, fusiform spicules. Polype retractile.*

a. *Stem, branches, and polype-cells covered with spicules.*

Fam. 8. **Nidalidæ.**

Coral simple or branched; stem cylindrical, cartilaginous, with a crustaceous skin and imbedded spicules. Polypes on the upper surface of a hemispherical head, with prominent large conical polype-cells; stem and polype-cells covered with large fusiform spicules.

Nidalia.

Gray, P. Z. S. 1835, ii. 59.

Coral cylindrical, branched, with an expanded hemispherical head with large conical cells on the upper surface; cells covered with spines.

Nidalia occidentalis, Gray, P. Z. S. iii. 30; P. Z. S. 1857, p. 129, t. 7. (not t. 3. f. 2).
Hab. ——?

Fam. 9. **Spoggodidæ.**

Coral membranaceous, cellular, branched, the outer surface covered with opake fusiform spicules. Polype-cells at the ends of the branchlets, and surrounded by a series of projecting spicules. Polypes retractile.

1. Spoggodes, Lesson.

Gray, Proc. Zool. Soc. 1862.

Polypes crowded together at the ends of the branchlets, the groups more or less surrounded by larger spicules.

1. *Spoggodes florida*, Gray, P. Z. S. 1862, t. 4. f. 1, 2, 3. (*Alcyonium floridum*, Esper, t. 16. *Xinia florida*, Lamk. *Neptea florida*, Blainv. *Spoggodes celosia*, Lesson.)
   Hab. Philippines (Cuming). B.M.

2. *Spoggodes spinosa*, Gray, *l. c.* t. 4. f. 5–7.
   Hab. New Guinea. B.M.

3. *Spoggodes capitata*, Verrill.
   Hab. Hongkong. B.M.

4. *Spoggodes arborescens*, Verrill.
   Hab. Feejee Islands.

2. Spoggodia.

Gray, P. Z. S. 1862, p. 29.

Polype-cells subcylindrical, prominent from the sides, or forming the tips of the branchlets.

1. *Spoggodia unicolor*, Gray, *l. c.* f. 1, 2.
   Hab. Bellona Reefs. B.M.

2. *Spoggodia divaricata*, Gray, *l. c.* f. 3, 4.
   Hab. New Guinea. B.M.

3. *Spoggodia ramulosa*, Gray, *l. c.* f. 5, 6.
   Hab. Bellona Reefs. B.M.

4. *Spoggodia gracilis*. (*Spoggodes gracilis*, Verrill.)
   Hab. Loochoo Islands.

b. *Stem with a coriaceous granular skin; branches and polype-cells strengthened with superficial fusiform spicules.*

Fam. 10. **Nephthyadæ.**

Gray, Ann. & Mag. Nat. Hist. 1859, iv. 444.

Coral fleshy, cellular, branched; stem coriaceous or granular externally; branches and polype-cells with superficial spicules. Polype-cells subcylindrical, incurved. Polypes retractile.

1. NEPHTHYA, Savigny.

Coral fleshy, with a large horizontal basal mass. Stem erect, divided above into heads or spikes of polypes; branches and polype-cells with many large superficial and few internal spicules. Polype-cells crowded on all sides of the ovate club-shaped terminal branchlets. Polypes half-retractile, leaving an incurved tubercle covered with fusiform spicules.

1. *Nephthya Savignii*, Ehrenb., Savigny, Polyp. Egypte, t. 2. f. 5. (*N. Chabrolii*, Audouin. *N. innominata*, Blainv.)
Hab. Red Sea. B.M.

2. *Nephthya polyanthus.* (*Ammothea polyanthus*, Duchass. & Michel. 15, t. 1. f. 6.)
Hab. West Indies.

3. *Nephthya parasitica.* (*Ammothea parasitica*, Duchass. & Michel. 15, t. 1. f. 3, 4, 5.)
Hab. West Indies.

4. *Nephthya aurantiaca*, Verrill.
Hab. China Seas.

2. AMMOTHEA, Savigny, Pol. Egypte.

Coral fleshy, with a horizontal creeping basal mass. Stem erect, divided above into heads or spikes of polypes. Stem and branches with very few minute superficial spicules, and with many internal spicules. Polype-cells crowded on all sides of the oval club-shaped terminal branchlets; polype-cell subcylindrical, incurved, lobed at the mouth.

Ammothea virescens, Savigny, Polyp. Egypte, t. 2. f. 6. (*Nephthea Cordieri*, Audouin. *Neptea Savignii*, Blainv.)
Hab. Red Sea. B.M.

3. CAPNELLA.

Coral erect; stems clustered, coriaceous, granular, divided into short branches; outer surface studded with small, flat, smooth, irregular-shaped spicules. Polype-cells crowded and imbricate on all sides of the oval club-shaped branchlets; polype-cell campanulate, slightly eight-lobed. Polypes retractile.

Capnella imbricata, Quoy & Gaim. Voy. Astrol. iv. 281, t. 23. f. 8–14. (*Ammothea imbricata*, M.-Edw.)
Hab. New Zealand, Australia. B.M.

4. MORCHELLANA, Gray, Proc. Zool. Soc. 1862, p. 30.

Coral clavate; stem thick, contracted below; outer surface coriaceous, granular; skin of branches thin, studded with large, opaque, fusiform spicules. Upper part divided into short, conical, spreading branches, closely covered with subcylindrical incurved polype-cells.

Morchellana spinulosa, Gray, P. Z. S. 1862, p. 31, fig. at page 30.
Hab. Indian Ocean. B.M.

See *Alcyonium spongiosum*, Esper, Zooph. t. 3. *Ammothea phalloides*, Lamk. Figured from a dry specimen.

c. *Coral soft, membranaceous, cellular, smooth, with the polypes at the ends of the fleshy branches. Polypes partly retractile, leaving a subspherical terminal head to the branchlets; a few imbedded spicules near the mouth and in the tentacles. Lower part of the coral simple or retractile into a tubular spinulose sheath.*

Fam. 11. **Lemnaliadæ.**

Coral simple at the base; stem formed of the clustered cylindrical tubular bodies of the polypes; outer surface smooth, without spicules.

Known from *Nephthyadæ* by the polype-cell being pedicelled, and the stem and branches of the coral not being covered with superficial fusiform spicules.

1. LEMNALIA.

Gray, Ann. & Mag. Nat. Hist. 1868, ii. p. 442.

Coral-stem forming an expanded creeping base. Polype-cells racemose.

1. *Lemnalia Jukesii*, Gray, *l. c.* fig. 1.
Hab. ——?

2. *Lemnalia terminalis.* (*Alcyonium terminale*, Quoy & Gaim. Voy. Astrol. t. 23. f. 15–17.)

Stem unknown. Spicules fusiform, smooth, small, flat, irregular-shaped (Quoy).
Hab. ——?

3. *Lemnalia nitida.* (*Ammothea nitida*, Verrill, Bull. Mus. Comp. Zool. 39.)
Hab. Zanzibar (Verrill). Stems clustered.

2. VERRILLIANA.

Coral soft, branched. Stem tapering, cylindrical, longitudinally grooved. Polypes clustered together on all sides of the ends of the branches, forming an ovate-lanceolate group or thyrse. Polype-cell cylindrical, with a subglobular head when the polype is contracted.

1. *Verrilliana ramosa.* (*Alcyonium ramosum*, Quoy & Gaim. Voy. Astrol. iv. 275, t. 23. f. 8–11. *Ammothea ramosa*, M.-Edw.)
   Hab. New Granada (Quoy).

2. *Verrilliana thyrsoides.* (*Ammothea thyrsoides*, Ehrenb. *Nephthya thyrsoidea*, Verrill.)
   Hab. Red Sea (Ehr.), Cape of Good Hope (Verrill).

Fam. 12. **Paralcyoniadæ.**

Coral membranaceous, branched above, smooth, with minute dermal spicules near the mouths of the polypes; the bodies of the polypes opening into each other, making a common cavity. The coral retractile into a tubular sheath covered with large dermal spicules. Tentacles retractile.

PARALCYONIUM, M.-Edw. (*Alcyonidia*, M.-Edw. 1835.)

Paralcyonium elegans, M.-Edw. Corall. i. 130, t. 1 *a*. f. 1. (*Alcyonidia elegans*, M.-Edw. Ann. Sc. Nat. 1835, iv. t. 12, 13.)
Hab. Algiers.

XX.—*Notice of a Gigantic Species of* Batrachus *from the Seychelle Islands.* By A. GÜNTHER, F.R.S.

THE British Museum has lately received, through Lieut.-Col. Playfair, the dried head of a gigantic Acanthopterygian Fish, which was captured by Swinburne Ward, Esq., H.M. Civil Commissioner for the Seychelles. To judge from the head, this fish appears to be equal in bulk to any of the species of *Histiophorus*, if, indeed, it does not exceed them in size. I was previously acquainted with this fish from a pair of jaws only, preserved in the British Museum for a long time; but I was unable to form any opinion from these fragments as regards the systematic position of the fish to which they belonged. Although one character of *Batrachus*, viz. prominent spines of the opercles, is absent, or at least not conspicuous in the head before me, its appearance and structure is that of the species of this genus; and as I do not know of a species to which it may be referred, I regard this fish as undescribed, and it may be appropriately called *Batrachus gigas*. I may hope soon to supplement the following incomplete description by the acquisition of more perfect specimens.

The head is 26 inches broad (between the ends of the gill-covers), 21 inches long from the snout to the end of the opercle, or 16 inches to the occiput. It is depressed, with the eyes directed upwards, as in *Batrachus*, covered all over with comparatively small hard scales, the scale-pouches of the skin being also provided with minute scales. The crown of the head is flat, without ridges; the eyes (1½ inch wide) are far apart (5⅔ inches). The cleft of the mouth is enormous, about 16 inches wide, slightly obliquely directed upwards, with the lower jaw somewhat prominent. The jaws, vomer, and palatine bones are armed with broad bands of villiform teeth. The vomerine teeth form a semicircular disk, well separated from the palatine bands, which are tapering in front and behind, lancehead-shaped. The maxillary bone (10 inches long) becomes gradually broader towards its extremity, where it is 3 inches broad; it is entirely smooth. The præoperculum has its margin irregularly denticulated; and the denticulations at the rounded angle are much the strongest, perhaps the remnants of worn-off spines. The margins of the other opercles are smooth, but there are still traces of two spines on each operculum.

The jaws mentioned above are somewhat larger still than those of the head described; so that some individuals of this species must evidently attain an enormous size.

XXI.—*Descriptions of new Genera and Species of* Tenebrionidæ *from Australia and Tasmania.* By FRANCIS P. PASCOE, F.L.S. &c.

[Continued from p. 45.]

[Plate XI.]

AFTER the following additions have been made to the genus *Adelium* of Kirby*, there remain a few species, the types apparently of as many genera related to it, but differentiated by characters which will not allow them to be conjoined. We find that there are three characters which seem to belong without exception to the *Adelia*, viz. the tarsi tomentose beneath, their penultimate joints subbilobed, and the eyes transverse, narrow, and more or less impinged on by the antennary ridges; a secondary character, because there are cases in which it be-

* Trans. Linn. Soc. xii. p. 420.

comes scarcely recognizable, is the emarginate apex of the prothorax. The subbilobed form of the tarsi is the most permanent of all, and is absent from none of the new genera here recorded. The mentum and lower lip seem subject to considerable modifications; but, after the examination of those of several species, I think it would be unsafe to depend on them alone for generic characters. The subjoined tabular arrangement will give an idea of the diagnoses of the genera:—

Tarsi tomentose beneath.
  Eyes narrow, transverse.
    Anterior tarsi with the three intermediate joints transverse. *Adelium.*
    Anterior tarsi with the three intermediate joints narrow and obconic in the female .... *Apasis.*
  Eyes nearly round.................................... *Brycopia.*
Tarsi pilose beneath.
  Prothorax emarginate at the apex .... *Dystalica.*
  Prothorax not emarginate at the apex.
    Eyes round.. *Dinoria.*
    Eyes transverse, narrow .... *Licinoma.*

Adelium plicigerum.

A. nigrum, parum nitidum; prothorace late transverso, marginibus foliaceis, disco longitudinaliter plicato; elytris fusco-cupreis, breviter obovatis, interrupte striatis.

Hab. Queensland.

Black, slightly nitid; head irregularly punctured; two transverse wrinkled impressions above the clypeus; prothorax short, the sides strongly rounded, the foliaceous margins very distinct, the disk marked with fine longitudinal, irregular, raised lines; scutellum broadly triangular; elytra of a clear brownish copper-colour, shortly obovate, sharply striate, the striæ interrupted, the alternate intervals between them slightly raised, epipleuræ with scattered punctures; body beneath and legs dark pitchy, impunctate; prosternum and corresponding portion of propectus elevated; antennæ black, the outer joints obconical, the last ovate. Length 8 lines.

A very distinct species, having the outline of *A. auratum*, but at once distinguished from all other *Adelia* by the sculpture of the prothorax.

Adelium œrarium.

A. viridi-æneum, subnitidum; prothorace transverso, marginibus haud foliaceis, disco creberrime punctato; elytris interrupte costatis.

Hab. Darling Downs.

Greenish bronze, rather nitid; head and prothorax closely punctured, the punctures varying in size and shape, and frequently confluent, the latter transverse, well rounded at the sides and without foliaceous margins; scutellum small, triangular; elytra rather short, the sides but slightly rounded, irregularly costate, the costæ more or less interrupted, the intervals irregular but scarcely punctured, epipleuræ strongly punctured; body beneath dark glossy green, nearly glabrous, but the last abdominal segment punctured; legs and antennæ dark green, clothed with short black sparse hairs, the latter with the outer joints obconic. Length 7 lines.

Allied to *A. augurale*, but more glossy, the elytra more regularly striate, without granulations, &c.

Adelium pilosum.

A. fusco-cupreum, subnitidum, pilosum; prothorace creberrime punctato, lateribus angulato-rotundatis, haud foliaceis; elytris subcostatis, irregulariter punctato-impressis.

Hab. Lachlan River.

Brownish copper, slightly nitid, everywhere clothed with short scattered erect hairs, especially on the back; head uneven between the eyes, finely punctured; prothorax transverse, closely and here and there contiguously punctured, the sides forming a rounded angle at the middle, not foliaceous, the apex only slightly emarginate; scutellum indistinct, unicolorous; elytra oblong obovate, subcostate, the intervals with two rows of irregular punctures, one of the rows with much larger and more oblong punctures than the other; epipleuræ of the elytra, and body beneath, glossy purplish black, finely punctate, or nearly impunctate; legs black, the femora glossy, with a greenish tinge; antennæ brown, the outer joints obconic, the last oval. Length 7 lines.

Adelium scutellare.

A. fusco-cupreum, subnitidum, pilosum; prothorace interrupte punctato; scutello nigro; elytris punctatis et punctato-impressis, lineisque subelevatis.

Hab. Darling Downs; Brisbane.

Brownish copper, slightly nitid, clothed with short scattered erect hairs above; head with a few small punctures, uneven between the eyes; prothorax as in the last, but the punctures fewer, scattered, and leaving here and there glabrous patches; scutellum greenish black, broadly triangular; elytra oblong, rounded at the sides, seriate-punctate, many of the punctures (two or three together) in oblong impressions, the intervals between the alternate rows slightly raised; epipleuræ of the elytra, and body beneath, glossy greenish black, the former finely punctured; legs greenish black, shining, slightly pilose; antennæ brown, with the outer joints elongate obconic, the last obovate. Length 7–8 lines.

These two species belong to the category of *A. angulicolle*, Lap., with which my *A. succisum* is probably identical.

Adelium reductum.

A. fusco-cupreum, nitidum; prothorace subtilissime punctato, haud foliaceo; elytris modice obovatis, leviter seriatim punctatis, punctis inæqualibus, interstitiis impunctatis; antennis linearibus.

Hab. Brisbane.

Brownish copper, shining; head sparingly and rather finely punctured; prothorax transverse, the sides well rounded, not suddenly contracted near the posterior angle, disk very minutely punctured; scutellum small, rounded behind; elytra not broadly obovate, seriate-punctate, the punctures small, unequal in size, some oblong or more deeply impressed, the intervals between the rows rather wide and impunctate, epipleuræ impunctate; body beneath and legs dark copper, smooth; tarsi with bright golden-brown hairs; antennæ linear, the joints elongate-obconic, pitchy black, ferruginous towards the apex. Length 5½ lines.

Adelium geniale.

A. fusco-cupreum, nitidum; prothorace subtiliter punctato, lateribus subfoliaceis; elytris late obovatis, striato-punctatis, interstitiis subtiliter punctatis; antennis linearibus.

Hab. Clarence River.

Brownish-copper, shining; head and prothorax black, finely punctured, the latter short and transverse, well rounded, broadly margined at the sides, but the margin only slightly foliaceous; scutellum transversely triangular, black; elytra broadly obovate, striate-punctate, the striæ well marked, not widely apart, the punctures small and very nearly contiguous, the intervals between the rows slightly convex and rather finely punctured, epipleuræ finely punctured; body beneath and legs pitchy black; tarsi ferruginous beneath; antennæ linear, the joints elongate-obconic, pitchy, ferruginous towards the apex. Length 6½ lines.

This species, as well as the former, belongs to the category of *A. calosomoides*, Kirby. From this the first is distinguished by its narrower form, scarcely punctate prothorax, and the larger and unequal punctures of the elytra; the second, with the same broad outline, has the elytra striated. The next species departs from the *calosomoides*-type in having the antennæ gradually thicker outward, and with shorter joints. The four species have a short curved impressed line on each side of the prothorax.

Adelium neophyta.

A. fusco-cupreum, nitidum; prothorace subtiliter punctato, haud foliaceo; elytris subanguste obovatis, striato-punctatis, interstitiis subtilissime punctulatis; antennis apice crassioribus, articulis paulo breviusculis.

Hab. Adelaide; Essendon Plains, Victoria.

Brownish copper (much darker in the Victorian example), shining; head and prothorax black, finely punctured, the latter transverse, moderately well rounded at the sides, not foliaceous; scutellum black, broadly triangular; elytra rather narrowly obovate, striate-punctate, the striæ broad and shallow, the punctures rather small and not nearly contiguous, the intervals of the striæ slightly convex and very minutely punctured, epipleuræ glabrous, nearly impunctate; body beneath and legs smooth, pitchy black, tibiæ and tarsi with ferruginous hairs; antennæ a little thicker outwardly, the joints obconic, not elongated, the third equal to the fourth and fifth together, pitchy, with scattered short hairs. Length 4½ lines.

A. brevicorne, Blessig, judging from the figure he has given*, appears to be a much broader species, with the prothorax much less narrowed at the apex; in the description the latter is said to be twice as broad as long.

Adelium ancilla.

A. cupreum, sat nitidum; prothorace subtiliter punctato, angulis posticis productis; elytris irregulariter seriatim impresso-punctatis.

Hab. Darling Downs.

Copper-brown, rather nitid; head sparingly punctured; clypeus rounded at the apex, its suture somewhat indistinct, but the groove at the base of the antennary ridges well marked; prothorax transverse, much narrower than the elytra, finely and rather remotely punctured, broad at the base, the apex narrowed, sides strongly rounded, posterior angles produced directly outwards; scutellum transversely triangular, its apex rounded; elytra broadly obovate, convex, seriate-punctate, the punctures irregularly impressed, oblong or round, here and there one, two, or three together, the intervals of the rows broad, impunctate, and more or less uneven from the impressed sides of the punctures; epipleuræ of the elytra, body beneath, and legs glossy reddish copper, sparingly and finely punctured;

* Horæ Soc. Ent. Rossicæ, fasc. i. p. 101, taf. 3. fig. 2.

antennæ more than half the length of the body, slightly thicker outwards, glossy copper at the base, gradually becoming ferruginous and opaque, third joint nearly as long as the next two together, the last joint a little larger than the preceding one, and somewhat semicircular. Length $5\frac{1}{2}$ lines.

Differs from *A. cisteloides*, Er. (?*A. helopoides*, Boisd.), *inter alia*, in its longer antennæ, and in the greater breadth of the base, and the produced posterior angles of the prothorax.

Adelium repandum.

A. cupreum, subnitidum; prothorace creberrime punctato, punctis magnis rarissime dispersis; elytris seriatim punctatis, interstitiis alternis interrupte subcostatis.

Hab. Brisbane.

Copper-brown, a little nitid; head rather finely punctured; clypeus truncate at the apex, its suture going off near the antennary ridges, no branch groove; prothorax moderately transverse, not so broad as the elytra, sides well rounded, posterior angles not produced, base emarginate, rather close to and slightly overlapping the elytra, closely and minutely punctured, a few large punctures irregularly dispersed among them; scutellum very short and transverse; elytra obovate, irregularly seriate-punctate, punctures small, not crowded, the intervals between the rows broad, the alternate ones with slightly raised interrupted lines, epipleuræ with a few minute scattered punctures; body beneath and legs dark greenish brown, very glossy, the middle of the abdominal segments finely corrugated; antennæ rather short, copper-brown, thicker outwards, third joint a little longer only than the fourth, the last ovate, much longer than the tenth. Length $5\frac{1}{2}$ lines.

A distinct species; in the closeness of its prothorax to the elytra, and also in habit, slightly approaching the genus *Coripera.*

Adelium scytalicum.

A. fusco-cupreum, pernitidum; prothorace nigro, lævissimo; elytris seriatim punctatis, punctis inæqualibus.

Hab. Swan River.

Brownish copper, very nitid; head and prothorax black, the former minutely punctured, the latter very smooth and glossy, rather transverse, the sides well rounded and not foliaceous, the base and apex of equal breadth; scutellum nearly semicircular; elytra oblong, slightly rounded at the sides, seriate-punctate, the punctures unequal in size, the intervals but very slightly convex; epipleuræ of the elytra, legs, and body beneath very smooth and glossy; tarsi ferruginous; antennæ dark brown, eighth, ninth, and tenth joints triangular, dilated on one side, the eleventh obliquely ovate, larger than the preceding one. Length 5 lines.

I have but one example of this very distinct species; it is probable that the peculiarity of the antennæ is sexual.

Adelium orphana.

A. cupreum, nitidum; prothorace subtiliter punctato; elytris striato-punctatis.

Hab. Yankee Jim's Creek, Victoria.

Glossy copper-brown; head finely punctured; clypeus very slightly emarginate at the apex, its suture moderately arched; prothorax transverse, nearly as broad as the elytra, a little rounded at the sides, minutely punctured, posterior angles not produced; scutellum transversely triangular; elytra subparallel at the sides, punctate-striate, punctures rather small and approximate, intervals of the striæ thickly punctured, epipleuræ finely punctured; body beneath and legs glossy copper; tarsi fulvous; antennæ ferruginous, gradually thicker outwards; last joint larger than the tenth, somewhat semicircular. Length $4\frac{1}{2}$ lines.

Very like an *Amara* in habit; narrower, more parallel at the sides, and more glossy than any of the others.

The three following species have a more slender form than the *Adelia* generally: the prothorax is also less transverse and only slightly emarginate at the apex, and the eyes are broader and less impinged on by the antennary ridges. The third species has the prothorax nearly as broad at the base as at the apex, while in the first two it is very much narrower. They lead to a certain extent to *Apasis*, from which, however, they are separated by the characters of their anterior tarsi.

Adelium steropoides.

A. gracile, æneum; prothorace apice parum emarginato, basi angustiore; elytris punctato-striatis.

Hab. Victoria.

Brassy, nitid; head concave and thickly punctured between the antennary ridges, the front with a slightly bilobed gibbosity; clypeus deeply emarginate; prothorax rather broader than long, the sides well rounded, narrowed at the base, very minutely punctured; scutellum triangular; elytra oblong, slightly rounded at the sides, moderately convex, punctate-striate, the punctures nearly contiguous, the intervals of the striæ narrow, convex, and impunctate; epipleuræ of the elytra, body beneath, and legs glossy copper-brown, with minute scattered punctures; tarsi and outer joints of the antennæ ferruginous. Length $6\frac{1}{2}$ lines.

Adelium ruptum.

A. gracile, piceo-fuscum; prothorace apice parum emarginato, basi angustiore; elytris æneis, striatis, striis interruptis.

Hab. Yankee Jim's Creek.

Pitchy brown, nitid; head concave between the antennary ridges, rather thickly punctured, front slightly raised between the eyes; clypeus tinged with steel-blue, deeply emarginate, the upper lip very short and narrow; prothorax slightly transverse, well rounded at the sides, narrowed at the base, very minutely punctured; scutellum rather narrowly triangular; elytra oblong, slightly rounded at the sides, a little depressed, striate, the striæ more or less interrupted, the intervals of the striæ flattish and nearly impunctate, epipleuræ indistinctly punctured; body beneath and legs dark brown, glossy; tarsi and outer joints of antennæ ferruginous. Length 7 lines.

Adelium commodum.

A. gracile, nigrum; prothorace apice parum emarginato, basi haud angustato; elytris æneis, tenuiter subpunctato-striatis.

Hab. Tasmania.

Black, subnitid; head scarcely punctured, flattish in front and above the eyes; clypeus strongly emarginate, somewhat ferruginous, as well as the upper lip; prothorax as long as broad, apex slightly emarginate, sides moderately rounded, base rather broad, but less so than the apex, the disk very slightly convex and scarcely punctured; scutellum transverse; elytra slightly rounded at the sides, finely striate, the striæ with traces of punctures only, the intervals narrow, with an indistinct punctuation; epipleuræ of the elytra, body beneath, and femora glossy reddish brown, with minute shallow punctures; tibiæ reddish ferruginous; tarsi and antennæ paler, inclining to fulvous. Length 5 lines.

Apasis.

Mentum angulis anticis rotundatum.
Prothorax apice truncatus.
Tarsi ant. in fœm. art. tribus intermediis obconicis; omnes subtus tomentosi.

The type of this genus has a very different appearance from any of the species of *Adelium*; and therefore, in the absence of any very salient differential character, I have been led to attach some importance to the peculiar form of the intermediate joints of the anterior tarsi of the female; for in the male they are transverse, as in both sexes of *Adelium**, but more dilated.

I owe my specimens, as well as all the new allied forms here described, to my kind friend Dr. Howitt, to whom I dedicate the species.

Apasis Howittii. Pl. XI. fig. 7, ♂.

A. atra, nitida; tarsis palpisque fulvis; elytris striatis.

Hab. Victoria.

Black, shining; head nearly impunctate, very hollow between the antennary ridges in the line of the clypeal suture, a transverse groove in front above the eyes; clypeus strongly emarginate, upper lip large and prominent; prothorax very glabrous, finely and sparsely punctured, about equal in length and breadth, convex, rounded at the sides, the margins with a narrow raised border; scutellum transverse; elytra oblong oval, a little broader than the prothorax, slightly rounded at the sides, striate, the striæ and the spaces between them impunctate, scutellar stria nearly obsolete; epipleuræ of the elytra, body beneath, and legs pitchy brown, very smooth and glossy; tarsi and palpi fulvous; antennæ a little thicker outwards. Length 10 lines.

Licinoma.

Mentum angulis anticis rotundatum.
Tarsi subtus leviter pilosi.
Prothorax apice haud emarginatus.

In other respects, except that the eye is broader, this genus resembles *Adelium*, with the habit of some of the smaller *Feroniæ*.

Licinoma nitida.

L. cuprea, nitida; elytris punctato-striatis; tarsis fulvis; antennis ferrugineis.

Hab. Mount Macedon, Victoria.

Copper-brown, shining, finely punctured; head convex between the antennary ridges, sparsely punctured; clypeus emarginate at the apex; prothorax nearly as long as broad, the sides slightly rounded, a little narrowed at the base; scutellum small and indistinct; elytra oblong, very moderately rounded at the sides, scarcely broader than the prothorax, de-

* The anterior and frequently the intermediate tarsi are more dilated in the males of *Adelium* than in the females.

licately punctate-striate, the intervals of the striæ flattish, sparingly punctured; epipleuræ of the elytra, body beneath, femora, and tibiæ glossy reddish brown, sparsely punctured; tarsi fulvous; antennæ ferruginous, thicker outwards, the last joint large and as long as the two preceding together. Length 4 lines.

Brycopia.

Oculi prominuli, subrotundati.
Mentum angulis anticis rotundatum.
Prothorax apice haud emarginatus.

The principal differentiating character in this genus is the prominent and nearly circular eye. The simple clypeal suture may probably also be taken as a generic character. The tarsi are closely tomentose beneath, as in *Adelium*.

Brycopia pilosella.

B. breviter et sparse pilosa; capite prothoraceque violaceo-nigris; elytris cupreis, punctato-striatis.

Hab. Mount Macedon, Victoria.

Shining above, with short erect scattered hairs; head and prothorax violet-black, coarsely punctured, the clypeal suture not sending a branch along the base of the antennary ridge; sides of the prothorax well rounded anteriorly, then contracting more gradually to the base; scutellum triangular; elytra oblong oval, coarsely punctate-striate, the intervals between the striæ impunctate, epipleuræ scarcely punctured; body beneath reddish pitchy, punctured; legs and antennæ pale ferruginous, the last joint of the latter rounded, a little larger than the preceding one. Length 3 lines.

Dinoria.

Oculi parvi, rotundati.
Tarsi subtus pilosi.
Prothorax apice haud emarginatus.

Very similar to *Brycopia*, and only to be distinguished by the pilose tarsi. The clypeal suture is also simple.

Dinoria picta.

D. cuprea, nitida; elytris marginibus fulvis.

Hab. Tasmania.

Copper-brown, shining; head coarsely punctured, the clypeus forming a prominent fold above; prothorax transverse, roughly and not closely punctured, rounded at the sides, more narrowed behind the middle, the posterior angles prominent, but not acute; scutellum narrowly triangular; elytra obovate, closely and strongly punctate-striate, the intermediate intervals more elevated, the margins of the disk and apex fulvous; body beneath and femora at the base dark glossy brown, sparsely punctured; rest of the femora, tibiæ at the apex, and tarsi clear fulvous; palpi and antennæ yellowish ferruginous, the latter a little thicker outwards, the last joint oval, nearly equal to the two preceding together. Length 3 lines.

Dystalica.

Oculi angustati.
Tarsi subtus pilosi.
Prothorax apice emarginatus, lateribus crenatus.

In habit resembling *Adelium porcatum* more than anything else in the subfamily.

Dystalica homogenea.

D. subparallela; capite prothoraceque nigris; elytris æneis, fortiter punctato-striatis.

Hab. Swan River.

Head and prothorax closely and rather coarsely punctured; clypeal suture strongly arched, sending back on each side a shallow groove terminating near the upper edge of the eye; prothorax much broader than long, convex, the sides rounded and remotely crenate; scutellum narrowly triangular; elytra oblong, the sides nearly parallel, about the width of the prothorax, strongly punctate-striate, the punctures approximate, intervals between the striæ narrow and very convex, epipleuræ coarsely and rather closely punctured; body beneath and legs greenish black, glossy, slightly punctured; antennæ with the third joint elongate, fourth to tenth equal and obconic, the last oval, not larger nor longer than the tenth. Length 8 lines.

Omolipus lævis.

O. ater, nitidus; antennis tarsisque ferrugineis; elytris subtiliter seriatim punctatis.

Hab. Cape York.

Black, shining; head and prothorax very minutely punctured, the latter transverse, well rounded at the sides, the base broader than the apex; scutellum very small, triangular; elytra shortly ovate, seriate-punctate, the punctures very small and invisible to the naked eye; body beneath and legs very glossy; the antennæ, palpi, and tarsi ferruginous; claw-joint very stout. Length 6 lines.

Omolipus gnesioides.

O. ater, nitidus; prothorace antice gibbosulo; elytris fortiter seriatim punctatis, punctis oblongis.

Hab. Port Denison.

Black, shining; head very minutely punctured, punctures somewhat scattered, much more crowded on the clypeus; prothorax also minutely punctured, somewhat compressed, and becoming slightly gibbous anteriorly, the sides moderately rounded; scutellum small, transverse, rounded behind; elytra rather narrowly ovate, seriate-punctate, the punctures oblong and strongly impressed; body beneath and legs very glossy; antennæ and tarsi black. Length 4 lines.

Omolipus (Pascoe, Journ. of Entom. i. p. 127) is allied to the European genus *Misolampus*, from which it may be at once distinguished by the presence of a scutellum and the hooked inner maxillary lobe. The species are all of an intense black colour, more or less glossy; and, in addition to the characters given of the genus, it may be stated that the claw-joint is unusually stout, and the epipleura gradually narrows posteriorly and disappears a little way from the apex. The other two species may be diagnosed as follows:—

Omolipus corvus, Pasc. *l. c.*—Ater, nitidus; prothoracis basi apice angustiore; elytris fortiter seriatim punctatis.

Hab. Brisbane*.

Omolipus socius, Pasc. (Ann. & Mag. Nat. Hist. ser. 3. ix. p. 463).—Ater, nitidissimus; prothoracis basi apice latiore; elytris fortiter seriatim punctatis, punctis distantibus.

Hab. Lizard Island.

Ectyche.

Subfamily *Amphidorinæ.*

Clypeus a fronte discretus, antice paulo rotundatus.
Tibiæ anticæ apice dilatatæ, oblique truncatæ.
Processus intercoxalis angustatus, apice rotundatus.

Head rather short, inserted into the prothorax as far as the eyes, regularly convex in front; the clypeus large, a little rounded anteriorly, separated from the front by a strongly arched suture. Eyes narrow, entire. Antennæ slightly thicker outwards, the third joint longer than the others, the fifth to the tenth more or less ovate, submoniliform, the last larger and oblong. Mentum pedunculate, trapezoidal, the anterior border slightly biemarginate; labium small, membranous, transverse. Maxillary lobes narrow, the inner hooked. Maxillary palpi

* Not Melbourne, as erroneously stated in the 'Journal of Entomology.'

large, strongly securiform; the labial short, thick, approximate at the base. Prothorax transverse, convex, apex rather slightly emarginate, sides rounded but broadly emarginate at the posterior angle, the emargination with a tooth in the middle. Elytra ovate, convex, the shoulders rounded; epipleura broad at the base, gradually narrower and almost obsolete at the apex. Femora strongly clavate; anterior tibiæ toothed along the outer margin, gradually thicker below, the apex obliquely truncate and terminating in a stout spur inwardly, the intermediate and posterior linear, the edges round their cotyloid cavities spinous; tarsi slender, setose beneath; the basal joint of the posterior moderately elongate. Prosternum abruptly elevated, rounded anteriorly and posteriorly. Mesosternum abrupt and a little excavated in front. Metasternum very short. Abdomen with the third and fourth segments membranous at their edges. Body, with the legs and antennæ, covered with long flying hairs.

After Dr. Leconte, I have taken *Amphidora* as the type of a subfamily perfectly distinct from the Adeliinæ, in which M. Lacordaire places it, although with some doubt. The subfamily forms to a certain extent an exception to the cognate groups in regard to the tarsi, the pubescence beneath being "very coarse, sometimes almost spinous;" in *Ectyche* it is completely setose (or spinous). The Amphidorinæ hitherto have been exclusively Californian and Chilian; and, notwithstanding there are so many points of agreement between the latter and the Australian beetle-faunas, it was not until after a long examination that I ventured to consider this genus one of its members. All the essential characters, however, are the same, the intercoxal process, very broad in *Amphidora* itself, is considerably less so in *Stenotrichus*; and we have seen that the vestiture of the tarsi is variable.

I owe my specimen to the Rev. George Bostock, of Freemantle.

Ectyche erebea. Pl. XI. fig. 1.

E. oblonga, nigra, opaca; elytris striato-punctatis, interstitiis crebre punctatis.

Hab. Freemantle.

Black, opaque, everywhere above covered with long, erect, slender, black hairs; head, upper lip, and prothorax closely and finely punctured; scutellum minute, punctiform; elytra about three times the length of the prothorax, striate-punctate, the intervals closely and rugosely punctured; breast glabrous, closely punctured; abdomen coarsely punctured, hairy. Length 2 lines.

The following species is closely allied to *Ectyche*, but differs in the character of the tibiæ, which are all of the same form and toothed (or rather, perhaps, shortly spined) externally. It is a much smaller species; and my specimen, which I owe to Mr. Odewahn, of Gawler, having been carded, the gum (?) used has such a tenacious property that it is impossible to get rid of it so as to be able to examine the different organs satisfactorily. I record it here principally to call the attention of Australian entomologists to the subject. The occurrence of two such closely allied species so far apart suggests the probability that these are by no means such isolated forms as they now appear to be. It is not unlikely that they are ants'-nest insects.

Ectyche? nana.

E.? breviter ovata, nigra, opaca; elytris subnitidis, crebre punctatis, interstitiis rugosis.

Hab. Gawler.

Shortly ovate, opaque black, but the elytra slightly glossy, covered above with long black erect hairs; head and prothorax finely and closely punctured; clypeus not distinct from the front; prothorax transverse, convex, rounded at the sides and anterior angles, the posterior acuminate; scutellum inconspicuous; elytra scarcely broader than the prothorax, subnitid, the punctures mostly irregular, or with slight indications of rows, crowded, the intervals rugose; body beneath dark brown, closely punctured; antennæ and legs ferruginous; tibiæ slightly compressed, gradually dilated downwards, the outer edge shortly spined; tarsi with longish hairs beneath. Length $1\frac{3}{4}$ line.

BRISES.

Subfamily CŒLOMETOPINÆ.

Caput ad oculos retractum.
Maxillæ lobo interiore mutico.
Prothorax lateribus foliaceis.

Head transverse, inserted into the prothorax as far as the eyes; antennary ridges dilated; clypeus broad, separated from the front by a slightly arched line, strongly emarginate in front. Eyes transverse, entire. Antennæ small, thicker outwards; third joint elongate; fourth, fifth, and sixth obconic; seventh to the tenth submoniliform, the last obovate. Mentum, as well as the labium, transverse, broader and truncate anteriorly. Maxillary lobes small, the inner short and unarmed. Palpi gradually thicker outwards; the maxillary with a short basal joint, second as long as the two following together, the last narrowly triangular; the labial with a basilateral insertion. Prothorax transverse, the apex strongly emarginate, sides foliaceous and recurved, disk scarcely convex, the base subtruncate, with the posterior angles narrowly produced. Elytra shortly ovate, broader than the prothorax at their base, shoulders round; epipleuræ gradually narrowing posteriorly. Legs rather feeble; femora slightly thickened, the anterior with trochanters; tibiæ linear, shortly spurred; tarsi clothed beneath with long, stiff hairs, the middle and posterior with the claw-joint as long, or nearly as long, as the preceding joints together. Prosternum elevated, produced above. Mesosternum V-shaped. Metasternum short. Intercoxal process narrowly triangular, obtuse anteriorly. Abdomen with the fourth segment very short, and with the third incurved at the sides.

This is another of those special forms in which Australia is so prolific; and therefore there is little to be said respecting its affinities. As may be supposed, it differs in some respects from the characters of the Cœlometopinæ as laid down by M. Lacordaire. Many species of this subfamily are Californian, where, according to Dr. Leconte, they are found under the bark of trees. We are ignorant of the habits of the Australian species.

Brises trachynotoides. Pl. XI. fig. 5.

B. nigro-fusca, opaca; elytris granulatis, punctatis, singulis bicostatis.

Hab. Champion Bay.

Opaque blackish brown; head and prothorax finely and very closely granulate, the granulations more or less confluent; scutellum transverse, pointed at the tip; elytra moderately convex, irregularly punctured, with the intervals granulate, each elytron with two very marked costæ not reaching to the apex; body beneath pitchy brown, finely but obscurely punctured; antennæ and legs dark ferruginous, covered with scattered stiffish hairs. Length 7½ lines.

Asphalus.

Subfamily *Cœlometopinæ.*

Caput ad oculos retractum.
Maxillæ lobo interiore hamato.
Tarsi omnes art. ultimo cæteris simul sumptis longiore.

Head transverse, inserted into the prothorax as far as the eyes; clypeus separated from the front by an arched line, slightly emarginate anteriorly; labrum broadly transverse, porrect. Eyes transverse, nearly entire. Antennæ rather short, gradually thicker outwards, the third joint a little longer than the second and fourth, and all, as far as the seventh, obconic; eighth, ninth, and tenth broader and shorter, the last larger than the preceding, round and a little depressed. Mentum shortly pedunculate, hexagonal, winged *; labium very transverse, subtrilobed. Maxillary lobes—inner narrow, gradually terminating in a strong hook; outer short, broad, somewhat triangular. Maxillary palpi stout, the last joint securiform; labial short, last joint large, cup-shaped. Prothorax convex, broader than long, sides rounded, terminating posteriorly in a strongly produced acute angle; apex deeply and broadly emarginate, base bisinuate. Elytra ovate, as broad as the prothorax, convex; epipleuræ entire, gradually narrowing from the shoulder to the apex. Legs stout, the posterior longest; femora gradually thickened, furnished with trochanters; tibiæ shortly spurred, intermediate and anterior arched; tarsi short, entire, the claw-joint longer than the rest together. Prosternum broad, produced behind. Mesosternum broadly V-shaped. Metasternum very short. Intercoxal process small, quadrate. Abdomen with the third and fourth segments strongly incurved at the sides.

In habit resembling *Pedinus*, with which I at first thought this genus might possibly be connected; but its true place is with the Cœlometopinæ. Mr. F. Bates has already placed his two Australian genera *Hypaulax* and *Chileone*, dismembered from *Nyctobates*, in this subfamily; but these are very different in appearance from *Asphalus*. There is a considerable depression on the throat of the species here described, which represents the grooves of *Hypaulax* and *Cœlometopus*. The lower lip is also remarkable, inasmuch as the central lobe appears to be corneous, whilst the lateral ones are membranous.

Asphalus ebeninus. Pl. XI. fig. 3.

A. aterrimus, nitidus, lævis; elytris leviter punctato-striatis.

Hab. Clarence River.

Deep black, smooth and shining; antennæ and tarsi ferruginous; head and prothorax very minutely punctured, the latter with the sides rather more broadly margined anteriorly than posteriorly; scutellum very short, transverse; elytra very convex, faintly punctate-striate, the epipleura at its junction

* Mr. F. Bates (Trans. Ent. Soc. 1868, p. 259) proposes by this word to designate that "peculiar form of mentum composed of a central portion large and convex and two smaller flat pieces (wings) situated on each side at the back." These wings appear to be the "lateral lobes" of Dr. Leconte. The presence of these lobes differentiates *Nyctobates* from *Iphthimus*.

with the disk forming a prominent line, especially anteriorly; body beneath more or less finely corrugated. Length 8 lines*.

Promethis.

Subfamily *Tenebrioninæ.*

Caput exsertum, pone oculos collo cylindrico contractum.
Prothorax angulis anticis productis, rotundatis; marginibus integris.
Tibiæ haud calcaratæ; *tarsi* postici validi, breviusculi.

The type of this genus is "*Upis* (*Iphthimus*) *angulatus*," Er.†, a species remarkable for the bearded mentum of its males—a peculiarity which does not appear to be anything more than specific. This genus is differentiated both from *Upis* and *Iphthimus* by the form of its prothorax, and its entire margins when compared with the latter,—to which, as a secondary character, may be added the sculpture of its elytra. The first of the two species described below has been long known in collections; and in my own it formerly stood as a *Baryscelis*, an unpublished name of Dr. Boisduval. *Iphthimus niger*, Blessig, appears to be in some respects intermediate between the two following.

Promethis lethalis.

P. nigra, subnitida; prothorace basi angustiore; elytris postice latioribus, fortiter punctato-striatis, interstitiis convexis.

Hab. Queensland.

Black, shining; head minutely punctured; clypeus slightly emarginate at the apex, separated from the front by a fine transverse line bent downwards at the sides; prothorax very finely punctured, longer than in *P. angulata*, gradually narrowing towards the base, strongly canaliculate on the disk, with two impressed spots on each side; scutellum semicircular; elytra much broader than the prothorax at the base, and gradually widening posteriorly, rounding towards the apex, deeply punctate-striate, the punctures indistinct, the intervals raised and very convex; beneath glossy black; first three segments

* Mr. F. Bates, as we have already noticed, having withdrawn several species previously placed with *Nyctobates*, to form his two genera *Hypaulax* and *Chileone*, which he places in Cœlometopinæ, it will be necessary to constitute another for my *N. feronioides*. This genus, which I propose to name *Hydissus*, differs essentially from both the above in having the penultimate joint of all the tarsi subbilobed; it has no grooves behind the mentum; and the epipleural line terminates at the shoulder, this raised and strongly marked line, which in *Hypaulax* is continuous with the basal, being interrupted, the basal line turning backwards and running down for a short distance inside and parallel to the other.

† Wiegmann's Archiv, 1842, i. p. 174. It is found in Victoria as well as in Tasmania.

of the abdomen finely and thickly punctured; legs pitchy; antennæ ferruginous, scarcely extending to the middle of the prothorax. Length 13 lines.

A much larger species than *P. angulata*, but with shorter antennæ proportionally, more nitid, a longer prothorax contracted behind, and strongly striated elytra, which are considerably broader posteriorly. In the following species the elytra are nearly parallel, and the prothorax has the apex and base of the same breadth.

Promethis quadricollis.

P. nigra, subnitida; prothorace transversim subquadrato; elytris subparallelis, punctato-striatis, interstitiis modice convexis.

Hab. Swan River.

Resembles the last, but with head and prothorax much less finely punctured, the latter very much more transverse, not narrower at the base, slightly canaliculate; elytra nearly parallel at the sides, punctate-striate, the striæ broad and shallow, the punctures large, intervals of the striæ moderately convex; abdomen very minutely punctured, the second and third segments with a series of short longitudinal ridges at the base. Length 9 lines.

It will be necessary to form a new genus for the reception of *Upis cylindrica*, Germ.*, which, as M. Lacordaire justly observes, is more related to *Menephilus* than to *Upis*. It is a very distinct form, for which I propose the name of

Œctosis.

Oculi angustati, infra acuti.
Prothorax angulis posticis rotundatis.
Epipleura postice defecta.

It is a less depressed form than *Menephilus*, and has on each side between the base of the mandible and the eye a prominent fold, as in *Iphthimus*; and it is this apparently which gives the latter its peculiar form. The prosternum is recurved behind, and terminates in a short triangular process. The absence of the epipleura towards the apex is also characteristic of *Dechius*, Pasc.†, another Australian genus of this subfamily, but which is notwithstanding more allied to *Tenebrio*, as it appears to me, on account of its spurred tibiæ. My specimen is from the Darling River.

* Linn. Entom. iii. 198.

† Journ. of Entom. ii. p. 455. Mr. F. Bates (Trans. Ent. Soc. 1868, p. 265) contradicts my statement as to the absence of the hook on the internal maxillary lobe of *Dechius aphodioides*. This part has since been examined by Messrs. Smith and C. Waterhouse, of the British Museum, who agree with me that it does not possess a vestige of such a peculiarity.

Meneristes.

Subfamily *Tenebrioninæ.*

Tibiæ calcaratæ; *femora* incrassata.

This genus differs only in the above characters from *Menephilus*, Muls. The type I have received from Dr. Howitt, under the name of "*Baryscelis laticollis*, Boisd." That genus was never published; but, according to a note of M. Lacordaire's, it belongs to the Cœlometopinæ, and therefore cannot be this. In the British Museum the same species is labelled "*Tenebrio australis*, M'L. (Boisd.)." The descriptions of Dr. Boisduval in the 'Voyage de l'Astrolabe' are very short, varying from five Latin words to five-and-twenty, the latter exceptional; and these are followed by a strictly literal French translation. With the vague ideas of genera common thirty years ago, and even later, the generic name affords scarcely any clue, and it is only by a sort of tradition that we are able to accept at all many of Dr. Boisduval's names*. The types, many of them at least, seem to have been lost. I retain the name of "*laticollis*," as it is sufficiently distinctive, and, should it hereafter be found to be the species so designated by Dr. Boisduval, there will be no alteration.

Meneristes laticollis. Pl. XI. fig. 2.

M. niger, nitidus; sutura clypeali valde impressa; prothoracis angulis anticis et posticis productis; tibiæ anticæ valde arcuatæ.

Hab. Victoria.

Black, shining; head glossy, finely and closely punctured; clypeal suture arched, strongly impressed; prothorax minutely punctured, anterior angles produced, subacuminate, posterior terminating in a long acute angular process; scutellum curvilinearly triangular; elytra nearly parallel, coarsely punctate-striate, punctures slightly quadrate, very close together, intervals between the striæ very narrow; body beneath and legs glossy black; anterior tibiæ equal in length to the intermediate, strongly curved. Length 9 lines.

Meneristes intermedius.

M. niger, nitidus; sutura clypeali impressa; prothoracis angulis minus productis; tibiis anticis (♀) vix arcuatis.

Hab. Gawler.

Black, shining; head opaque, finely punctured; clypeal

* Under the name of *Mallodon australis*, Boisd., for example, M. Lacordaire says he found "several species, belonging to different genera, in collections." (Gen. viii. p. 111, note.)

suture arched, moderately impressed; prothorax as in the last species, but the angles, especially the posterior, less produced; scutellum triangular; elytra broader in proportion, less glossy, and less strongly punctured; body beneath black, shining; legs glossy reddish pitchy; anterior tibiæ in the male strongly arched; shorter, and nearly straight, at least on the outer edge, in the female; the former only with the tarsi dilated. Length 8 lines.

A stouter insect comparatively than the last, and differing in the form of the anterior tibiæ. In both species there is a deep fovea on each side of the prothorax at the base.

Meneristes servulus.

M. niger, nitidus; sutura clypeali vix impressa; prothoracis angulis posticis productis (♂); tibiis anticis in mare longioribus, arcuatis, apice penicillatis.

Hab. "Tasmania to Queensland."

Black, shining; head glossy, very minutely punctured; clypeal suture marked by a smooth arched line only; two small impressed curved lines between the eyes; prothorax longer in proportion to the width, very smooth, anterior angles rounded, the posterior narrowly produced in the male; scutellum triangular; elytra narrower anteriorly and not much broader than the prothorax at the base, the greatest width a little distance from the apex in the male, the base broader in the female, punctate-striate as in the last; body beneath and legs pitchy; anterior tibiæ in the males much longer than the rest, strongly arched, and having a tuft of golden hairs at the apex; in the females shorter, less arched, and without the tuft at the apex. Length $6\frac{1}{2}$ lines.

EPHIDONIUS.

Subfamily *TENEBRIONINÆ.*

Caput exsertum, rhomboideum, pone oculos elongatum.
Tibiæ fortiter calcaratæ; *tarsi* subtus subnudi.

Head exserted, rhomboidal, broad in front, gradually narrowed behind the eyes; clypeus widely emarginate at the apex, its suture nearly straight, except at the sides. Eyes small, rather narrow, transverse. Antennæ slender; third joint longest; fourth, fifth, and sixth shorter, obconic, nearly equal in length; seventh to tenth more or less obovate; the last ovate, pointed, scarcely longer than the tenth. Mentum trapezoidal, broadest and truncate anteriorly. Labium corneous in the middle, with two rounded membranous lobes at the sides; its palpi elongate, a little thicker outwards. Maxillæ with two short lobes, the inner narrow and unarmed; maxillary palpi with the first joint very short, second long, the last obconic, truncate at the apex. Prothorax transverse, slightly emarginate anteriorly, anterior angles not produced, sides rounded, without a raised border, and terminating in well-marked posterior angles, base broad and subtruncate. Elytra ovate, slightly convex, broader than the prothorax. Femora sublinear; tibiæ strongly spurred; tarsi slender, gradually longer from the anterior, nearly naked beneath, except a few setæ at the tips. Prosternum narrow, declivous; mesosternum V-shaped; metasternum moderately elongate. Abdomen with the fourth segment very short, its sutural edge arched.

The general appearance of the insect forming the type of this genus is more nearly that of *Iphthimus italicus* than any other known to me. The vestiture of the tarsi, however, and the presence of spurs to the tibiæ is sufficiently distinctive; the former character, indeed, may lead to the doubt of its belonging to the Tenebrioninæ at all; but in this case I believe it is exceptional.

I am indebted for my specimens to Johannes Odewahn, Esq.

Ephidonius acuticornis. Pl. XI. fig. 6.

E. niger, capite prothoraceque nitidis; elytris opacis, seriatim et leviter punctulatis.

Hab. Gawler, South Australia.

Black; head and prothorax finely punctured, shining, the former from the clypeus backwards smooth and convex; base of the prothorax close to the elytra, but below their level; scutellum triangular; elytra finely seriate-punctate, the suture thickened into a line, three other lines also on each elytron placed on the intervals of every four rows of punctures; body beneath and legs shining pitchy brown; antennæ reddish brown. Length 9 lines.

TANYLYPA.

Subfamily *BORINÆ.*

Oculi transversi.
Maxillæ lobo interno inermi.
Tibiæ arcuatæ.

Head exserted, small, gradually narrower behind the eyes; clypeus separated from the front by a short arched suture. Eyes rather narrow, transverse. Antennæ a little thicker outwards; the basal joints more or less obconic, the eighth to the tenth transverse, the last rounded. Mentum trapezoidal; labium short, transverse, corneous. Maxillary lobes short, the inner narrow, unarmed, the outer broadly triangular. Maxillary palpi stout, broadly dilated upwards; the labial distant at the base, with the last joint very large, cup-shaped, obliquely truncate. Prothorax longer than broad, narrowed and truncate at the apex, sides rounded, posterior angles acute, the base truncate. Elytra elongate, parallel, not broader than the prothorax, rounded at the apex; epipleura narrow and nearly equal throughout, but expanding as it ascends to the shoulder. Femora stout; tibiæ strongly curved; tarsi short, the last joint as long as the rest together. Anterior coxæ transverse. Prosternum slightly elevated, rounded behind. Mesosternum short, V-formed. Metasternum elongate. Intercoxal space very narrow, short, triangular. Abdomen with five segments, all nearly equal in length and with corneous edges.

Allied to *Boros*, Herbst, a genus placed with the Pythonidæ by Dr. Leconte*, on account of its anterior cotyloid cavities being open behind. The same authority also credits them with conical anterior coxæ. I do not know the American species; but in *B. Schneideri* they are slightly transverse †, and they are still more so in the present genus. Although I cannot agree to separate *Boros* from the Tenebrionidæ, as Dr. Leconte and M. C. G. Thomson have done, yet it seems desirable to keep them apart from *Calcarinæ*, with which they do not appear to be very intimately connected.

Tanylypa morio. Pl. XI. fig. 4.

T. nigra, nitida; prothorace basi trifoveolato; elytris seriatim punctatis.

Hab. Tasmania.

Black, shining; head and prothorax very finely punctured, the latter with three very distinct foveæ at the base; scutellum semicircular; elytra rather strongly punctured in closely approximate rows, the sutural row diverging near the scutellum, a very short one taking its place; body beneath and legs dark pitchy, smooth and shining; antennæ glossy ferruginous; fore tibiæ with a delicate fringe of hairs within. Length 6 lines.

EXPLANATION OF PLATE XI.

Fig. 1. *Ectyche erebea*: *a*, mentum &c.; *b*, maxilla &c.
Fig. 2. *Meneristes laticollis.*
Fig. 3. *Asphalus ebeninus*: *a*, maxilla; *b*, mentum.
Fig. 4. *Tanylypa morio*: *a*, mentum; *b*, maxilla; *c*, fore leg.
Fig. 5. *Brises trachynotoides*: *a*, mentum; *b*, maxilla.
Fig. 6. *Ephidonius acuticornis*: *a*, mentum; *b*, maxilla.
Fig. 7. *Apasis Howittii* (♂).

* Class. Col. N. Am. p. 255.

† M. C. G. Thomson characterizes them as "ovato-globosæ" (Skand. Col. vi. p. 326).

XXII.—*On the Male and Female of the genus* Lernæa *before the commencement of the so-called Retrograde Metamorphosis.* By Dr. A. Metzger *.

In March 1866 I discovered, on the branchiæ of *Platessa flesus*, besides *Chondracanthus cornutus*, which is usually to be found upon them, a new and extraordinarily elegant Copepod, about one line in length. Subsequent investigations, however, have convinced me that this is to be met with in abundance, at almost all seasons of the year, upon every large specimen of the above-mentioned species of fish, but that, from its small size and concealed position, it easily escapes observation. In fact, on the first glance at the branchiæ, we observe nothing that could betray the presence of a parasite, except some small dark points and streaks; and it is only when the branchiæ are cut out and put into water, so that their individual laminæ are separated from each other, that the little parasite is seen, with the free extremity of its body floating at the apices of the branchiæ.

On a careful examination of the different individuals, I could at once distinguish two different forms—a shorter and stouter form, and a slenderer one with an elongated abdomen. My supposition, that in these sexual distinctions were to be seen, was speedily confirmed by the discovery of numerous united pairs. In every such pair the shorter form was always affixed at the base of the abdomen of the slenderer form by means of its strong clasping antennæ. I could never find females with egg-threads, notwithstanding my looking for them repeatedly until late in the autumn. As to the systematic determination of this Copepod, which apparently belonged to the Dichelestiinæ, I consequently remained in doubt.

At last, in April of the following year, I found, contrary to my expectation, the same little animal upon the branchiæ of a *Cyclopterus lumpus* of not very large size,—and at the same time, on the branchial arches of the same fish, four specimens of a young *Lernœa*, recognizable at the first glance by three cylindrical horns situated on the upper part of the trunk, and also by the abdomen, which had already become somewhat horny and twisted into a sigmoid form; but how great was my astonishment when, on closer examination, I detected all the characters of my parasite in these *Lernœœ*! The structure of the antennæ and limbs, the peculiar fine transverse striation of the abdomen, &c. were so perfectly accordant that I could have no doubt that the two forms belonged to each other. As

* Translated by W. S. Dallas, F.L.S. &c., from the 'Archiv für Naturgeschichte,' 1868, pp. 106–110.

the males of *Lernœa*, and, indeed, of the Penellinæ in general, so far as I am aware, are not yet known *, and, except the completely transformed females, only the first *Nauplius*-stage and some, so-called, young forms are described †, the stage of development now to be communicated, in which *in all probability copulation takes place*, will not be entirely destitute of interest.

Male form.—Cephalothorax (head and first thoracic segment) longer than broad, exceeding one-third of the whole length of the body, circularly bowed in front, truncated behind. In the middle of the anterior part of the cephalothorax there is a pretty large eye-spot with two spherical lenses. Second, third, and fourth thoracic segments free, gradually diminishing in breadth, and together shorter than the cephalothorax. Genital segment increasing in breadth towards the apex, nearly as long as the three free thoracic segments. Caudal piece divided by a slight lateral constriction into two unequal sections, of which the last and largest bears two small processes (*furca*), each terminating at the apex with three longer bristles.

First pair of antennæ slender, indistinctly jointed, fringed in front with fine hairs, and terminating with bristles.

Second pair of antennæ powerful, three-jointed ; second joint with a tooth-like process, against which the sickle-shaped terminal joint strikes.

In the moveable buccal cone is placed the cylindrical sucking-tube, terminating in a ring armed on its whole circumference with an elegant row of little curved teeth ; this is followed by two rings open in front (ventrally), each formed by two semicircular arcs, which appear to be articulated to a band running down to the basal framework of the buccal cone. Externally, on each side of the base of the cone, are the palpi, which bear at their extremity two long and stiff bristles, and, on a lateral basal enlargement, a shorter one.

The first pair of maxillipedes three-jointed ; basal joint large and with a dentiform process in front on the outer side ; second joint obliquely dilated towards the extremity ; third joint claw-like, slightly curved. The second and third joints together are not very unlike the picture of a pointing hand.

Second pair of maxillipedes rather stronger, consisting of a large oval basal joint and a long hook-shaped claw-joint.

First and second pairs of natatory feet *biramose*, the rami two-jointed, last joint with long natatory bristles.

* See Claus, "Ueber die Familie der Lernæen," Würzb. naturw. Zeitschrift, Bd. ii. p. 17.

† Kröyer, Naturh. Tidsskr. i. p. 293 ; and Van Beneden, Recherches sur la faune litt. de Belgique (Crustacés), p. 130, pl. 19. figs. 5–12.

Third and fourth pairs of natatory feet *uniramose*, in other respects agreeing with the preceding.

The entire little animal, which is scarcely more than $\frac{3}{4}$ line in length, is translucent, and of a peculiar bluish-grey colour, with the exception of some particular parts of the body, which contain a pigment varying from dark violet to blue.

The *female form* is distinguished from the male (1) by the want of the second pair of maxillipedes, and (2) by the elongated, nearly uniformly cylindrical and slightly bent abdomen, in which the genital segment and caudal piece are not distinguishable externally. The two apical processes (*furca*) are excessively minute, and beset only with two or three short bristles. The whole surface of the abdomen also shows an extremely fine and regular transverse striation, in consequence of which the margins of the abdomen, when slightly pressed with a glass cover, appear as if denticulated.

The natatory feet, the first pair of maxillipedes, the buccal cone, and the antennæ do not differ from those of the male; but whilst in all the male individuals which were found united with females the genital segment was swelled, and presented a spherical inflation at each of the two spots where the genital apertures are situated, nothing of the kind, indicating the commencement of the business of generation, was to be observed in the females. Even in further advanced individuals, already in course of retrograde metamorphosis, in which the cephalothorax and the three free thoracic segments were no longer distinguishable, but which still all possessed the two pairs of antennæ, the pair of maxillipedes, and the four pairs of natatory feet, with the basal joint somewhat abbreviated however, and which also showed some of the above-mentioned pigment-spots, no inflation of the abdomen by sexual materials was observable. The abdomen was only a good deal elongated, strongly twisted into a sigmoid form, and even showed still under the thin horny coat the transverse striation so characteristic of the female form. Nevertheless I believe that *copulation takes place* in the stage of development above described, in favour of which we have not only the union of the two sexes so frequently observed by me and always taking place in the same manner, but also the circumstance that males have never been found even upon the forms of *Lernœa* in course of transformation and not yet furnished with egg-threads. After the completion of copulation the female quits the branchial laminæ of its host, and seeks instead of them the branchial arches of the same or of some other fish. It is only here that the horns, which effect a permanent fixation, and which, like the adherent organ of *Lernœopoda*, represent the second pair of maxillipedes of the male, are developed, and the limbs, which are then no longer called into action, are gradually aborted and disappear. The male, on the other hand, will not be subject to such a transformation; for "his task is always that of vigorous sexual activity—above all, to seek the female for the purpose of copulation" (Claus, 'Freilebende Copepoden,' p. 7); he consequently *never* acquires the characters established for the family and genus. It follows, however, from the above that both sexes of the *Lernæa* here in question show a grade of development such as we find again only among the Dichelestiinæ, and such as the *Chondracanthæ* and *Lernæopodæ* do not attain, which evidently may be of some importance in connexion with the systematic position of the *Lernææ*.

XXIII.—*Observations on the Group of the Mole-Rats.* By M. A. Milne-Edwards*.

The conditions of existence under which animals are placed generally coincide with certain peculiarities of organization, and tend to modify the external form of these creatures to fit it for the necessities to which they are subjected. Thus we see, in nearly all the orders of Mammalia, natatory species side by side with terrestrial species, and among the latter there are often some which lead a subterranean life. These biological conditions betray themselves outwardly by organic modifications, which, whilst mutually presenting a great similarity, are realized by animals of very different types. Analogies which depend upon the modification of the animal machine to a special mode of existence may be observed not only between species belonging to different orders, but also between species of the same order and of different families. Frequently an exaggerated importance has been ascribed to them, and certain peculiarities have been taken for dominant characters which, without having any influence upon the organic plan of the animal, had merely modified its external appearance. The species which form the subject of this memoir are a fresh proof of this.

Most zoologists have combined in a single group those Rodentia which lead a subterranean life, which dig deep galleries by means of their claws, and feed upon the roots and bulbs of plants. In their general aspect these animals have something that reminds one of the Moles: their body is thick, more or less cylindrico-conical, and borne upon short and robust limbs; and their eyes are often scarcely open. On

* Translated from the 'Comptes Rendus,' August 17, 1868, tome lxvii. pp. 438–441.

account of these resemblances they have been called Mole-Rats. They are distributed into a certain number of genera, such as *Bathyergus*, *Georychus*, *Heliophobius*, *Spalax*, *Elobius*, and *Siphneus*.

The group thus constituted is far from being natural, and includes essentially distinct creatures. Thus I propose to show that the *Siphnei*, commonly called "Zocors," really differ much more than is generally supposed from the other genera which I have just cited, and in the midst of which they have been arranged. Their true place is beside the Voles (*Arvicolæ*).

The genus *Siphneus* was established in 1827 by Brantz to receive a species from Siberia, described by Laxmann under the name of *Mus myospalax*, and figured by Pallas under that of *Mus aspalax*. This new division was placed in the family Cunicularia, by the side of *Ascomys*, *Spalax*, and *Bathyergus*.

The zoologists who have subsequently occupied themselves with the study of the Rodentia have retouched this classification; but for the most part they have placed the genus *Siphneus* by the side of *Spalax*; and F. Cuvier even united the species in a single genus. He describes and figures the dentary system, which really seems to authorize some such approximation; but I have been able to assure myself that the skull which served as a term of comparison for the zoologist just cited did not belong to the Zocor or *Siphneus myospalax* (Laxmann), but was derived from a Zemmi, *Spalax typhlus* (Pallas), bearing a false determination. It was therefore not surprising that so great a resemblance should exist between the teeth figured by F. Cuvier, since they were derived from the same species, and from individuals which only differed from each other in age.

This error, the existence of which no naturalist has suspected, has been of great importance; for it established close relations between the Zemmi and the Zocor (that is to say, between the genera *Spalax* and *Siphneus*)—an approximation which, since that period, has been admitted in all treatises on zoology, and in quite recent works we still see the characters of the dentition of *Spalax* reproduced as belonging to *Siphneus*.

M. Brandt, of St. Petersburg, is the only person who has given an exact representation of the skull of this latter Rodent; but he persisted in placing it side by side with the Zemmis and the genera *Rhizomys* and *Bathyergus* in the family Spalacidæ. In these latter forms the teeth are arranged according to the same plan; they are always furnished with roots, so that their growth is not continuous, and the form of the folds of the enamel is much modified according to the greater or less degree in which the tooth is worn. It is only necessary to follow these changes to become convinced that the supposed Zocor figured by F. Cuvier and by M. P. Gervais is only a young Zemmi, and that the true Zemmi of these authors is an adult or even aged individual of the same species.

The molars of *Siphneus* belong to quite a different type. There are three pairs of them in each jaw; but they never exhibit roots, whatever be the age of the animal; consequently their growth is unlimited, and their form does not become modified, whatever be the degree of wearing of the tooth. They are formed by more or less triangular prisms alternating in an irregular manner, and resemble those of the *Arvicolæ* in all the essential features of their construction. This approximation, moreover, agrees very well with the other characters of the Zocors and the Voles.

These considerations lead me to refer the genus *Siphneus* to the little division of the *Arvicolinæ*, of which it may be regarded as an essentially fossorial derivative type, modified in its external form in consequence of the conditions in the midst of which it has to live. The genus *Elobius* (*Mus talpinus*, Pall.) must take its place in the same family. On the contrary the Zemmis (genus *Spalax*) belong to the group of Mole-Rats properly so called, of which *Bathyergus* and *Georychus* are the principal representatives.

Hitherto only a single species of *Siphneus* has been known; this came from Siberia. The Museum of Natural History has just received two others, completely unknown to zoologists,—one of them (*Siphneus Fontanierii*) discovered in the neighbourhood of Pekin; the other (*S. Armandii*) has hitherto been found only in Mongolia. These Rodents are very difficult to distinguish by their external characters, but they may be determined at once and with certainty by the examination of their dental system. I cannot enter here into an examination of the anatomical details by means of which this end may be attained, and I shall merely refer the reader to the more complete memoir that I have prepared upon this subject.

I will add that in the caverns of Siberia bones of *Siphneus myospalax* are found, as I have been able to ascertain by the study of the specimens derived from excavations made on the banks of the Inia and Tcharysh by MM. Meynier and L. von Eichthal, which have been kindly communicated to me by the latter. In Mongolia the Abbé Armand David collected several skulls belonging to *Siphneus Fontanierii* and *S. Armandii* in alluvial deposits probably of quaternary age. At this ancient period, therefore, the geographical distribution of the species of this genus was the same as in the present day.

The Record of Zoological Literature, 1867. Volume Fourth. Edited by Albert C. L. Günther, M.A. &c. &c. Van Voorst, 1868.

We must, with our opening words in noticing this publication, congratulate the publisher and editor upon the wise step which they have taken in giving naturalists the opportunity of purchasing either the whole volume or only that portion of the 'Record' which relates to the special section of zoology in which they may be chiefly interested.

Zoologists, as a rule, are not overburdened with cash; and it has doubtless been the feeling with many that, however much they recognized the value of the 'Zoological Record' and desired to have that portion which related to the classes they were studying, they could not afford to devote thirty shillings, out of their annual sum set apart for books, for the purchase of the volume; but now such persons have it in their power to obtain what they require for one-third of that sum. This is an immense gain to naturalists, and we trust that there will be few libraries now from which these valuable analyses will be absent. The slip in this year's volume which gives us this information we print here for the information of our readers:—

"To facilitate the acquisition of these Reports, which are almost indispensable to working zoologists, it has been arranged to issue, in future, each volume in three parts, viz.:

"Part I., containing the Reports on Mammals, Birds, Reptiles, and Fishes. By Dr. Günther and Prof. Newton. Price 10*s*.

"Part II., containing the Reports on Entomology. By W. S. Dallas, F.L.S. Price 14*s*.

"Part III., containing the Reports on Mollusca, Crustacea, and the Lower Animals. By Dr. Von Martens and Prof. E. P. Wright. Price 10*s*.

"Purchasers of the entire volume will receive it in the same form and at the same price (30*s*.) as before."

In our notice of the volume of last year we expressed a hope that at the ensuing meeting of the British Association steps would be taken to renew a grant made the previous year in aid of the large expenses incurred in the publication of the Record. It must, we think, have proved most gratifying to Dr. Günther and his coeditors to witness the manner in which this question was taken up at Norwich. It was not that a grant was made, which was in itself a trifling circumstance; but the way in which the members of Section D vied with each other in their terms of eulogium on the value of the editor's labours, the manner in which all other committees applying for grants conceded the first place to the 'Record,' and desired that in the communication to the Committee of Recommendations it should be distinctly stated that it was the unanimous desire of Section D that the grant to the 'Record' should be the first entertained, and the special vote of thanks to the editors for the services which they were rendering to all students of zoology were circumstances so unusual, and marks of approbation so exceptional, that they cannot have failed to prove most gratifying to those whom it was thus intended to honour. The publication of this work is a credit to the naturalists of our country; and if it should prove that the number of really scientific workers and consequent purchasers is insufficient to defray the expenses necessarily incurred in the printing and publishing of an annual volume of this kind, then, as we have before maintained, there can be no more proper appropriation of the funds of the British Association than the voting of such a sum as shall enable the Record to be continued for the "advancement of science."

The contributors this year remain as before, with one exception: Mr. Spence Bate, who reported on the Crustacea, has resigned, and Dr. Von Martens has become his successor. He has been a most able and accurate analyser from the first, of that portion of zoological literature which relates to the Mollusca; and he appears to have most carefully and conscientiously executed the additional burden which has now been laid upon him.

On a former occasion we extracted from the 'Record' the short *résumé* of what had been written during the preceding year upon that most interesting fact, the migration and extension of the bivalve mollusk *Dreissena polymorpha* over Continental Europe. The present volume contains further notes on the same subject, and with these we conclude our brief notice of this volume, heartily wishing the editors continued success in their most useful "labour of love."

"*Dreissena fluviatilis* (Pall.) [*polymorpha*] appeared in 1864 in the Loire near Orleans and Tours, and recently at Nantes and in some smaller streams of France, and in October 1865 in the Rhone near Avignon. (J. Mabille, Journ. Conch. xv. pp. 108–110.) P. Fischer adds some other particulars, referring its appearance in the Département du Nord to the year 1838, in the Scarpe and Canal de la Deule to 1844, in the Rhone to 1856 [?], and in the Garonne to 1866. The same *Dreissena polymorpha* has been observed in the kingdom of Würtemberg, in the river Neckar at Heilbronn, by M. Drauitz, in the spring of 1867. Würtemb. naturwiss. Jahreshefte (1868) vol. xxiv. p. 44. O. A. L. Mörch persists in doubting whether this mollusk had not been living in Germany before 1820, regarding Sander's note (see Record for 1865, p. 217) as a sufficient proof (Ann. & Mag. Nat. Hist. Feb. 1867, xix. pp. 82–84)."

Annuario della Società dei Naturalisti in Modena. Modena, 1868, 8vo, pp. 206, pls. 7.

The third volume of this work has just reached this country. It contains the following papers:—

L. Gambari.—Description of the Quartz of Porretta.

C. Rondani.—Larva and Parasite of *Tischeria complanella.*—Diptera collected in South America by Prof. P. Ströbel in the years 1866, 1867.

L. Salimbeni.—The corpuscular moth of the Silkworm.

D. Ragona.—On the Ozonometric Coefficients of Humidity and Temperature.

G. Generali.—On a calculus from the Urinary Bladder of an Ox.

A. Ghiselli.—On the successful application of local Anæsthesia in a case of Lameness in a Horse caused by Rheumatism.

G. Grimelli.—Meteorological method of foreseeing and predicting Aqueous Meteors.

F. Coppi.—Notes upon some Crystallized Fossils and upon the locality in which they are found in the Modena district.

G. Canestrini.—Researches on the Labroids of the Mediterranean. —On some ancient Skulls found in the districts of the Trentino and Venice.

P. Bonizzi.—On the Reproduction of *Pholcus phalangoides,* Walck.

G. Mayr.—Formicidæ novæ Americanæ collectæ a Prof. P. de Ströbel.

E. Stoehr.—Some Observations on the Natural History of Shelly Clays.

G. Canestrini.—New Italian Arachnida.

MISCELLANEOUS.

Considerations drawn from the study of Mole-Crickets. By Samuel H. Scudder.

Mr. S. H. Scudder stated that he had recently been studying the mole-crickets with a view to their classification, and found that they were naturally divisible into two groups. For one he retained the name of *Gryllotalpa,* under which all the species had formerly been grouped; to the other he applied that of *Scapteriscus.* These two groups were separated by the following characteristics.

In *Scapteriscus* the posterior margin of the sternum of the eighth abdominal segment of the ♂ is produced into a stout prominent central tooth; in *Gryllotalpa* the margin is entire.

The mesosternal ridge of *Gryllotalpa* is prominent, and almost equally so throughout; that of *Scapteriscus* is never prominent on the anterior half of the segment, and is often limited to the posterior half, or is even obsolescent.

The fore trochanter of *Scapteriscus* is large; the free portion almost always equals the tibial dactyl in length, and is of about the same size at the tip as at the base; that of *Gryllotalpa* is proportionally small, seldom exceeding half the length of the tibial dactyl; the form is cultrate or lenticular.

Scapteriscus is furnished with only two fore tibial dactyls, both of which are moveable; *Gryllotalpa* has two moveable dactyls and a second pair which are immoveable.

With but few exceptions the hind femora of *Scapteriscus* more than equal the pronotum in length, while in *Gryllotalpa* they are always shorter than the pronotum.

In *Gryllotalpa* the length of all the hind tarsal joints taken together seldom exceeds half the width of the pronotum, while they equal its whole width in *Scapteriscus*.

The hind tarsal claws of *Scapteriscus* are clothed with short hairs nearly to the tip; those of *Gryllotalpa* have hairs only at the base.

The tegmina of *Scapteriscus*, with but few exceptions, cover, when at rest, two-thirds of the abdomen; in *Gryllotalpa* they seldom conceal more than one-half of the abdomen.

The nervures of the middle field of the tegmina in the females of *Gryllotalpa* are distant and rather irregular, somewhat resembling those of the males; in *Scapteriscus* they are approximate, regular, and straight.

The anal cerci are longer than the pronotum in *Gryllotalpa*; shorter in *Scapteriscus*.

Finally, the ninth and, sometimes, the eighth abdominal segments are furnished above, in *Gryllotalpa*, with two transverse lateral rows of long hairs directed inward, as if to keep the long folded wings in place; these are absent from *Scapteriscus*, where the wings are equally long and similarly folded.

Only one species of *Scapteriscus* has been found without the limits of South and Central America, and that (occurring in a single instance in Europe) must undoubtedly be considered an emigrant from the same warm regions; the members of the genus *Gryllotalpa*, on the contrary, are found throughout the whole world, not excluding Central and South America.

Comparing these two genera with their nearest allies, *Tridactylus*, *Cylindrodes*, &c., we find great and striking differences—differences which are extraordinary compared with those which divide *Scapteriscus* and *Gryllotalpa*: the comparatively simple fore tibiæ and the abnormal appendages which supplant the hind tarsi in *Tridactylus*, the abbreviated legs fitting into cavities in the body, and the absence of articulated appendages at the extremity of the abdomen, in *Cylindrodes*—these characteristics are far more important than the sexual sculpture of the abdomen, the ultimate neuration of the tegmina, the length of the legs, the contour of the trochanters, or the digitation of the tibiæ, which separate *Scapteriscus* and *Gryllotalpa*.

The facts cited above present two features which bear upon the question of the origin of species.

First: these little mole-crickets, so unique in their structure as to be widely separated from their nearest allies, are spread uniformly over the whole surface of the globe; but few species occur in any one place, and at least one is found in every temperate or hot region.

Now, if species originate or change from physical causes, or by "Natural Selection," why is it that under every physical condition and surrounded by every variety of antagonism possible in their habitat, this same unique structural form has sprung up all over the globe?

Again, how can such theories account for another feature (common, indeed, to all natural groups), that it is not one striking characteristic which separates *Scapteriscus* and *Gryllotalpa*, and which

"Natural Selection" might have seized upon, with reference to some special benefit, but a combination of features which have no apparent dependence upon each other, correlated, but not necessarily connected? Why should "Natural Selection," altering for its own purpose the palm of the four-fingered mole-cricket into that of the two-fingered species in South America, or developing in South America, from some previous synthetic form of mole-cricket, both the present four-fingered and two-fingered species, and in other parts of the world the four-fingered species only (destroying at the same time the primæval form all over the surface of the globe), at the same time place rows of hairs on the hinder part of the abdomen of the tetradactylate group, and none on that of the didactylate? or make the veins of the tegmina of the ♀ of one group distant and irregular, and those of the other straight and approximate? Why furnish the eighth abdominal segment of the ♂ of one with a projecting tooth, and deprive those of the others of such a prominence? Why give one long and the other short anal cerci, or clothe the hind tarsal nails of one with short hairs and leave the other naked? What have these features to do with the differences of structure we have mentioned in the palm-shaped fore leg, or in the length of the hind leg? These and similar difficulties, arising on every hand, seem to attend every derivative theory of the origin of species.—*Silliman's American Journal*, November 1868.

The Finner Whale of the North Sea.

M. G. O. Sars, the son of the well-known Professor of Christiania, has published a very interesting paper on the individual variations of the Finner Whale, in which he has compared, and formed tables of the measurements of, the eighteen specimens of the Finner Whale of the North Sea described by Sibbald, Müller, and other zoologists. He comes to the conclusion that there are six species, viz. *Balænoptera musculus*, *B. Carolinæ*, *B. gigas*, *B. laticeps*, *B. rostrata*, and *Megaptera longimana*.

The Scrag Whale of Dudley.

Mr. Cope, in the 'Journal of the Academy of Sciences of Philadelphia,' 1868, p. 222, describes the bones of an imperfect specimen of the Scrag Whale that was described by Dudley in 1725, but has not been seen by any naturalist since that period. It has a smooth throat, like the Right Whale; it has only four slender fingers at the carpus, and the bladebone of the Finner or *Balænoptera*. He proposes for it a new genus named *Agaphelus*. It is to be regretted that the cranium, cervical and dorsal vertebræ, and first ribs were carried away by the tide before the skeleton was examined. It proves a most interesting genus, intermediate in structure between the Right Whale and the Finner. It does not prove the truth of the theory of Capt. Atwoods, that the Scrag Whales "were probably specimens of the Right Whale that had been left by their mothers while young, and had grown up without parental care, which has caused a slight modification." It also shows that the Scrag Whale of the east coast of North America is not the same as the Finner of the coast of Spain, as it ought to be, according to Prof. Van Beneden's theory of the distribution of these animals.

Mr. Cope describes, as a second species of the genus, *Agaphelus glaucus*, or the Grey Whale of the coast of California. Mr. Cope thinks that *Balæna agamachuschik* of Pallas is allied to it, and he observes that "Dr. Gray has already (Cat. Brit. Mus.) indicated that this, if reliable, indicates a genus unknown to him." Two skeletons, and the baleen of a third, of the Grey Whale are known as existing in America.—J. E. Gray.

Investigation of the Organization and Development of the Dipterous genus Volucella. By Jules Künckel.

One portion of my investigation enables me to demonstrate certain unexpected facts with regard to the development of the appendages and tegumentary pieces. When we open a larva of *Volucella* we detect some small bodies grouped round the pharynx and nervous centres, and arranged symmetrically in pairs. I have ascertained that these bodies are the first rudiments of the head, thorax, and appendages of the adult *Volucella*. The two foremost masses are the embryonal parts of the pieces of the head which will form the frontal region; the second, which rest upon the brain, are the rudiments of the eyes; the third, placed upon the sides, will constitute the superior segment of the prothorax; the two following will unite to form the superior segment of the mesothorax and the wings; the fifth pair of these embryonal masses will form the dorsal segment of the metathorax and the halteres; and the three other pairs will give origin to the three inferior segments of the thorax with their appendages, the feet.

Each of these bodies consists of an aggregation of large cells held together by an envelope; the cells commence their activity during the transformation into a pupa. At the moment of the metamorphosis, there is an increase in the size of these rudiments; and the work of organization of the cells takes place with such rapidity that, as early as the second day, we may recognize the different joints of the limbs in the embryonal parts.

All these parts have an identical and very remarkable mode of development. The cells which they contain group themselves at first in such a manner that we may distinguish a peripheral zone and a central mass. The peripheral portion will constitute the tegumentary pieces; the central portion the appendicular pieces of the thorax. It is by the same principle of division that these appendicular pieces are formed. I have thus followed throughout, and with the greatest care, the course of development of the integuments and of the appendicular system; in this case the observations bring to light an important fact in the embryogeny of insects, namely, that the integuments and appendages of the adult, at least in the Diptera, are not constituted by a development or transformation of the corresponding parts of the larva, but by a new formation.

We have detected a curious adaptation to their mode of life in the larvæ of the *Volucellæ*. One species lives in the nests of hornets, another in those of the common wasps, and another in the nests of humble-bees; a special armature secures to each of them an easy progress upon the particular substance of which each of these nests is constructed. When adult, the *Volucellæ* seem to have borrowed the clothing of the hornets, wasps, or humble-bees, in order to come and lay their eggs in the habitations of those insects.

In the nervous system of the *Volucellæ* we have observed remarkable transformations. The very general character of the nervous system of insects in course of development is, to affect in the larvæ the form of a long ganglionic chain, undergoing a more or less considerable abbreviation as the animal advances in age. This abbreviation takes place in the connectives, and induces the fusion of several ganglia. On the contrary, in our Diptera, in the larva state, the nervous centres are approximated and so intimately united that they only form a single mass; with advancing age a separation is effected between the nervous centres of the head, thorax, and abdomen, at the same time that long connectives are formed uniting the medullary masses to each other. The important fact to be noted is, that this observation must modify the too general idea which has been conceived with regard to the changes which the ganglionic chain undergoes in the period of transition from the state of larva to the adult state.

On another hand the change of diet of our *Volucellæ* on passing from one form to the other offered us a subject of investigation of high interest. The larvæ of the *Volucellæ* are carnivorous; the adults live upon pollen: the diet corresponds to the differences presented by the digestive apparatus in the two states. The larva has no receptacle for food; the adult, on the contrary, is furnished with an ample crop: the former, having an abundance of nourishment always within its reach, has no abstinence to fear; for the adult, which is often prevented from seeking its nourishment by atmospheric conditions, an alimentary receptacle becomes very useful.

The salivary glands of the larvæ are enormous: the diet of the insect having to change, a transformation of its glands is effected during the pupal period; they are in part destroyed, to be afterwards regenerated with a different histological constitution. In the adult they have acquired the form of slender tubes, which extend into the thorax and abdomen. Equally great modifications take place in the same way in the four appendages of the stomach—long cæcal tubes, which are replaced by four conglomerated glands.

With regard to the respiratory apparatus, we must also cite some of the results of our observations. It affects a special character in each phase of the life of the insect. In the larva we find four stigmata—two anterior, on the second segment, and two posterior, on the twelfth segment. When the animal is metamorphosed, the integument separates from the skin of the larva, the orifices for the admission of air disappear, and two tubes, which might be taken for horns, issue from the anterior dorsal part of the pupa. It is at the surface of these horns that the peculiar stigmata of the pupa are seated; and I have ascertained that these orifices, to which no attention has been paid, are in considerable numbers. In the adult there is no longer any trace of these respiratory orifices at the place which they occupied in the pupa; but seven pairs of stigmata have been produced on the sides of the thorax and abdomen. This multiplicity of the stigmata coincides with the increase of the respiratory activity, denoted by the perfection of the tracheal apparatus.

Of all the organic systems the circulatory system undergoes the least important transformations. In the larvæ of the *Volucellæ* the heart, extended in a straight line from one extremity of the body to the other, has the aortic portion very short; in the adult the heart becomes incurved to take the form of the body, and a long aorta traverses the thorax.

One of the most essential facts which springs from this investigation of the organization of the *Volucellæ* is, that, at least in the Diptera, the development of certain apparatus of the adult is accomplished by a transformation of the organs of the larvæ, whilst the development of other apparatus is effected by entirely new formations.—*Comptes Rendus*, December 21, 1868, tome lxvii. pp. 1231–1234.

Sphenodon, Hatteria, *and* Rhynchocephalus. By Dr. J. E. Gray.

In the first part of my 'Zoological Miscellany,' published in 1831, I shortly described the skull of an Agamoid Lizard, of very peculiar structure, that I had seen in the Museum of the College of Surgeons, and I proposed to regard it as a new genus, named *Sphenodon*.

In the second part of the same work, published in 1841, I described a Lizard, which I had received in spirits from New Zealand, under the name of *Hatteria punctata*.

Professor Owen, in the first volume of the 'Descriptive Catalogue of the Osteological Series contained in the Museum of the Royal College of Surgeons,' published in 1853, at p. 142. nos. 662, 663, described with considerable detail the skull and the five vertebræ of the trunk of a Lacertian which he names *Rhynchocephalus*. The skull so named is evidently the same as that I described in the 'Zoological Miscellany,' in 1831, as *Sphenodon*, though the specimen is said in the Catalogue to have been presented by Prof. Owen, whose name certainly was not attached to the specimen when I described it. The specimen is still in the collection, but without the lower jaw, which was with it in 1831.

When I described the *Hatteria punctata* from the specimen in spirits I had no idea that it was the same Lizard that I had described from a skull under the name of *Sphenodon*; for it is not easy to observe the characters on which the genus *Sphenodon* was described without dissecting the animal.

A second specimen of *Hatteria* arriving at the British Museum, it was made into a skeleton, and then Dr. Günther discovered that the skull at the College of Surgeons and the skull of the Lizard I had named *Hatteria* were most probably the same. It should now be called *Sphenodon punctatum.*

I was much struck with the peculiar formation of the skull, and that induced me to describe it; but I did not then attach the great importance to its structure that Dr. Günther has since done: I only regarded it as one of the variations of structure that are found in most families. Indeed, when I consider the almost universal disinclination that zoologists have shown, almost up to this time, to admit the distinction of the two great families of Lizards, Agamidæ and Iguanidæ, which are so well characterized by the teeth and geographical distribution, it would have required more than usual hardihood in 1831, when the genus was described, to venture to form for it even a family; while an order may now be suggested for the single genus, with every probability of its being adopted—a decided proof of the progress of the science in a few years.

Deep-sea Dredging.

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

Gentlemen,—You will confer a favour on me, and, at the same time, enable me to acknowledge an act of courtesy on the part of my friend Dr. E. Perceval Wright, by inserting in the 'Annals' the following correspondence, which has already appeared in the pages of 'Scientific Opinion.'

I remain, Gentlemen,
Yours very faithfully,
Kensington, Jan. 13, 1869. G. C. Wallich.

"*To the Editors of Scientific Opinion.*

"*Deep-Sea Dredging and Dr. Wallich.*

"Sir,—I neglected to read 'Scientific Opinion' for the 16th inst. until a day or two ago, when I perceived you had done me the honour of transferring to your paper my few brief notes on 'Deep-Sea Dredging,' published in the 'Annals and Magazine of Natural History for this month. I was, however, at the same time very much grieved to find, from a footnote which you have appended to the first portion of my notes, that I have appeared to you to make little of Dr. Wallich's researches.

"I assure you and my friend Dr. Wallich that nothing was further from my thoughts. Few are, I think, better acquainted with the writings of Dr. Wallich than I am, and I yield to none in my appreciation of their value. Science has lost a great deal by the delay in the publication of the second part of his 'North-Atlantic Sea-Bed;' and no matter what may be the discoveries of future investigators, it is to the Rosses and Wallichs that we are indebted for our truest and earliest information on the subject.

"My notes had only to do with the use of the dredge, and what I meant to convey was 'Dr. Wallich records the presence of life at great depths; but the animals thus recorded belong to the Protozoa, with the exception of the *Ophiocoma*. Now, this was taken, not by the dredge, but by the accident of its clinging to the sounding-line; for the purpose of demonstrating the occurrence of Echinoderm life at such depths, it was as valuable a fact as if a hundred starfishes had been taken by a dredge. But, after all, it is not with a sounding-line, but with a dredge, that we must look for these forms of life; and as by the use of this machine I have found some additional forms, I hasten to record them,' &c. Again expressing my regret that I so wrote the sentence you extract that it should appear even for a moment to make little of the persevering labours of my accomplished friend, and trusting you will publish at least the substance of this letter in your early number of 'Scientific Opinion,'

"I remain, &c.

"Ed. Perceval Wright, M.D."

"Museum, Trinity College, Dublin.
Dec. 26."

"*The Dredge and the Sounding-Machine at Great Depths.*

"Sir,—The frank and manly explanation offered by my friend Dr. E. Perceval Wright, in his letter published in 'Scientific Opinion' of the 30th ult., regarding the sense in which he used the term 'accidental,' when referring to the capture of the *Ophiocomæ* from a depth of 1260 fathoms in the North Atlantic, deserves my warmest acknowledgments; and I can only say that the manner in which he has withdrawn the sting from his words, the moment it was brought to his notice, proves him to be made of the right metal.

"I have accordingly to thank him for his letter, and also to express my obligation to you for showing, in the brief note which you appended to the transcript of Dr. Wright's paper on 'Deep-Sea Dredging,' that I was by no means solitary in the interpretation I put upon the second paragraph of his communication. In order, however, to remove any misconception that may exist as to the circumstances under which I failed to use the *dredge* in preference to the sounding-machine, and also to prove that the discovery of animal life at the greatest depths in the ocean was fully believed in by me even before the capture of the *Ophiocomæ* set the question at rest for ever, I beg the attention of your readers to the subjoined extract of a letter addressed by me to Sir Leopold M'Clintock, when our expedition reached its extreme outward destination, at Sydney, in Nova Scotia, premising that I cannot doubt Sir Leopold would have cheerfully afforded me the opportunities I so earnestly solicited, had the instructions received from the Admiralty and the exigencies of an exceptionally tempestuous season permitted him to do so. My letter was dated Sept. 7th, 1860. In it, after drawing attention to the very meagre results attained during the outward voyage, and the comparatively small number of instances in which apparatus for bringing up specimens of bottom had been employed, I wrote as follows:—

"'In submitting these observations to your notice, I would at once disclaim any desire on my part to impede the ordinary duties of the expedition by an unreasonable regard for the objects I have in view. I would only request that during the remaining portion of the voyage, the circumstances may, if possible, be taken into consideration, both as regards the strictly deep-sea soundings *and any opportunities for dredging in deep water that may present themselves.* Under a conviction that you will give me credit for addressing you with no other desire than that proceeding from extreme anxiety to perform the task entrusted to me satisfactorily, I remain, &c. &c.'

"It will, I hope, thus become manifest that the comparatively limited number of animals belonging to the higher types which I was enabled to procure was the result of circumstances over which, unfortunately, I could exercise no control. Let me observe, however, that Dr. Wright labours under a serious misapprehension when he states that the *Ophiocomæ* were the only creatures of a highly organized type which the 'Bulldog' soundings brought to light from abyssal depths.

"To the perfect facility with which the dredge may be used, even at the greatest depths, the operations conducted on board the 'Great Eastern' steamship, several years ago, whilst employed in recovering the lost telegraphic cables, bear ample testimony. It is to be hoped, therefore, that the exploration of the deep-sea bed, in the systematic manner which was proposed by me, in 1863, to the President and Council of the Royal Geographical Society, and received from that body most cordial approbation, may now obtain from Government the liberal encouragement which it deserves.

"Lastly, will you permit me to point out, with reference to an erroneous idea which has got abroad and been brought to my notice by several friends, that, so far from having ignored the observations of Sir John Ross, in Baffin's Bay, in 1818, and of Sir James Ross, in the Antarctic Seas, in 1848, I was the first person to exhume them from the ill-merited oblivion into which they had been allowed to fall, and to accord to these eminent navigators, in my 'North-Atlantic Sea-Bed,' published in 1860, the credit to which they were undoubtedly entitled?

"I remain, &c.

"Kensington, Jan. 3." "G. C. Wallich."

Note on the Genus Helleria.

By the Rev. A. M. Norman, M.A.

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

Gentlemen,—I should be obliged if you would allow me to correct an error in the characters of the genus *Helleria* as given by me (Ann. Nat. Hist. ser. 4. vol. ii. p. 418, the Number for December). Instead of "Superior antennæ slender, much shorter than inferior, *with* secondary appendage," it should be "Superior antennæ &c. *without* secondary appendage," as will be seen by reference to the specific description and to the figure. The error must have crept in either through the printer or very probably in my own transcribing.

Believe, &c.

Your most obedient Servant,

January 24, 1869. Alfred Merle Norman.

Colobus palliatus, Peters.

Dr. Peters has described a *Colobus* from Zanzibar, under the name of *Colobus palliatus*, from a young specimen that was living in the Zoological Gardens at Hamburg, and is now in the Hamburg Museum. The description agrees in many particulars with the *Colobus Kirkii*, received from Dr. Kirk, which I described and figured in the 'Proceedings of the Zoological Society' for Feb. 1868, p. 180, t. 15. When Dr. Kirk sent that skin, he informed me he had sent a young living specimen to Hamburg, on its way to our Zoological Gardens in England. I have every reason to believe that the animal described by Dr. Peters is the one sent (though his name is not mentioned) by Dr. Kirk. It is most probably a specimen of the species which I have described, the difference in the description probably arising from the animal being immature and having been kept in confinement.—J. E. Gray.

Hadrosaurus.

Mr. Waterhouse Hawkins has obtained permission of the Academy of Natural Sciences of Philadelphia to erect, at his own expense, in the hall of the Academy a model of the skeleton of the *Hadrosaurus*, in accordance with the restoration of Dr. Leidy.

Living Crinoids of the North Sea. By Dr. Michael Sars.

Prof. Michael Sars has published a quarto monograph, in French, describing *Rhizocrinus lofotensis* and the pentacrinoid states of *Antedon Sarsii*. The *Rhizocrinus* was discovered by M. G. O. Sars at Lofoten Island. It was at first believed to be the pentacrinoid state of an undescribed *Antedon*; a more careful examination showed that it is a Lily Encrinite, and more nearly allied to the genus *Bourgueticrinus* of Dujardin and Huppe.

Prof. Sars shows how the pentacrinoid form of *Antedon Sarsii* differs from the same form of *A. rosaceus*, described by Prof. Wyville Thomson and Dr. W. Carpenter; and he states that the larvæ of the genus *Antedon* undergo six distinct transformations. These animals are illustrated with six plates full of most minute details of the structure, habit and development, and the physiology and morphology of these most interesting animals, so important as explaining the very numerous fossil Crinoids.

New Alligator from New Granada.

Mr. Edward Cope, in the 'Journ. of the Acad. of Natural Sciences of Philadelphia,' 1868, p. 203, describes an Alligator, from Magdalena River, in New Granada, under the name of *Perosuchus fuscus*, peculiar for having only two claws on the front feet, and fleshy eyebrows without any bony plates. The single specimen obtained had the peculiarity (most probably individual) that the lower canine tooth on one side, like a true Alligator's, fitted into a notch, and on the other side fitted into a concavity in the upper jaw as in the crocodiles. In most other characters, and especially in the belly being protected by bony plates, it agrees with the alligators of Brazil. Other specimens of this alligator are very desirable, to confirm the characters assigned to it.—J. E. Gray.

On the Habits of Hyalonema.

Dr. Gregory writes, "My friend Mr. Cramer, who is collecting plants for Mr. Veitch, has been down three or four times to fishing-villages at Inosima to look after the *Hyalonema*, and the whole of his researches point to this:—'The Japanese do not know where to find it, but occasionally it comes up in their nets, in deep water; they say it has the same appearance as when dried, and that it has no slime or gelatinous substance adhering to it.'"

Note on the Vitality of a Sponge of the Family Corticatæ (Tethya lyncurium, *Lamarck*), By M. Léon Vaillant.

The author has endeavoured to investigate the mode in which the Sponges repair accidental loss of substance, and to graft them upon each other in various ways. He employed principally *Tethya lyncurium*, Lamk., belonging to the section Corticatæ, O. Schmidt, which is common on the shores of Brittany, and the regular form and histological complication of which render it better fitted for experiment than the Halichondriæ.

Of these Sponges the author endeavoured to isolate the cortical and afterwards the medullary substances; he cut away portions taken in different directions, to observe the mode in which the reproduction of these tissues is effected, and their cicatrizations; and he attempted to graft *Tethya lyncurium* upon itself, and also various Sponges of the genera *Lycon*, *Halichondria*, *Reniera*, and *Polymastia* upon that species. From more than fifty experiments he draws the following conclusions:—

1. The two substances of which *Tethya lyncurium* is composed are mutually capable of reproduction, the isolated medullary substance reproducing the cortical substance, and *vice versâ*.

2. The vitality of the cortical substance is greater than that of the medullary—which is in relation to its histological constitution. It is able to produce prolongations capable of reproducing adherence. Its contractility is also more noticeable than that of the medullary substance, if, indeed, the latter possesses that property.

3. The cortical substance certainly plays a special protective part in the economy of the Sponge.

4. The grafting of individuals in this species is easy, but it requires a certain time for its completion.

5. The grafting of a different genus upon *Tethya lyncurium* has not hitherto succeeded.—*Comptes Rendus*, Jan. 11, 1869, tome lxviii. pp. 86–88.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

No. 15. MARCH 1869.

XXIV.—*On the Animal and Operculum of* Georissa, *W. Blanf.*, *and on its relations to* Hydrocena, *Parreyss*; *with a Note on* Hydrocena tersa, *Bens.*, *and* H. milium, *Bens.* By William T. Blanford, A.R.S.M., C.M.Z.S., &c.

[Plate XVI.]

In the 'Annals and Magazine of Natural History' for June 1864, ser. 3. vol. xiii. p. 463, I pointed out that some small land-shells from the Khasi Hills and Burma, described by Mr. Benson as species of *Hydrocena*, differed so much in the characters of the animal and operculum from the other forms classed in that genus by Pfeiffer and other conchologists, that it was necessary to found a new genus for their reception; and I suggested that this genus, which I proposed to call *Georissa*, might be an ally of *Helicina*, which it resembled in the absence of spiral structure in the operculum. Recently Capt. Godwin-Austen has had opportunities of examining living specimens of *Georissa sarrita*, Bens., in the Khasi Hills, and he has very kindly placed his drawings at my disposal, calling attention to one point which I had overlooked: this is the existence of a projection on the inner side of the operculum, somewhat resembling that in *Rissoina*. This projection is so brittle that, unless great care be used in extracting the operculum, it is sure to be broken, as it was in the two or three specimens which I examined in 1864.

On hearing of this, I reexamined the opercula of the three species of *Georissa* of which I possessed specimens, viz. *G. pyxis*, Bs., *G. frustillum*, Bs., and *G. sarrita*, Bs., and found the projection in all, varying slightly in form.

Both Capt. Godwin-Austen and I have also examined the lingual teeth, and found that, although they belong to the Rhipidoglossate type, they differ entirely from those of *Helicina* and its allies. Capt. Godwin-Austen could detect no teeth in the central portion of the lingual membrane of *Georissa sarrita*; in that of *G. frustillum* I saw, with some difficulty, long conical spikes, like needle-points, about four in each row, somewhat irregularly placed at a distance from each other. They appear to be no more regular in number than in position; occasionally there are more than four, at other times some are obsolete. The rows of lateral teeth are extremely oblique, and consist of about ten distinctly tricuspid teeth near the centre, passing gradually, as they diverge from it, into simple hooks, which are very numerous. In *G. sarrita*, Capt. Godwin-Austen represents the lateral teeth as bicuspid.

In *Georissa pyxis* I found the tentacles to be represented by very blunt, almost hemispherical lobes, with the eyes at their outer bases. Capt. Godwin-Austen's drawings of *G. sarrita* represent no tentacular projections whatever, the eyes being sessile on a kind of frontal lobe, much as in *Amphibola*. The difference is very trifling, as the rounded lobes observed by myself might easily unite to form one slight frontal projection. The extreme minuteness of the animals necessitating the employment of a microscope for their observation, makes it difficult to ascertain the exact form of the soft parts, especially as the animals only emerge very little from the shell.

With reference to these additional observations, some change in the generic character becomes necessary. The following may be suggested:—

Genus Georissa.

Testa minima, imperforata vel vix perforata, conica, succinea, spiraliter sulcata vel striata, apertura fere semicirculari vel semiovata, columella callosa.

Operculum ovatum, haud spiratum, excentrice striatum, testaceum, transparens, processu elongato intus haud procul a basi marginis interni munitum.

Animal parvum; tentaculis hemisphæricis (v. connatis?); oculis sessilibus; pede brevi, rotundato, operculum in medio dorso juxta aperturam ferente.

It is evident that neither in the shell, operculum, animal, nor lingual dentition is there sufficient resemblance to *Helicina* to confirm the position I at first suggested for the genus as the type of a subfamily of the Helicinidæ. But I think that the true affinities of *Georissa* can now be clearly ascertained.

Subsequently to the publication of my paper in the 'Annals' for 1864, Von Martens pointed out, in the 'Malakozoologische Blätter' for the same year, that the type of the genus *Hydrocena* of Parreyss, *H. cattaroënsis*, Pfr., differs entirely from the numerous species classed with it by Pfeiffer, H. and A. Adams, and Gray. The latter, in the British-Museum Catalogue, places it in *Realia*; Pfeiffer, who is followed by H. & A. Adams, retains it as the type of a genus which he places next to *Realia*, but associates with it a number of species belonging, some of them, as Von Martens shows, to *Assiminea*, others to *Omphalotropis** or an allied genus. It is curious that Pfeiffer, who usually attaches rather too much importance to the characters of the operculum, should have overlooked the peculiarities of that of *Hydrocena cattaroënsis*, which he simply describes as "Operc. paucispirum, rubellum" (Mon. Pneum. Viv. Supp. i. p. 160), although it is figured by Küster in the second edition of Martini and Chemnitz, and the description and figure are quoted by Pfeiffer† with his usual accuracy. The operculum is in almost every respect similar to that of *Georissa*; and as Küster's description of the genus appears to have been generally overlooked, it may be as well to append a translation of it, in order to show the connexion of the two genera. The description, in German, occurs at p. 80 of part I. 21, of Martini and Chemnitz:—

"Shell small, imperforate, conical, thin, with a broad conical spire, scarcely exceeding the aperture in height; the whorls few in number, slowly increasing, convex. Aperture ovate, angulate above as in *Paludina*, edges united by a thin callus resting on the penultimate whorl; peristome straight, not expanded or thickened; columella somewhat concave, with a free reflected edge below; umbilicus filled by a callus, which, when highly magnified, exhibits a very fine granular wrinkled sculpture (as in *Neritina*).

"The operculum is of peculiar construction, widely different from that of *Paludina* ‡. It is calcareous, and has a nucleus,

* In the original publication of his 'Monographia Pneumonopomorum Viventium,' Pfeiffer quite correctly excluded *Hydrocena cattaroënsis* from the Cyclostomacea, retaining *Omphalotropis rubens*, Quoy & Gaimard, and its allies, which belong to the order, unless, as is possible, they are terrestrial Rissoidæ. It is strange that in the first supplement to the monograph, after Küster and Troschel had described and figured the animal and tongue of *Hydrocena*, Pfeiffer should have reintroduced it amongst his Cyclostomacea, and have retained it in the same position in the second Supplement.

† Pfeiffer, in his second Supplement, refers to a description of the animal of *Hydrocena* by A. Adams, in the Ann. & Mag. Nat. Hist. for 1861, vol. vii. p. 196. The animal there described, however, is that of one of the land-shells allied to *Omphalotropis* which have been incorrectly referred to *Hydrocena*.

‡ *Hydrocena* is classed with *Paludina* and *Valvata* in Küster's Monograph. Hence the allusions.

which occasionally shows a trace of spiral structure at the lower part of the left side; additions are made to the left side and the apex, so that the striæ seen running from the nucleus are bent over in an open curve above. Inside, at the nucleus, there is a projection of considerable size, with a blunt termination, which increases the resemblance, already existing in other characters, to the opercula of the smaller *Neritinæ.*

"The animal is short, the foot rounded off and broader in front; the head separated from it and but slightly emarginate and broad when at rest, but when the animal is creeping it is stretched out somewhat like a proboscis. On the top of the head are two short triangular tentacles, bearing large black eyes on the upper bases.

"The operculum is fastened on the hinder portion of the foot, as in *Paludina.*"

The accompanying figures are not good; and if a specimen in my possession be authentic (as I have every reason to believe it is), they convey a very inaccurate idea of the form of the shell and its colour, which is of the same peculiar amber tint as in *Georissa*, and resembles that of some of the more deeply coloured *Succineæ.* I am therefore induced to doubt if the representations of the operculum* are exact. The only important distinction shown by the latter from that of *Georissa* is in the striation, which, as described, shows a different mode of increase in the operculum. The internal process is very nearly the same.

So far as the shell is concerned, there is evidently no distinction of any consequence between the two types; and the differences presented by the operculum are at the most subgeneric; but the distinctions shown by the animals are of some importance. They are, briefly (if Küster's figures and description are trustworthy, and I can certainly see no reason why any shortcomings in the former should imply inaccuracy in the latter):—that, to use Pfeiffer's terms, *Hydrocena* is opisophthalmate, while *Georissa* is ectophthalmate, the former having the eyes above the base of the tentacles, the latter at the side; and also that in *Hydrocena* the operculum is carried on the end of the foot, at some distance from the aperture—in *Georissa* close to the aperture, the foot being only extended a very short distance behind, and being generally shorter and rounder in the latter genus.

Were this the only distinction, I should be much disposed, taking into consideration the marked similarity of the shell

* I have endeavoured to extract the operculum in the only specimen of *Hydrocena cattaroënsis* which I possess; but it is too deeply inserted in the shell to be removed without breaking the aperture.

and operculum, to believe that either Küster or I had committed some oversight in the examination of the animals, and that they are in reality alike. But the circumstance that *Hydrocena* is a truly marine species, living in water, whilst all the species of *Georissa* are found on hills at a distance from the sea*, renders it probable that a difference really exists; and the characters of the lingual ribbon tend to bear out that distinction.

The lingual teeth of *Hydrocena* have been figured by Troschel in the 'Gebiss der Schnecken,' vol. i. Taf. 6, and described at page 83. They differ from those of *Georissa* in the characters of the central teeth, which, however, are rudimentary in both forms, and have not been clearly made out in *Georissa.*

Troschel regards the genus *Hydrocena* as forming the type of a family of Mollusca with affinities to the Helicinidæ and the Neritinidæ—a view which appears best to meet the circumstances of the case. If, therefore, the genus *Georissa*, as a land-shell, be kept distinct from *Hydrocena*, it will form a second genus of the family.

But I cannot conclude without calling attention to the surprising resemblance shown in this case by a true land-mollusk to an undoubted marine form, as one more addition to the numerous arguments against separating the Cyclostomidæ, Cyclophoridæ, and Helicinidæ from their natural allies living in fresh or salt water.

Note on Hydrocena tersa, *Benson, and* H. milium, *Bens.*

Two minute shells were described by Mr. Benson in the 'Annals' for 1853 (ser. 2. vol. xi. p. 285), under the names of *Cyclostoma tersum* and *C. milium.* They were found in moss brought from the Khasi Hills. Subsequently, in 1856 (*op. cit.* vol. xvii. p. 232), Mr. Benson referred both species, together with *C. sarritum*, to the genus *Hydrocena.* When, in 1864, I proposed the genus *Georissa* for the last-named species and its allies, I suggested that *C. tersum* and *C. milium*, which I had never seen, might perhaps belong to it. Neither the animals nor opercula of these two species were known to Mr. Benson, nor have they hitherto been described.

I am indebted to Capt. Godwin-Austen for specimens of a shell which I have no hesitation in referring to Mr. Benson's *Cyclostoma tersum*, and for figures of the animal, operculum, and lingual ribbon. The original specimen was probably weathered; when fresh, the shell is of the colour of horn.

* *G. sarrita* is found at a height of 4000 feet above the sea, on the Khasi Hills.

The operculum is horny, extremely thin, and very difficult to isolate; it appears to be paucispiral. The animal, as represented in Capt. Godwin-Austen's drawing, bears a most remarkable resemblance to that of *Assiminea*, the eyes being above and nearly at the tips of short blunt tentacles. The lingual teeth are figured by Capt. Godwin-Austen as 5, ranged 2 . 1 . 2, the outermost lateral teeth being probably rudimentary.

The shell on the whole resembles *Acicula* more than any other genus of operculated land-shells; and as the characters both of the animal and operculum approach those of that genus, the present species may with probability be placed in it. The teeth of *Acicula* have not, so far as I am aware, been examined. Those of *Assiminea* are very different from Capt. Godwin-Austen's drawings.

Acicula tersa is distinguished from all the typical species of the genus by its shell being conico-ovate instead of subcylindrical, and, which is of much more importance, by the eyes being pedunculated, and not sessile; for the position of the eyes nearly at the tip of the tentacles shows that they are situated on pedicels which are connate with the tentacles. The differences are not generic; but I think they are subgeneric, and I would therefore propose to make the present species the type of a subgeneric section, with the name of *Acmella*. It is just possible that *Cyclostoma striata*, Quoy and Gaimard, referred by Gray and Pfeiffer to *Acicula*, may belong to the same subgenus.

The following characters require to be added to those given by Mr. Benson:—

Testa cornea; operculum corneum, tenuissimum, paucispirale, nucleo sinistrali.

As regards *Cyclostoma milium*, I fear that I can add nothing very certain. Amongst the very numerous small forms of Mollusca collected by Capt. Godwin-Austen I have seen no shell which I can with certainty refer to Mr. Benson's description. I at first thought that a small aberrant *Cyathopoma*, collected near Cherra Poonjee, might be the species; but it is ribbed spirally, while Mr. Benson's species is described as smooth; and the proportions differ to too great a degree from those of *C. milium* to allow of its being the same. All that can certainly be asserted is that *C. milium* must, on account of its form and characters, be removed from the genera *Hydrocena* and *Georissa*, and that it may be a *Cyathopoma*. It may be an immature shell; but if so, I am unable to suggest to what species it can belong.

The accompanying figures, with the exception of the operculum of *Georissa sarrita*, which is by my brother, are drawn by Capt. Godwin-Austen.

EXPLANATION OF PLATE XVI.

Fig. 1. *Georissa sarrita*, Benson, sp.; shell, magnified about 18 diameters; the mouth is a little turned away: 1 *a*, operculum, seen from the inside, showing the projection, magnified; 1 *b*, animal, sketched in three different positions, magnified; 1 *c*, lingual ribbon, magnified 250 diameters; 1 *d*, teeth near the centre, still further enlarged; 1 *e*, uncini near the margin.

Fig. 2. *Acicula* (*Acmella*) *tersa*, Benson, sp.; shell, magnified about 15 diameters. The specimens sent to me by Capt. Godwin-Austen differ in being more conical and less ovate, but otherwise agree well. The shell perhaps varies slightly in form. 2 *a*, operculum, magnified. A small portion of the foot (*f*) remained attached, and could not be removed, on account of the minuteness and thinness of the operculum. 2 *b*, animal, magnified, sketched in three different positions. 2 *c*, lingual ribbon, greatly magnified; the outer teeth to the left partly turned back.

Calcutta, December 26, 1868.

XXV.—*The Rabbit* (Lepus cuniculus) *as known to the Ancients.* By the Rev. W. Houghton, M.A., F.L.S.

The rabbit appears to have been but little known to the ancients; the old inhabitants of Greece and Rome were not plagued, as tenant farmers in this country are, with this prolific little pest to agriculture. The rabbit in its wild state is essentially a European animal. To the ancient Jews it was entirely unknown; there is no mention of it in the Bible; it is generally acknowledged that the Hebrew word (*Shâphan*) rendered "coney" by the authorized version denotes the *Hyrax syriacus*: several species of hare have been described as occurring in the Bible-lands, but no kind of native rabbit. Rabbits were noticed by Russell as occurring rarely in the vicinity of Aleppo; but they had been introduced from Europe. If we turn to Aristotle, we shall find that, in all probability, the rabbit was quite unknown to him, though he sometimes speaks as if he were alluding to this animal. The words he uses are λαγωὸς and δασύπους: the former word occurs but once in his 'History of Animals,' viz. in a passage (viii. 27. § 4) in which he mentions that the λαγωοὶ of Egypt are smaller than those of Greece. Of the δασύπους he says:—it is prudent and timid (i. 1. § 15); it is retromingent (ii. 3. § 4); it is one of those animals which, having teeth in both jaws, have cotyledons in the pregnant uterus (iii. 1. § 15); its blood, like that of the stag, does not coagulate so completely as that of many other animals (iii. 6. § 1); it alone of all animals has hair on the inside of its cheeks (iii. 10. § 13); its milk, like that of ruminating animals, contains rennet, and is therefore useful in diarrhœa (iii. 16. § 6); the female δασύπους in coition often mounts upon the male (v. 2. § 1); it produces its young at all seasons, and becomes pregnant a second time while previously pregnant; it has young every month; as soon as the young are born, copulation again takes place, and the female conceives while giving milk, which is as thick as that of the sow; the young are born blind (vi. 28. § 3); if a δασύπους be taken into Ithaca, it will not live, but will be found dead on the sea-coast, with its face turned towards the spot from which it was brought (viii. 27. § 2); there is a kind of δασύπους, near Lake Bolba and in other places, which has its liver so divided as to look like two livers (ii. 12. § 3). The only passages that call for attention are those in which Aristotle speaks of the δασύπους having hair inside its cheeks, and of its producing its young, which are born blind, every month: the former statement is true of the hare, the latter of the rabbit. But Aristotle is so frequently in error with regard to matters of common observation, and is often so prone to hasty generalization, as to lead me to infer that by the term δασύπους he understood a hare, and believed that this animal produces its young ones blind, and more frequently than is really the case. As he nowhere alludes to the burrowing habits of a leporine animal, it is hardly likely that he was acquainted with the rabbit.

Neither, again, does Xenophon, so minutely graphic in his description of the hare, and hare-hunting, ever allude to the rabbit. Living, as the old general did for many years, as a Greek squire, in his house at Scillus, in the game-abounding district of Elis, Xenophon must have made some remarks on an animal so closely allied to, and yet differing in some remarkable ways from, his favourite hare, had he been acquainted with it.

The earliest Greek writer, so far as I have been able to ascertain, who distinctly alludes to the rabbit, is Polybius the historian (*circ.* B.C. 204). Speaking of the natural history of Corsica, he says the only animals found wild there are foxes, wild sheep, and rabbits (*κύνικλοι*). He thus describes the *κύνικλος*:—"At a distance it looks like a small hare; but when you take it into your hands, there is a great difference between the two, both in appearance and flavour; it lives for the most part underground." (Histor. xii. 2.) Polybius was a traveller, and had, no doubt, seen the rabbits he so well describes.

Rabbits are mentioned expressly by Strabo (*circ.* B.C. 50) as occurring abundantly in Spain, the great home of *Lepus cuniculus,* though it is not certain whether this geographer was himself ever in Spain. The following is his description:—"Of destructive animals there are scarcely any, with the exception of certain little hares, which burrow in the ground (πλὴν τῶν γεωρύχων λαγιδέων), and are called by some *leberides.* These creatures destroy both seeds and plants, by gnawing at the roots. They are met with throughout almost the whole of Spain, extending to Marseilles, and infesting the islands also. It is said that formerly the inhabitants of the Gymnesian islands [Majorca and Minorca] sent a deputation to the Romans soliciting that a new land might be given them, as they were quite driven out of their country by these animals, being no longer able to stand against their vast multitudes. It is possible that people might be obliged to have recourse to such an expedient for help as waging war in so great an extremity, which, however, but seldom happens, and is a plague produced by some pestilential state of the atmosphere, which at other times has produced serpents and rats in like abundance; but for the ordinary increase of these little hares many ways of hunting have been devised, amongst others by wild weasels from Africa trained for the purpose (καὶ δὴ καὶ γαλᾶς ἀγρίας, ἃς ἡ Λιβύη φέρει, τρέφουσιν ἐπίτηδες). Having muzzled these, they turn them into the holes, when they either drag out the animals they find there with their claws, or compel them to fly to the surface of the earth, where they are taken by people standing by for that purpose." (Geograph. iii. 2. § 6.)

Ælian, who lived in the third century of the Christian era, thus speaks of the rabbits of Spain:—"There is also another kind of hare, which is small and never attains the size of the common hare; it is known by the name of κόνικλος: I retain the original nomenclature adopted by the people of western Spain, as I am not an inventor of names. In that country this animal is abundantly found: its colour is darker than that of other hares; it has a shorter tail, and differs in the size of the head, which is finer and smaller and less fleshy; its whole body, too, is shorter; but in other respects it is like an ordinary hare. It is unusually excited when it unites sexually with the female. Like the stag, it has a bone in its heart, the use of which let others divine." (Nat. Hist. xiii. 15.)

Athenæus (A.D. 230), after quoting the passage from Polybius already given, says that Poseidonius the philosopher makes mention of rabbits in his history, but the grammarian gives no further information. Athenæus himself, however, was acquainted with these animals. "We ourselves," he says, " have seen a great many in our voyage from Dicæarchia (Puteoli) to Naples; for there is an island, not far from the mainland, opposite the lower side of Dicæarchia, inhabited by only a very scanty population, and having a great number of rabbits." (Deipnosoph. ix. 64.)

Pliny says, " There is also a species of hare in Spain which is called *cuniculus*; it is extremely prolific, and produces famine in the Balearic islands by destroying the harvests. The young ones, either when cut from out of the body of the mother, or taken from the breast without having the entrails removed, are considered a most delicate food; they are called *laurices.* It is a well known fact that the inhabitants of the Balearic islands begged of the late emperor Augustus the aid of a number of soldiers to prevent the too rapid increase of these animals. Ferrets (*Viverræ*) are much prized on account of their hunting these animals; they are put into the burrows, with their numerous outlets, which the rabbits form, and from which circumstance they derive their name, and as the ferrets drive them out they are taken above." (Nat. Hist. viii. 55.) Pliny also mentions superfœtation as occurring in both the hare and the rabbit.

Martial says, rabbits first taught men how to undermine enemies' towns—

> " Gaudet in effossis habitare cuniculus antris,
> Monstravit tacitas hostibus ille vias."
> (Ep. xiii. 60.)

The Latin word *cuniculus*, it is well known, denotes both a rabbit and an underground passage. Varro (De Re Rust. iii. 12. § 6) suggests that the rabbit derived its name from the burrows it forms: " cuniculi dicti ab eo, quod sub terra cuniculos ipsi facere soleant ubi lateant in agris." J. G. Schneider contends with much force that the word *cuniculus* is of Spanish origin: "Animal ex Hispania allatum, Romani vetere Hispanico nomine appellarunt." Ælian, it will be remembered, says the same in distinct words. There was an ancient Spanish nation called Cunei (Κουνεοὶ), of which, according to Appian, the chief town was Κονίστοργις. I may mention that there is a small island of the Balearic group, called Conejera, which is abundantly stocked with rabbits: hence the Spanish name (" a rabbit-warren ").

Appius in Varro (*l. c.*) gives instructions how to form a leporarium, and speaks of three kinds of hares, the *cuniculus* being one of them. Two of these kinds he concludes he has already in his leporarium; " and since," he says to his veteran friend Varro, " you have been so many years in Spain, I think it likely you have brought the third kind (rabbit) with you from that country."

What can we gather from the above extracts from classical authors? I think we may safely infer that the rabbit was not indigenous either in Greece or Italy in early times. In Greece there is, as far as I can make out, no record of its existence, either in a wild or a domesticated state; in Italy there is no mention of its occurrence prior to the time of Athenæus (A.D. 230), who, as we have seen, observed specimens in his journey from Puteoli to Naples. Once give a couple of rabbits standing-ground either in Italy or Greece, and they surely must have increased in those countries, and consequently have been specially noticed by some classical writer or other. The rabbit, where expressly mentioned, is spoken of as an animal not familiar to the people of Greece and Italy; it is looked upon as a foreigner, and generally as an inhabitant of Spain or its outlying islands. Consequently, if rabbits exist in large numbers in either of these countries at the present day, I consider they have been introduced there, as we know they have been in other countries. In the Cyclades a large variety of rabbit is known to exist at present. In his 'Fauna der Cycladen,' Dr. Erhard speaks of this variety being as large as or larger than the common hare. How did these rabbits get to these islands? Were they there in the times of Aristotle and other Greek writers? Are the present large rabbits of the Cyclades the descendants of those that lived there in the time of the ancients? It does not seem to me probable that this is the case: I think it more likely that this large variety now inhabiting the Cyclades is descended from some large domestic variety that may have been carried thither, some time or other subsequent to classic times. I should be obliged to any one who will give an opinion on this point. The subject of the natural history of the ancients has been for some time an interesting study to myself, and it is one which, both archæologically and zoologically, has some claims upon our attention.

XXVI.—*Notes on Lizards of the Group* Anolis.—*The Characters and Synonymy of* Norops. By Arthur W. E. O'Shaughnessy, Senior Assistant in the Natural-History Department of the British Museum.

The great disadvantage which one has to contend with in studying the lizards of the group *Anolis* is, that their brilliant and varied metallic colours, which are so important a characteristic of their species, fade, and even vanish completely, in the preserved states of the specimens. A person able to test the accuracy of the present determinations of species in this group by continual observation of the living or fresh animal, would of course be in a position to speak more confidently than one who has only specimens in spirits to judge from.

Unfortunately most persons who have as yet possessed such opportunity have not had the qualification necessary to the employing of it to much scientific advantage, and have furnished us with only a few more or less confused notices of the lizards in question. Consequently a careful investigation of all such persistent characters as may be found in the specimens of a good collection, aided by any vestige of colour and general life appearance as may yet remain, is still the method most likely to produce valuable results.

Norops, the first form noticed by Duméril and Bibron in their history of the group, is at present in some confusion, owing to a misapprehension of the descriptions of the two species given by different writers.

Daudin (Hist. Nat. des Rept. tome iv. p. 89), in 1802, described a lizard under the name of *Anolis doré*, which is evidently a *Norops*. His description, though very good, inasmuch as it anticipates many of those general characters on the ground of which *Norops* has been separated from *Anolis* by modern naturalists, cannot now be regarded as anything more than a successful attempt to discriminate the form *Norops*, confusedly mentioned by Linnæus, Lacépède, and other previous naturalists.

Daudin states that his acquaintance with the lizard was confined to two specimens, one of them being in a very corrupted state.

Wagler in 1830 (Natürliches System der Amphibien, p. 149) established the genus *Norops*, and cites *N. auratus*, the *Anolis doré* of Daudin, as its single representative.

These are the only scientific notices of the lizard in question previous to the great work of Duméril and Bibron, 1837.

The description of *Norops auratus* at p. 82, tome iv., of the 'Erpétologie Générale,' must therefore be regarded as the first which characterizes a *species* of the genus *Norops* sufficiently for modern scientific investigation. Although the specific name may be attributed with propriety to Daudin, in recognition of his having first clearly extricated the *form* from the confused notices of previous writers, the first description of specific characters in the genus must be assigned to Duméril and Bibron; and all subsequent attempts at identification or criticism of the species must be held to date from that description.

Now, since the year 1840 it has been known that two distinct forms of *Norops* exist,—(1) a lizard with a comparatively short tail, toes distinctly dilated, although not to the same extent as in many species of *Anolis*, the head entirely covered with strongly keeled scales, and long limbs, the hinder ones when laid forward reaching to the tip of the snout; (2) a slenderer lizard with head more depressed and pointed, the muzzle only furnished with keeled scales, those of the rest of the head smooth, a much longer tail, much shorter limbs, the hinder ones reaching, when laid forwards, to the ear-opening only, and a bright white vitta passing along the side.

This second form was described by Berthold in 1840, 'Abhandlungen der Königlichen Gesellschaft der Wissenschaften zu Göttingen,' 1840, p. 62, under the name of *Draconura* 12-*striata*. His description is full and distinct, and accompanied by a coloured figure (not very good, but showing well the slenderer shape and long tail of the form in question) and a diagram of the upper surface of the head, which exactly represents that configuration and arrangement of the shields which distinguishes this species from the other.

The shields of this part of the head are much smoother, present a more regular symmetrical arrangement, and give a much flatter appearance to the whole surface than in the first-mentioned form. Moreover the occipital plate is an ovate, well-defined shield, much larger than any other shield of the head, whereas in the other form it is very small and inconspicuous. There is only *one* series of scales between the supralabials and the eye, whereas there are two in the *auratus* of Duméril and Bibron.

The anterior limbs are said to reach to the tip of the snout, the posterior ones to the ear. The length of the tail is said to be three times that of the body.

In a memoir, 'Ueber verschiedene neue oder seltene Reptilien, &c.,' Göttingen, 1846, at p. 6, Berthold mentions the *Anolis auratus* of Daudin, the *Norops auratus* of Wagler and D. & B., as the only known species of *Norops*, thus regarding it still as even generically different from 12-*striatus*. He says, "the head is covered with small, many-keeled plates; the hinder limbs reach to the mouth, the fore limbs even beyond." These are clearly the characters of the form of *Norops* first mentioned above.

Returning to the original description of *Norops auratus* by Duméril and Bibron, taken from two specimens, one from Guiana the other from Surinam (or Cayenne), we find that it differs only in one point from this particular form, *i. e.* the *auratus* above mentioned, the shorter-tailed, longer-limbed one. This point is precisely the relative length of the limbs, the hinder ones being said to reach only to the margin of the ear-opening—a characteristic of 12-*striatus*. In the description of the coloration the colours characteristic of the two forms (allowing for alteration in deteriorated specimens) are separately mentioned.

It is probable, therefore, that the second specimen was one of 12-*striatus*, and furnished the character of the relative length of the limbs. As regards every other distinctive character the description is that of the other form, as will be seen by this enumeration of *distinctive characters* only.

All the scales of the head are said to be keeled:—

"Celles qui occupent l'intervalle intérorbitaire et l'occiput offrent un peu moins de longueur et ne portent la plupart qu'une seule carène.

"Les régions surciliaires . . . . présentent vers leur partie centrale, *quatre* ou *cinq* plaques.

"Il existe un *double rang* de grandes écailles carénées au-dessus de la série des plaques labiales supérieures.

"La queue est environ *une fois* de plus étendue que le reste du corps.

"Corps d'un brun fauve doré, avec ou sans bande d'une teinte plus claire sur le dos."

Dr. Hallowell (Proc. Ac. Nat. Sc. Philad. 1856, p. 222), speaking of the specimens of *Norops* in the Smithsonian collection, says:—"But one species of this genus has been described, viz. *N. auratus*, from Surinam and other parts of Guiana. The specimen in our collection, received from the Garden of Plants, is from Mexico. The toes are dilated, but not to so great an extent as in many species of *Anolis*." He then proceeds to describe a second "species with the same generic characters, but in which the toes are totally destitute of any such dilatation." He calls this species *N. macrodactylus*. In the course of his description he says:—"The head is long and narrow, occipital plate quite distinct; fingers and toes not dilated; body slender; upper surface white; sides brown, white-spotted; a lateral white stripe extending from beneath the eye along the side of the head immediately above the tympanum, passing along the side of the neck about a line above the shoulder, and extending the whole length of the side of the body, becoming lost on the tail.

There is sufficient here to enable one to recognize the 12-*striatus* of Berthold, of whose previous description he was of course ignorant. The colours are particularly accurate and characteristic of this species, which has quite a different coloration from that of *auratus*, as will be seen by the summary of the latter by Duméril and Bibron :—"Corps d'un brun fauve doré, avec ou sans bande d'une teinte plus claire sur le dos."

Cope (*l. c.* 1861, p. 212) enumerates the 12-*striatus* of Berthold (affixing his own name to the species with no apparent reason), and says that it is identical with Hallowell's *macrodactylus.*

Thus the true *Norops auratus* is the *auratus* described by Duméril and Bibron; and this has been recognized by Berthold, the first authority for the other species, and by every writer since who has discriminated between the two species, with one exception.

Dr. Peters, in the 'Berichte der Verhandlungen der Akad. Berlin,' 1863, p. 135, described an *Anolis tropidonotus* as a new species "nearly allied to the *A. auratus* of Daudin." He then gives, as synonyms of the latter species, the *Draconura 12-striata* of Berthold and the *Norops macrodactylus* of Hallowell.

The species of Berthold and Hallowell is *not* the *auratus* of Daudin, since those writers have characterized it as a slender species, with a tail nearly thrice the length of the body, toes not dilated, the scales of the *muzzle only* keeled, the rest of the head-shields smooth, occipital plate distinct, only *one* series of scales between the eye and upper labials, and Duméril and Bibron have characterized the *auratus* of Daudin as having the tail only twice the length of the body, the occipital plate very small and indistinct, *two* series of scales between eye and upper labials, and all the head-shields strongly keeled.

On the other hand, the species *Anolis tropidonotus* of Dr. Peters is nothing more than the true *auratus.*

The principal characters which he enumerates are as follows :—

1. *Two* longitudinal rows of larger keeled scales between the supralabials and the eye.

2. The occipital shield is much smaller, and the surrounding shields larger, than in *A. auratus* (12-*striatus*).

3. The ear-opening is larger.

7. The expansion of the toes is much more developed.

8. The tail is shorter.

9. The white lateral stripe, so characteristic of *A. auratus* (12-*striatus*), is absent.

10. In adult males the gular pouch hangs down very much.

Dr. Peters then describes the colours, which are, in fact, exactly those of the true *auratus.*

He further gives also the important character of the greater length of the limbs. The fore and hind limbs, he says, reach, when laid forward, even beyond the head, while in the other case, he adds, the latter attain only to the *nasal* aperture (Nasenöffnung; he probably means ear-opening, Ohröffnung).

We have already seen that Berthold mentions expressly the first proportionate length as distinguishing the *auratus* of Daudin, thereby, indeed, supplementing the description of Duméril and Bibron in the one point in which it fails, and the other, no less expressly, in his description of 12-*striatus*.

It is curious that Dr. Peters should remark at the end of his notice, "It is probably this species which the Smithsonian Institution received from Paris as *N. auratus*," referring, of course, to the specimen which Dr. Hallowell mentions, and which, as we have seen already, both he and Cope regarded, very properly, as the true *auratus*.

The following is a description of the genus *Norops* and its species, with their correct synonymy:—

NOROPS, Wagler, Natürliches System der Amphibien, 1830.

Skin beneath the neck forming a salient fold, a sort of small throat-pouch without denticulations. Palate not toothed*. Femoral pores none. Toes slightly or not at all dilated, with keeled rhomboidal scales on each side, and a series of smooth imbricate transverse plates beneath. Scales of the back and belly keeled, imbricate, disposed in longitudinal rows, of the sides very small, round or oval; those of the belly are slightly smaller than those of the back. Back and tail without crest. Tail moderate, not prehensile.

1. *Norops auratus.*

Anolis auratus, Daudin, Suites à Buffon, An x.; Hist. Nat. des Reptiles, tom. iv. p. 89.

Norops auratus, Wagler, Natürliches System der Amphibien, 1830, p. 149; Wiegmann, Herpetologia Mexicana, pars 1, 1834, p. 16; Duméril et Bibron, Suites à Buffon, Erpétologie Générale, 1837, tom. iv. p. 82, pl. 37. f. 2; Berthold, Ueber verschiedene neue oder seltene Reptilien, &c., Göttingen, 1846, p. 6; Hallowell, Proc. Acad. Nat. Sc. Philadelphia, 1856, p. 222.

Anolis tropidonotus, Peters, Berichte über die Verhandlungen der Akad. Berlin, 1863, p. 135.

Head, as well as snout, covered with strongly keeled scales;

* Dr. Gray (Catalogue of the Lizards in the British Museum, 1845, p. 207) says, "Palate toothed." Every writer since Daudin, however, has confirmed this, the principal character upon which the separation of *Norops* from *Anolis* has been based.

Duméril and Bibron say, "Quoiqu'il en soit, les *Norops* constituent un petit groupe générique assez nettement caractérisé par l'absence complète de crêtes dorsales et de pores fémoraux." Now *Anolis*, likewise, has no femoral pores, but has teeth on the palate.

At the date at which Dr. Gray's Catalogue was compiled there was no specimen of *Norops* in the British Museum.

two rows of scales between supralabial series and eye; occipital plate very small. Toes dilated, although not to the same extent as in *Anolis*. Both fore and hind limbs, when laid forward, reach to the tip of the snout. Tail twice the length of the body.

Coloration. Upper surface of a bright gilded brown; a black or purple stripe upon side of body: lower surface yellowish, with glossy reflections.

In a specimen of this interesting species in the collection of the British Museum the shape of the head exhibits a strong convexity from the eye to the nape; the upper surface immediately in front of the eyes is occupied by a remarkable depression. The breadth of the head at its broadest part behind is contained only once and one-third in the length of the same. Every scale of the head has a strong raised ridge or keel along its whole longitudinal extent; the united effect of all these keels is to give a very rugose appearance to the general surface. All the descriptions of this species at present extant represent the scales of the head, and more particularly of the snout, as many-keeled or tricarinate. None of these scales, however, seem to possess more than the one very strong keel just mentioned. It is probable that this statement, especially in Duméril and Bibron's description, was founded upon a specimen of 12-*striatus*, in which, as we shall see, the scales of the muzzle are distinctly 3-keeled. Dr. Peters does not mention the extent to which the scales are carinated in his *tropidonotus*. There are distinctly two series of elongated keeled scales between the supralabial series and the eye, as stated by Duméril and Bibron and Dr. Peters.

The supraorbital space is occupied by a group of five large keeled scales, surrounded externally by a multitude of very small round scales, and internally by a semicircular ridge formed by the stronger and more raised keels of the adjacent head-shields. The superciliary edge is sharp, keeled, sending a sort of crest down to the nasal opening. The occipital plate is very small, scarcely distinguishable without a lens as a circular point in the midst of the keeled scales of the occipital part of the head. Ear-opening large.

The general line of the back is convex; although the body is somewhat compressed, the surface of the back is rounded. Thirteen to fourteen series of large, imbricate, keeled scales, beginning immediately behind the head, extend longitudinally the whole length of the back, and continue convergently on the tail; their keels form regular longitudinal ridges. The scales of the upper surface of the tail are a continuation of those of the back.

The tail (exactly described by Duméril and Bibron) is almost quadrilateral at its root; but afterwards, and for the rest of its length, it presents a slight compression, without, however, presenting any raised sharp ridge above.

The scales of the sides form a broad surface, beginning abruptly under the outermost series of the dorsal scales; they are very minute, uniform, closely set, and appear at first sight merely granular. They extend forwards to the tympanic region; the scales immediately anterior to the ear become larger and more distinctly keeled. The twelve to fourteen longitudinal series of large keeled scales which extend the whole length of the ventral surface bound abruptly this lateral space of minute scales on each side beneath; they are somewhat smaller than those of the back.

Upper surface of the limbs with keeled scales like those of the back and belly; lower surface like the sides of the body.

A rather large gular pouch, or compressed longitudinal fold of skin, depends from immediately beneath the eyes to considerably beyond the fore limbs, along the central line of the chest and belly. It is not serrated along the edge, where the scales are much more closely set than on the sides of the pouch, on which they are distributed in radiating stripes with wide intervals not apparent when the skin is folded close against the throat. These scales have a brilliant metallic lustre.

The hind limbs are long and well developed. The fourth toe is much longer than the third. The toes are distinctly expanded into an ovate or pear-shaped disk beneath, and covered inferiorly with narrow transverse plates.

Both fore limbs and hind limbs, when stretched forward, reach to the tip of the snout.

The tail is exactly twice the length of the body.

The colour characteristic of *Norops auratus* is well rendered, in the words of Duméril and Bibron, as "un brun fauve doré." The entire upper surface is of this golden brown, and probably very glittering in life; the lower surface is yellowish, with metallic lustre. There is a black or purplish stripe along the side of the body, apparently not beginning at so anterior a point as the lateral stripe in 12-*striatus*; but there is no white stripe in this species.

The dark stripe of this species is represented in the figure at pl. 37. f. 2 of the 'Erpétologie Générale;' but it is evident that, although in general form more like *auratus*, the figure in question partakes of the characters of the two species.

Localities given by different writers:—Mexico (Peters and Hallowell); Guiana or Surinam (Duméril and Bibron).

The specimen in the British Museum is said to have come from South America.

2. *Norops duodecim-striatus.*

Draconura duodecem-striata, Berthold, Abhandlungen der Königlichen Gesellschaft der Wissenschaften zu Göttingen, 1843, p. 62.
Draconura Bertholdii, Fitzinger, Systema Reptilium, 1844.
Norops macrodactylus, Hallowell, Proc. Ac. Nat. Sc. Philad. 1856, p. 222.
Anolis auratus, Peters, Berichte über die Verhandlungen der Akad. Berlin, 1863, p. 135.

Head somewhat depressed, pointed, covered with regular rather flat shields, those of the snout only minutely tricarinate, the rest smooth; one series of long narrow scales between supralabials and eye; occipital plate large, oval, larger than any of the other head-shields. Toes not dilated. Fore limbs, when laid forward, reaching to nasal opening, hind-limbs to ear-opening. Tail about thrice the length of the body.
Coloration. Head, back, and upper part of tail white above (probably pale golden when alive); sides brown, white-spotted; a white stripe extending from eye, over tympanum, along the side of head and neck, and the whole length of the body, becoming lost on the tail.

The general shape of *N. 12-striatus* is slenderer than that of *auratus*. The head is longer and narrower, its width at the posterior broadest part being contained exactly twice in the length of the same; the muzzle is more pointed than in that species. The upper surface of the head is somewhat flattened rather than convex. The scales of the muzzle only are minutely but distinctly tricarinate; those covering the rest of the upper surface of the head are smooth. No projecting ridge bounds the inner semicircular border of the supraorbital space, which is composed of a group of large smooth plates, more numerous than in *auratus*, and a mass of minute granular ones. The upper edge of the orbit is rather sharp, and extends down to the nostril much as in that species. The occipital plate is large, oblong, much larger than any other plate on the head. Ear-opening *smaller*. There is only one series of elongated scales between the supralabials and the eye.

The longitudinal line of the back is much flatter than in *N. auratus*, and the surface of the back is wider, the body being less compressed. The scales on the back, belly, and sides are similar to those of the latter species. The tail, somewhat flattened above at its commencement, does not present the quadrilateral form or the compression mentioned by Duméril and Bibron, gradually becoming more rounded; it is covered with keeled scales like those of the back.

A gular pouch is mentioned by Berthold and Dr. Hallowell. Like that of *N. auratus*: the gular pouch is evidently possessed by the male *Norops* only.

The hind limbs are much shorter than in the preceding. The fourth toe is much longer than the third. The under surface of the toes is covered with transverse scales, which, however, are much narrower than the same scales or plates in *auratus*, as there is no appearance of dilatation in any of the toes.

The fore limbs, when stretched forward, reach to the extremity of the snout, the hind limbs only to the ear-opening.

The tail is thrice the length of the body.

Colours as stated above,—well described by Dr. Hallowell.

Localities given by different writers:—Surinam (Berthold), New Granada (Hallowell), New Granada? (Cope).

A specimen collected by Mr. Bates at Santarem, Amazons.

As both Dr. Hallowell and Dr. Peters agree in giving Mexico as the habitat of the *N. auratus*, the latter speaking of six specimens collected by Dr. Hille at Huanisco, it is not improbable that *N. auratus* is a truly Mexican species, while 12-*striatus* is its South-American representative.

XXVII.—*On the Manner of Growth of* Hyalonema. By Dr. J. E. Gray, F.R.S., V.P.Z.S., &c.

The writers of anonymous papers in two scientific journals state that I have adopted Prof. Lovén's opinion that the *Hyalonema* grows rooted in the mud. I thought that by my paper I had sufficiently shown the difference between Prof. Lovén's and my theory. From the examination of the direction of the polypes and the form of the sponge of the specimens which had come into my possession, and the study of Dr. Max Schultze's description of the sponge of one of his specimens, I was convinced that the sponge to which the *Hyalonema* was attached could not be attached to any marine body by what Prof. Brandt, Prof. Max Schultze, and I have called its base, and that it must have lived with the so-called base upwards; and I believed that it did live free, with the free ends of the siliceous filaments sunk in the sand or mud.

Prof. Lovén, on the other hand, believes that all the specimens we have in museums are imperfect, and have been torn by force from a part of the specimen which is furnished with an expanded root and attached to some marine bodies.

Dr. William Carpenter does not appear to have a very clear idea of Dr. Lovén's paper; for in his very interesting "Preliminary Report of Dredging-Operations in the Seas north of of the British Islands" (Proc. Roy. Soc. xvii.), he seems to have made the same mistake: thus at page 176 he states, "As it thus appears that these siliceous sponges, when growing on the surface of the mud, send root-fibres (so to speak) far and wide into its substance, the idea previously suggested by Prof. Lovén, that the elongated flint-rope of *Hyalonema Sieboldii* is in reality the mud-imbedded stem, supporting the sponge with which it is connected, instead of being implanted in the sponge and supported by it (which is the commonly received opinion), seems the more likely."

Prof. Lovén has made this distinction himself very plainly in a very amusing and instructive letter, which he most kindly sent to me immediately on the publication of my paper in the 'Annals:'—

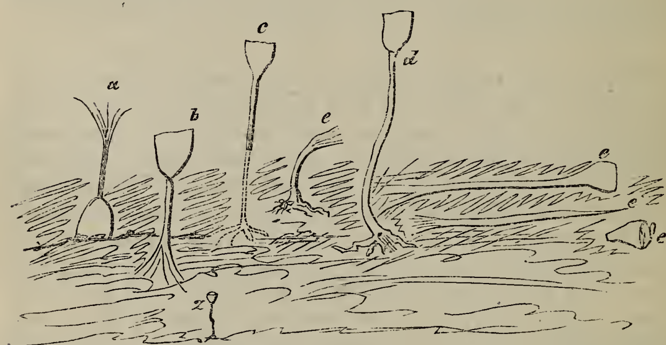
"I have just read your paper in the Ann. & Mag. 4th ser. No. 10; and, as I am not very fond of differing from you, I am glad to find that you now turn the old *Hyalonema* upside down—that is, place it with 'the sponge' upwards. This view, I see, is confirmed by Prof. Perceval Wright, who says, just as I maintained, that the 'siliceous axis' is the stem of the sponge; and also by Prof. Wyville Thomson, who found the *Hyalonema* growing upside down, which he might have more than 'suspected' from my paper. So far we all agree. As to what is now the lower end (formerly the upper) of the stem (coil), you are inclined to believe it to be 'sunk in the mud.' I cannot conceal that this mode of growing would be very unnatural indeed, unless you at the same time suppose the basal end to be provided with roots, in which case you have my *Hyalonema* complete.

"In order to settle the whole question, the best measure would be this: let orders be given to all the ships of your navy stationed in the Japan seas to dredge on the fishing-grounds off Inosima, and not to give up working till they have got entire specimens of the *Hyalonema*, with roots and all (every one to be preserved in strong spirits), and in a number sufficient for the glory of the British Museum *. Among the contents of the dredge brought from the bottom, and of which not a particle is to be thrown away, there will be found, besides those entire specimens, in some of which the stem will have an extraordinary length, other specimens mutilated by the dredge or by fishermen's nets, some being the stumps of the basal parts with the roots, others the upper parts of the stem with the head or without the same, it having been

* Allow me to suggest that perhaps one more specimen ought to be taken.

carried away by the dredge or by the nets, or otherwise; and on entire specimens, as well as on fragmentary ones, there will often be found the parasitic *Palythoa* investing them, and in some cases, where the head has been torn off, even creeping over the tip of the upper end of the stem and overgrowing it, as in the specimen you sent me.

"You see I venture to prophesy; and although it is said that 'no one is a prophet in his own country,' I may perhaps turn out to be one in the depths of the Japan sea. And when you have placed before you the superb specimens so procured, and the old ones too, you will have the history of the *Hyalonema*, as follows:—



"*a*, being the old notion.
"*b*, your supposition.
"*c*, my interpretation.
"*d*, what I expect from the dredge.
"*e*, disjecta membra.
"*z*, *Hyalonema boreale*, the innocent cause of this controversy."

As a note to the observation just quoted, Dr. Carpenter observes, as if he considered it a contradiction, that "Dr. J. E. Gray, whilst still maintaining that the flint-rope is a zoophytic product, and that the sponge with which it is connected is parasitic, has also come to the conclusion that the brush-like termination serves as the root implanted in mud, above which the sponge is borne."

It appears to me that the fact of Flint-Sponges and the zoophytic *Hyalonema* both having spicules sunk in the sand and serving as roots, may be an analogy as well as an affinity, considering that they both have to serve the same purpose of supporting the animal on a soft and yielding base, and that if the spicules were formed of calcareous matter they might be acted on by the sea-water and the chemical constituents of the mud. The discovery of this use of the spicules of *Hyalonema* induced me to believe it might be the use of the long spicules of *Euplectella* and *Semperella*; and more recently Mr. Carter has shown that a *Tethya* is supported by similar elongated flinty fibres.

I must own that I am not convinced; and I do not think that I should be true to science and scientific truth if I did conform to any views which do not satisfy my doubts, or I should be most ready to give up my opinion if I were so, standing as I now do almost alone in my view of the question.

It does appear to me remarkable that we should have zoologists and physiologists of established reputation giving so decided an opinion on the subject, when they do not consider it necessary to reply to the reason that has been assigned why the spicules of *Hyalonema* are not sponge-spicules. It is true that *Hyalonema* and Sponges have siliceous spicules; but it is also shown that they occur in zoophytes, and that silica forms a large part of the constituents of stony corals. The siliceous spicules of sponges and *Hyalonema* have a central canal, which Mr. Carter has lately shown is not found in the calcareous spicules of sponges or zoophytes. The spicules of *Hyalonema* are formed, like the axis of zoophytes, of concentric layers; but no microscopist or physiologist has attempted to show me a siliceous spicule of a sponge that was formed of concentric coats, nor have they responded to my challenge to show me any spicule of a sponge that has the mode of growth or the external microscopical characters of the spicule of *Hyalonema*, which as a spicule is *sui generis*, and is more like the axis of a zoophyte than anything else. And why might not a zoophyte have a bundle of axes as well as one? They all harp on the one string that the spicules of *Hyalonema* are siliceous, and so are the spicules of most sponges, of all true sponges (for I think the calcareous animal bodies that have been called calcareous sponges belong to quite a different class), and therefore *Hyalonema* must be a sponge—I must say, a very lame conclusion when we consider how the siliceous spicules of *Hyalonema* differ in structure and mode of growth from the spicules of sponges.

The zoologists and physiologists have not shown me any sponge in which every spicule is surrounded by a regular coat of sarcode. They say that this sarcode is full of siliceous spicules of another form; but why, if the sarcode existed and formed one siliceous spicule, should it not form others of the same or other forms?

It has been objected that the *Palythoa* is so like the *Palythoa* that does not secrete siliceous spicules, that it must be a parasite; but they forget that the animal of a Madrepore is very nearly allied to *Palythoa*—in fact only a *Palythoa* living in very crowded colonies and having a strong coral to protect it instead of a cartilaginous coat more or less strengthened with sand or spicules; and if the *Palythoa* of a Madrepore secretes 22 per cent. of silica in the same state of chemical combination as it is in the spicules of *Hyalonema*, why may not an allied species secrete silica that takes the form of spicules? The question is, I own, a very difficult one: but it is not to be solved by the *ipse dixit* of this or that Professor; it is one that requires careful study.

Unfortunately, some men of great reputation have, without sufficient examination and consideration, committed themselves to a theory, and they do not like to reconsider the question; but the time will come when it will be reconsidered; and if I am proved to be wrong, I shall have great pleasure in adopting their views and freely admit my mistake.

XXVIII.—*On the Habitat of the* Regadera (*Watering-pot*) *or Venus's Flower-basket* (Euplectella aspergillum, *Owen*). By Thomas J. Moore, Free Public Museum, Liverpool.

Dear Dr. Gray,

A few days since I received a note from Mr. S. R. Graves, M.P. for Liverpool, requesting me to call at his office to see some specimens which he thought would interest me. I went immediately, and Mr. Graves showed me two fair specimens of *Euplectella* which, with some others in still better condition, were brought to him by Capt. Robert Morgan, of the ship 'Robin Hood,' which vessel had just arrived in Liverpool from the Philippine Islands.

I fear I somewhat disappointed Mr. Graves when I told him we had already finer specimens in the Museum, from the first lot sold in England. Presently, however, Mr. Graves put in my hand an exceedingly clear and neatly written document by Capt. Morgan, detailing the place and mode of capture of these specimens, and illustrated by a rough sketch. This at once riveted my attention, as I could not call to mind any statement so definite and precise in any of the numerous papers published since the influx of these beautiful objects. I asked Mr. Graves's permission to publish the communication, which permission he kindly gave me, and promised that he would ask Capt. Morgan to call upon me; and I have this day had the pleasure of seeing him.

Capt. Morgan tells me that, after a tedious voyage among the Philippine Islands, he put into Cebú, to ship some sugar, and that he derived much of his information from a friend

(George Mackenzie, Esq.) resident in the neighbourhood, and fond of natural-history pursuits. Capt. Morgan had not actually been out with the natives, but had seen them from his ship engaged in the Regadera-fishing.

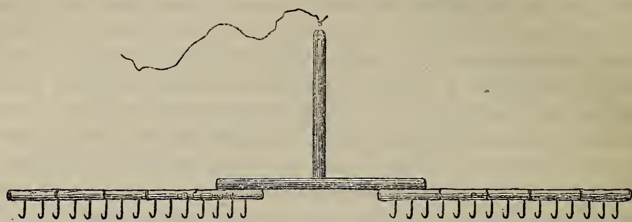
Soon after the arrival of specimens of *Euplectella* the island of Cebú was stated to be the place they were brought from. As an explanation of the sudden influx of what was previously known only from a unique specimen, I was told that Cebú had just previously been made a free port, and a large extension of commerce was the result. Instead of this having been the case, I am now informed that the sugar which Cebú largely produces was till lately transported to Manilla, to be there reshipped for Europe. This expense is now saved by the European vessels shipping the sugar direct from Cebú itself, which, after all, had a suitable though neglected harbour of its own; and *hence* the increase of trade with this previously little-known island. That the influx of specimens, though doubtless largely promoted by this increase of direct communication with Europe, is not caused thereby, will be evident on reference to the paper by Herr C. Semper ("On *Euplectella* and its Inhabitants"), translated in the 'Annals' for July 1868, p. 26. In this paper Dr. Semper bears personal testimony to their extreme rarity up to 1864. That communication also contains the nearest approach that I have seen to the habitat given by Capt. Morgan; but at the place indicated by the fishermen of S. Nicolas, in 120 fathoms water, Dr. Semper states he dredged in vain, and concluded that he had been purposely deceived.

I send herewith Capt. Morgan's paper just as received, and, in conclusion, only add that he told me, in reply to my question why the Regaderas were said to point one way, that when the natives draw their fishing-apparatus in one direction, they catch the specimens, and when they draw it in the opposite direction, they *don't* catch them. I should think the statement that the crustaceans within the Regaderas can travel in and out (by burrowing downwards) is due to the same lively imagination as the previously known statement that *they* are the architects of the abode in which they are found.

Liverpool, Dec. 23, 1868. T. J. Moore.

"The only place where Regaderas are to be found is about three miles from the shore in front of the small village of Talisay, which is about five or six miles south of the town of Cebú, Isle of Cebú, Philippine Islands.

"The mode of catching them is very ingenious, and is as follows:—When the tide is about its full, the natives go out in very small canoes to the bed in which they are found, and which is about one mile in circumference and from 130 to 135 fathoms deep. The native, when he considers he has come to about the extremity of the bed, then lets drop his fishing-tackle, composed, as in the rough sketch given herewith, of



a piece of iron of the shape of a T, to the two extremities of which are attached two flexible pieces of bamboo armed with hooks. This sinks to the bottom, and the native sits perfectly still in his tiny canoe, which is then gradually drifted by the tide or current over the ground on which are found the Regaderas. So soon as he feels that his trawling-apparatus has caught something, he begins to haul his line gently in, and generally finds two or three Regaderas impaled on the hooks. When taken out of the water, the Regaderas are dirty and yellow; but, after being put in fresh water or exposed to the rain and then dried in the sun, they become perfectly white.

"The bottom of the sea where the Regaderas are found is composed of soft mud and sand. The root of the Regadera is imbedded in this, and the top or broad part always looks, as the natives say, to the setting sun ("*a donde se pone el sol*"). In the Regadera, when fished up, are generally found from one to three small animals (*bichos*) of the crab species, of about the size of very small shrimps. [In the annexed sketch one is drawn of the size of life.] These are supposed to make

these Regaderas, which are at first very small—say about an inch long, and generally expand about a foot in length. These crabs or animals can burrow into the sand out of their pretty home, and reenter it at will. The hooks of course frequently catch Regaderas without bringing them up; and many that have been recovered show signs of having had a new piece of netting put over the part torn by the hook.

"It is said that the first Regadera discovered in Cebú was sold for \$50, and that a Dr. Caloo, who took it to Manilla, was there offered \$200 for it. For some time after that they continued to be worth \$16 each.

"It was only in 1865 that they became abundant, through the present bed being discovered."

XXIX.—*On the* Ehretiaceæ. By John Miers, F.R.S., F.L.S., &c.

[Continued from p. 112.]

Bourreria.

I have already stated (*ante*, p. 107) that the *Bourreria* of Browne (*Beurreria*, Jacq.), which DeCandolle regarded as a mere section of *Ehretia*, must be regarded as a distinct genus, on account of the several differential characters there mentioned. Its drupaceous fruit encloses four nucules, flattened on their converging angular sides, rounded exteriorly, where they are cleft obliquely into many thin laminiform plates, which are intersected by small divisions into numerous cells filled with fibrous and pulpy matter, thus forming a sub-spongiose rigid network on the exterior side; its inner portion is osseous, angular, and contains a single seed: this seminiferous cell is somewhat incurved longitudinally round another spurious cell, with which it has a placentary communication through a small spot to which the single seed is attached by its middle: this spurious cell is filled with nourishing tissue, and has a large foramen opening externally on one side of the nucule, either on the right or left side; for the four nuts are geminately arranged in pairs, as in *Rhabdia*, and in each pair, upon their contiguous sides, these foraminal openings face one another, while the opposite sides are plane; and through these channels the nourishing vessels from the placentary column are seen to enter each cell: the seed, which fills the true cell, is cylindrical, somewhat incurved as before mentioned, and attached by its middle to the placentary point; upon the integument on that side a line of descending raphe runs from the hilum to a small basal chalaza. Although Gaertner, by mistake, reversed its position, he was quite correct in stating that the embryo is enclosed in a rather thick fleshy albumen, notwithstanding that Prof. A. De Candolle mentions that he had been unable to find it. The calyx and corolla resemble those of *Crematomia*, only that the lobes of the border in *Bourreria* are simple, not auriculated; the style is more shortly bifid; the ovary has the placentation of *Rhabdia.*

Bourreria, Browne;—Beurreria, *Jacq.*;—Ehretiæ sect., DC. —*Calyx* ad medium tubulosus, coriaceus, superne in lobos 5 (rarius 6) acutos divisus, marginibus crassis, tomentosis, æstivatione valvatis, firme adhærentibus, demum solutis, vel interdum false 2–3-lobus, persistens. *Corolla* gamopetala, tubo calyce paulo longiore, limbi laciniis 5 (rarius 6), oblongis vel rotundatis, patentibus, tubo paulo longioribus, æstivatione valde imbricatis. *Stamina* 5 (raro 6), alterna, longiuscule exserta aut vix exclusa; *filamenta* subulata, carnosula, medio tubi vel sub fauce affixa, sæpe cum costis totidem decurrentibus continua; *antheræ* oblongæ, 2-lobæ, lobis coriaceis, sæpe rugulosis, imo a medio divergentibus, superne collateraliter adnatis, utrinque rima longitudinali nivea lateraliter dehiscentibus, sinu dorsali ad filamentum breviter curvatum versatiliter affixæ: *pollen* globosum, tela tartarea intermixtum. *Ovarium* oblongum, striatum, *disco* parvo suffultum, semiseptis e parietibus 2 oppositis intergerivis, mox in crura magna utrinque divaricatim recurvis, septa 2 parallela subincompleta efformantibus, marginibus *ovulum* singulatim amplectentibus, hinc pseudo-4-loculare, 4-ovulatum: *columella* compressa, membranacea, septis parallela, axem sistens et fibros nutritorios intra loculos emittens. *Stylus* teres, longiuscule exsertus, apice breviter bi- (rarius tri-)fidus, ramis *stigmate* peltato singulatim clavatis. *Drupa* carnosa, globosa, 4-pyrena; *pyrenæ* intus angulatæ, extus convexæ, bigeminatim per paria materiei placentari laxe adhærentes, dorso oblique spongioso-cellulosæ et reticulato-favosæ, aliter osseæ, 1-loculares, singulatim latere unico (invicem dextro et sinistro) locello spurio infossatæ, *loculo* vero circum spurium paulo curvato, 1-spermo. *Semen* loculum implens, cylindricum, teres, paulo curvatum, juxta locellum spurium puncto medio appensum: *integumenta* tenuia, *raphe* lineari ab hilo ad *chalazam* basalem descendente notata: *embryo* in *albumini* subamplo carnoso semianatropus et paulo curvatus, *radicula* tereti, supera, *cotyledonibus* æquilatis, subcompressis, hilo parallelis, æquilonga.

Arbores et arbusculæ *ramosi, in America intertropicali et in Antillis indigeni;* folia *alterna, oblonga vel obovata, integra,* *petiolata:* paniculæ *corymbosæ, terminales, dichotome ramosæ;* flores *mediocres, albidi:* drupæ *aurantiacæ vel rubræ, nitidæ.*

1. *Bourreria (Beurreria) succulenta,* Jacq. Amer. 44; Obs. 2, tab. 26; Gaertn. iii. 170, tab. 212 (non Griseb.);—Bourreria arborea, *Browne, Jam.* 168, tab. 15. fig. 2; Ehretia Bourreria, *Linn. Syst.* iii. 936; *Lam. Dict.* i. 527; DC. Prodr. ix. 506;—Cordia Bourreria, *Linn. Amœn.* v. 395;—Jasminum periclymenifolium, *Sloane, Jam.* ii. 96, tab. 204. fig. 1; *Ray, Dendr.* 63;—ramulis teretibus, subangulatis, tenuibus, glabris; foliis obovato-oblongis aut ovatis, imo cuneatis, apice rotundatis vel obtusis, glabris, supra nitidis, ad nervos sulcatis, subtus pallidioribus, flavidiusculis, nervis paulo prominulis, margine subundulatis; petiolo canaliculato, limbo 8–10-plo breviore: racemis apud ramulos ultimos novellos paucifoliosos terminalibus, brevibus, foliis delapsis deinde corymbum laxiusculum mentientibus, brachiis compressis, glabris; calyce tubuloso, crasso, glaberrimo, acute semi-5-fido, dentibus margine tomentosis; corollæ tubo calyce paulo longiore, limbi lobis oblongis, expansis; staminibus paulo exsertis; drupa globosa, carnosa, crocea, piso majore, 4-pyrena.—In Antillis: *v. s. in herb. Mus. Brit.*, Jamaica (specim. typ. in hb. Sloan. vol. vii. fol. 36, planta superior); Jamaica (Dr. Wright).

Many plants have been confounded with this species, the type of which exists in Sloane's herbarium; and, as no doubt can be raised concerning it, I have reformed its specific character from the original. It is described by Sloane and Browne as a tree from 14 to 20 feet high, growing in the lowlands of Jamaica. The leaves are $2\frac{1}{2}$ inches long, $1\frac{1}{2}$ inch broad, on a petiole 3–4 lines long; the racemes, terminal on the young branches, seldom exceed an inch in length; but as the leaves fall off, the inflorescence assumes the appearance of a more extended irregular corymb; the flowers are white, upon very short pedicels; the calyx is fleshy, 3 lines long, glabrous outside, pubescent within the teeth, which are tomentose on the margins; the tube of the corolla is 5 lines long, the lobes of the border 3 lines long; the subulate filaments are inserted above the base of the tube and extend beyond its mouth, the anthers are versatile, attached in the sinus of their divergent base. The placentation of the ovary and the structure of the fruit accord with the above generic character; the drupes, of a saffron-colour, are 3 lines in diameter.

The plant described by Desfontaines under the name of *Ehretia Bourreria* corresponds with my *B. recurva,* agreeing in the size and shape of its leaves, its inflorescence, and the peculiar form of the style. Jacquin's description embraces more than one species. The *Bourreria succulenta*, Grisebach (non Jacq.), Cat. Pl. Cub. p. 209, refers to two very different plants (both, Wright, 3119), described by him as flowering and fructiferous examples of this species: the former is a species closely allied to *Patagonula*, the latter is my *Bourreria clariuscula*.

2. *Bourreria Domingensis*, nob. (non Griseb.);—Ehretia Domingensis, *DC. Prodr.* ix. 508;—ramulis subangularibus, striatis, glabris; foliis oblongis aut oblongo-ellipticis, imo obtuse angustioribus, apice subacutis vel repente obtuse acuminatis, planis vel paulo navicularibus, supra nitidis, nervis tenuibus immersis, reticulatis, utrinque glaberrimis (nisi costa mediana superne sulcata et pilosula), subtus fulvo-glaucis, costa nervisque nitidis, rubescentibus, prominulis, in nervo marginali vix revolutis; petiolo tenui, supra canaliculato, glabro, rubello, margine ciliato, limbo 9-plo breviore: panicula corymbosa, terminali, laxe repetitim ramosa, ramis bracteatis, ramulisque angulato-compressis, glabris; floribus brevissime pedicellatis; calyce extus glabro, ad medium 5-fido, dentibus acutis, intus pubescentibus; corollæ tubo calyce vix longiore, laciniis ovatis, extus tomentellis, patentibus; filamentis tenuibus, sub fauce enatis, cum costis totidem tubo decurrentibus continuis, exsertis; ovario disco insito, conico-oblongo, striato; stylo tereti, apice breviter bifido; drupa globosa, 4-pyrena.—In Antillis: *v. s. in herb. Mus. Brit.*, in ins. Carib. (Ryan), (De Pouthieu); *in herb. Hook.*, St. Vincent (Guilding), Domenico (Imray, 127), Antigua (Nicholson).

The *Bourreria Domingensis* of Dr. Grisebach (Fl. Br. W. Ind. p. 482) is evidently a very different species, judging from his short character, in having a cyme terminated with glomerated sericeous flowers, a hoary calyx; and from his description of the leaves it appears to me to be my *Crematomia attenuata*; and this is confirmed by his citing as an example Dr. Alexander's plant from Albion Pen, in Jamaica, which I have elsewhere described.

The leaves in this species are 3–4½ inches long, 1¼–1⅝ inch broad, on a petiole 4–6 (rarely 7) lines long. The panicles are terminal upon the younger ultimate branchlets, about 2 inches long; and several of these often combine to make a large spreading corymb 5 inches long and broad; the calyx is 3 lines, the tube of the corolla 4 lines long, its lobes 3 lines in diameter; the ovary and fruit in their construction conform with the generic character.

3. *Bourreria recurva*, nob.;—Ehretia Bourreria, *Desf.* (*non Linn.*) *Ann. Mus.* i. 279:—ramulis compressis, glabris; foliis late ovatis, naviculari-recurvis et canaliculatis, apice brevi obtusulo attenuatis, imo rotundatis, inæquilateris et in petiolo subito brevissime decurrentibus, utrinque glaberrimis, supra subnitidis, reticulatis, subtus paulo pallidioribus; petiolo canaliculato, glabro, limbo 10-plo breviore: panicula terminali, a basi dichotoma, laxe et late expansa, ramis compressis, glabris; calyce carnoso, acute 5-dentato, fusco, extus glabro, intus pallido et subpuberulo; corollæ tubo calyce paulo longiore, lobis rotundatis; staminibus medio tubi insertis, cum costis totidem tubo adnatis continuis, exsertis; stylo exserto, superne incrassato, valde dilatato, 2-sulcato, emarginato, indiviso, stigmatibus 2 distinctis sessilibus terminato.—In Antillis: *v. s. in herb. Hook.*, Prince Rupert's Head, ins. Domenico.

A species differing from the two preceding in the very deeply channelled recurved leaves rounded at base, in its inflorescence, and particularly in the agglutinated divisions of the style. The axils are $\frac{3}{4}$–1 inch apart, the leaves $3\frac{1}{4}$–4 inches long, $1\frac{3}{4}$–$2\frac{1}{2}$ inches broad, on a slender petiole 4–5 lines long. The spreading panicle is 3 inches long, 5 inches broad; the calyx is 3 lines long, the tube of the corolla 4 lines, the lobes 2 lines in diameter.

4. *Bourreria ovata*, nob.;—ramulis teretibus, violaceis, cinereo-glaucis, glabris; foliis rotundato-ovatis aut oblongo-ovatis, apice suborbiculatis, imo breviter acutis aut obtusis, sæpe inæquilateris, planis, utrinque glaberrimis et valde opacis, nervis tenuibus venisque reticulatis subimmersis, fusco-viridibus, subtus paulo pallidioribus, nervis vix prominulis, nitentibus; petiolo tenuissimo, canaliculato, recto, limbo 4-plo breviore: panicula corymbosa, terminali, dichotome divisa, ramis interdum 1-foliolosis, ramulisque tenuibus, compressis, glabris; floribus brevissime pedicellatis; calyce obconico, crassiusculo, glabro, dentibus intus velutinis; corollæ tubo calyce paulo longiore, crassiusculo, lobis rotundato-oblongis, paulo brevioribus; staminibus medio tubi insertis, paulo exsertis; stylo breviter bifido.—In Antillis: *v. s. in herb. Mus. Brit.*, Bahamas (ex hort. Cliff.); *in herb. Hook.*, Bahamas (anon.), Jamaica (Wilson).

The axils are $\frac{1}{2}$–1 inch apart; the leaves are 2–$2\frac{3}{4}$ inches long, $1\frac{1}{4}$–$1\frac{5}{8}$ inch broad, on a stiff slender petiole 6–9 lines long. The terminal panicle is 3 inches long, much divided; the pedicels are $\frac{1}{2}$ line long, the calyx 3 lines, the tube of the corolla 4 lines, the lobes 3 lines long; the anther-cases are rugose and subcoriaceous.

5. *Bourreria clariuscula*, nob.;—Bourreria succulenta, *Griseb.* (*non Jacq.*), *Flor. Cub.* 209;—ramulis subangulatis, subnitidis, glabris; foliis late ovatis, apice rotundatis, brevissime acuminatis vel emarginatis, imo petiolum versus obtusato-attenuatis, subinæquilateris, coriaceis, glaberrimis, supra læte viridibus, nitidis, valde reticulatis, subtus pallidioribus, nervis divaricatis, arcuatim nexis, glaucis, prominentibus; petiolo canaliculato, glabro, limbo 8-plo breviore: paniculis in ramulis alaribus terminalibus, dichotome ramosis, ramis compressis, glabris, paucifloris; calyce coriaceo, glabro, 5-dentato, inæqualiter rupto; corollæ tubo calyce æquilongo, lobos oblongos æquante; drupa piso majore, 4-pyrena; pyrenis generis.—In Cuba: *v. s. in herb. Mus. Brit.*, Cuba (Wright, 3119).

As previously mentioned (*supra*, p. 202), Prof. Grisebach has confounded, under the same name and number of Wright's plants, this and another (a species near *Patagonula*); but neither of them have the smallest resemblance to *Bourreria succulenta* of Jacquin, to which he referred them: the above plant has much broader, far more coriaceous, more reticulated, brighter, and more shining leaves, upon stouter petioles; they are 2–$2\frac{3}{4}$ inches long, $1\frac{3}{4}$–$2\frac{1}{4}$ inches broad, on a petiole 2–3 lines long; the corymb is $2\frac{1}{2}$ inches long, its peduncle $1\frac{1}{2}$ inch long, the branches 3–6 lines long; the calyx is 3 lines long, the drupe 4 lines in diameter.

6. *Bourreria rigida*, nob.;—ramulis teretibus, pallide glaucis; foliis elongato-ellipticis vel lanceolato-oblongis, apice obtusis aut rotundatis, imo cuneatim attenuatis, coriaceis, marginibus sæpe valde revolutis, supra convexiusculis, viridibus, in nervis sulcatis, fulvidis, minute tuberculato-rugulosis et scabride pilosis, subtus flavido-glaucis, pulverulento-tomentellis, nervis valde prominulis; petiolo rigido, canaliculato, cum costa flavide pulverulento, limbo 7-plo breviore: panicula corymbosa, terminali, dichotome ramosa, tomentella; calyce extus rigide tomentoso, dentibus 5 intus puberulis; corollæ tubo crassiusculo, calyce longiore, lobis rotundato-oblongis; staminibus medio tubi insertis, antheris oscillatoriis, exsertis; stylo apice breviter bi- (rarius tri-)fido.—In Antillis: *v. s. in herb. Mus. Brit.*, Jamaica (Houston), ib. (Shakespear); *in herb. Hook.*, Jamaica (Bancroft), ib. (M'Fadyen).

A very distinct species, with branchlets $1\frac{1}{2}$ line in diameter and axils 3–6| lines apart; the leaves are 3–4 inches long, $1\frac{1}{4}$–$1\frac{1}{2}$ inch broad, on a petiole 5–6 lines long: the panicle is about 3 inches long and broad; the calyx $2\frac{1}{2}$ lines long; tube of corolla 3 lines, lobes 2 lines long.

7. *Bourreria virgata*, Don (non Griseb.), Dict. iv. 389;—Ehretia virgata, *Sw. Flor. Ind. Occ.* i. 463; *DC. Prodr.* ix. 506;—fruticosa, ramis tenuissimis, teretibus, flexuosis, divaricatis, ramulis filiformibus, scabridulis; foliis oblongis vel ellipticis, apice obtuse acutis, imo acute attenuatis, supra profunde viridibus, nervis tenuibus immersis, planis, in costa sulcatis, albo-tuberculatis et scabridulo-pilosis, subtus pallidis, in nervis pilosulis; petiolo tereti, scabridulo, limbo 14-plo breviore: paniculis terminalibus, dichotome ramosis, ramis longis, tenuissimis, rigide pilosulis, paucifloris; calyce turbinato, acute 5-dentato, extus pubescente; corollæ tubo calyce duplo longiore, lobis rotundatis, dimidio brevioribus; staminibus imo insertis, antheris fuscis, vix ultra faucem exsertis; stylo apice breviter bifido; drupa (sec. cl. Sw.) subglobosa, 4-costata, nitida, coccinea, 4-pyrena, pyrenis per paria semiadhærentibus.—In Antillis (ins. S. Domingo in desertis Hispaniolæ, Sw.): *v. s. in herb. Mus. Brit.*, specim. typ. (Swartz, in flore).

A shrub, 7 to 8 feet high, bearing the name of *Guazumillo*, with very slender, almost filiform branches, the axils being about 9 lines apart; the leaves are $1\frac{1}{4}$–$1\frac{3}{4}$ inch long, 7–10 lines broad, on a petiole 1–$1\frac{1}{2}$ line long: the terminal raceme is about 1 inch long, few-flowered, with pedicels 2 lines long; the calyx is $2\frac{3}{4}$ lines long, the tube of the corolla 4 lines, its lobes 3 lines long.

The three several plants referred here by Dr. Grisebach (Pl. Wright. Cub. Or. p. 528) all belong to different species.

8. *Bourreria radula*, Don, Dict. iv. 390;—Ehretia radula, *Poir.* (*non Cham.*) *Dict. Suppl.* ii. 2; *DC. Prodr.* ix. 506;—ramulis subangulatis, puberulis; foliis obovatis, apice rotundis vel obtusis, imo cuneatim attenuatis, valde coriaceis, convexis, in costa sulcatis, supra crebre tuberculato-scabris, profunde viridibus, subnitentibus, subtus cinereo-vel fulvido-pallidis, subtomentosis, in nervis prominentibus scabridulis, marginibus valde revolutis; petiolo hispidulo, limbo 12-plo breviore: paniculis terminalibus, laxe corymbosis; calyce tubuloso, cinereo, extus densius, intus sparse adpresso-pilosulis, dentibus obtusis; corollæ tubo calyce paulo longiore; drupa pisi magnitudine, 4-pyrena, pyrenis structura generis.—In Antillis: S. Domingo (Poiteau): *v. s.*

in herb. Mus. Brit., loc. ignoto (Aublet); *in herb. Hook.*, Havana (Greene), Cuba (Drummond), Key West (anon.).

A distinct species, different from the *Bourreria radula* of Chamisso, which is *B. tomentosa.* It is easily distinguished by its small coriaceous leaves, scabrid on both sides, and closely punctulated above with large white raised tubercles. Its leaves are 1–2 inches long, 6–9 lines broad, on a petiole 1–2 lines long.

This species is confounded by Dr. Grisebach (Flor. Br. W. Ind. p. 482) with the *Ehretia Havanensis*, Willd., which he makes a variety of *Bourreria tomentosa.*

9. *Bourreria tomentosa*, Don, Dict. iv. 390;—Ehretia tomentosa, *Lam.* (*non HBK.*) *Ill.* i. p. 425. n. 1919; *Poir. Dict. Supp.* ii. 1; *DC. Prodr.* ix. 507;—Ehretia radula, *Cham.* (*non Poir.*) *Linn.* viii. 120;—Jasminum periclymenifolium *in parte*, *Sloane*, *Jam.* ii. 96;—ramis striatis, ramulis brevibus, cinereo- vel brunneo-subvelutinis; foliis oblongis vel ellipticis, apice obtusis vel rotundiusculis, imo obtuse attenuatis, subcoriaceis, supra pallide viridibus, crebre scabridulis, sæpe in nervis tomentellis, subtus pallidioribus, velutino-tomentellis, nervis pubescentibus, marginibus paulo revolutis; petiolo pubescente, limbo 5-plo breviore: paniculis in ramulis terminalibus, brevibus, paucifloris, tomentosis, ramis compressis; calyce 5-dentato, submembranaceo, extus velutino, intus puberulo; corollæ tubo calyce duplo longiore, lobisque ovatis utrinque sparse puberulis; staminibus medio tubi insertis, exsertis; stylo apice bifido; drupa globosa, piso majore, 4-pyrena, pyrenis generis.—In Antillis: *v. s. in herb. Mus. Brit.*, Jamaica (in hb. Sloan. vol. vii. folio 36, planta inferior), loc. ignot (Aublet), Cuba (Wright, 3121 in parte); *in herb. Hook.*, Jamaica (March).

Sloane probably regarded this plant as a variety of his typical species, as it is fixed on the same sheet, without any remark. Lamarck, in his 'Illustrations,' established the species upon a plant which he recognized as being similar to it. Poiret quotes Lamarck's type as his authority, confounding it with Sloane's first type: hence the confusion to which DeCandolle alludes. The species is sufficiently distinct. The leaves are $1\frac{1}{4}$–$1\frac{3}{4}$ inch long, 6–10 lines broad, on a petiole 3–4 lines long. In Aublet's plant they are more scabrid, the hairs rising out of minute white tubercles; the calyx is $2\frac{1}{2}$ lines long, the tube of the corolla 3 lines, the lobes $2\frac{1}{2}$ lines long. Wright's plant above mentioned was considered identical with another under the same number by Dr. Grisebach; the latter is in reality *B. Havanensis*; but he referred both erroneously to *B. virgata.*

10. *Bourreria Havanensis*, nob.;—Ehretia Havanensis, *Willd. in Röm. Sch.* iv. 805; *HBK.* vii. 206; *DC. Prodr.* ix. 508; —Bourreria tomentosa, var. Havanensis, *Griseb. Fl. Br. W. Ind.* 482;—Bourreria virgata (*non Don*), *Griseb. in parte Cat. Pl. Cub.* 209;—Pittonia similis, *Catesb. Car.* ii. tab. 79; —fruticosa, ramosissima, ramis sparsis, cinereo-glaucis, glabris, ramulis subpubescentibus; foliis ellipticis aut obovato-oblongis, apice subobtusis aut acutis et mucronatis, sæpe emarginatis, basi sensim attenuatis, subcoriaceis, supra nitidis, reticulate nervosis, vix tuberculatis, glabris, rarius in nervis sparsim adpresse pilosulis, subtus pallidioribus, in nervis venisque pilosulis, planis; petiolo semitereti, subglabro, limbo 6-plo breviore: paniculis corymbosis, sæpius in ramulis novellis terminalibus, subdichotome ramosis, ramulis compressis, pilosulis; floribus brevissime pedicellatis, pedicellis articulatis; calyce coriaceo, cinereo-velutino, acute 5-dentato, dentibus intus puberulis; corollæ tubo calyce fere duplo longiore; lobis orbicularibus extus tomentellis; staminibus medio tubi insertis, exsertis, antheris coriaceis, rugulosis; stylo apice bifido; drupa pisi mole, carnosa, 4-pyrena, pyrenis generis.—In Antillis; ins. Cuba, Regla prope Havana (Bonpland): *v. s. in herb. Mus. Brit.*, Cuba (Wright, 3121, in parte); *in herb. Hook.*, Habana (La Sagra, sub nom. *E. revoluta*).

The above plants correspond with Kunth's diagnosis, except that the leaves are a trifle larger; in La Sagra's plant they vary from $\frac{3}{4}$ to $2\frac{1}{2}$ inches long, 7–12 lines broad, on a petiole 2–3 lines long; in Wright's specimen they are paler, more pointed, and more glabrous; the panicle is 1 inch long, with dichotomous branchlets 2–3 lines long; the calyx is 3 lines long, the tube of the corolla $4\frac{1}{4}$ lines; the drupe 3 lines in diameter.

11. *Bourreria cassinifolia*, Griseb. Pl. Wright. Cub. 528;—Ehretia cassinifolia, *A. Rich. in La Sagra Fl. Cub.* ii. 113; *Walp. Ann.* v. 541;—ramis sæpius glabris, ramulis vix pilosulis; foliis parvulis, sæpius obovatis, obtusis aut subacutis, imo angustioribus, marginibus apiceque revolutis, crassis, coriaceis, utrinque glaberrimis, supra canaliculatis, nitentibus, nervis immersis, subtus pallidioribus; petiolo glabro, limbo 10-plo breviore: panicula terminali, subdichotome ramosa, pauciflora, sæpius 3–5-flora; calyce minute puberulo, acute 5-dentato, extus subsericeo, dentibus intus puberulis; corollæ tubo calyce paulo longiore, lobis

oblongis, rotundatis; staminibus paulo exsertis; stylo brevissime bifido; drupa piso minore, globosa, 4-pyrena, pyrenis generis.—In Antillis: *v. s. in herb. Mus. Brit.*, Cuba (Wright, 3125).

A very distinct species, which is stated by Dr. Grisebach to resemble *B. Domingensis* in many characters; it is difficult, however, to conceive any two plants to be more unlike, the leaves here being at least twenty times as small, with a very different inflorescence. The plant has the appearance of a small *Gay-Lussacia*, with striated rugulose branches, the younger ones of a reddish hue, with axils 1–4 lines apart; the leaves are only 4–6 lines long, $2\frac{1}{2}$–3 lines broad, on a petiole $\frac{1}{2}$ line long; the panicle is $\frac{3}{4}$ inch long, sometimes reduced to a solitary flower; the calyx is $2\frac{1}{2}$ lines long, the tube of the corolla 3 lines, its lobes 2 lines long; the drupe is 2 lines in diameter.

12. *Bourreria divaricata*, Don, Dict. iv. 389; Griseb. Pl. Wright. Cub. 528; Cat. Pl. Cub. 210;—Ehretia divaricata, *DC. Cat. Monsp.* 108, *Prodr.* ix. 506;—Ehretia spinifex, *Griseb.* (*non R. & Sch.*) *Pl. Wright. Cub.* 528;—Ehretia montana, *Griseb. loc. cit.* 528;—Ehretia acanthophora, *DC. Prodr.* ix. 510;—fruticosa, ramulis nodosis, cinereis, divaricatissimis; foliis subfasciculatis, spathulato-oblongis, obtusis, subcoriaceis, supra nitentibus, in costa sulcatis, nervis tenuibus, divaricatis, intra marginem arcuatim nexis, albo tuberculatis et aspere scabridis, marginibus valde revolutis, subtus glaucis, pubescentibus, in nervis pilosulis; petiolo tomentoso, limbo 10–12-plo breviore: corymbis racemosis, terminalibus, paucifloris; calyce 5-dentato, dealbato, extus sericeo, intus sparse puberulo; corollæ tubo cylindrico, calyce dimidio longiore; staminibus medio tubi insertis, brevibus, vix exsertis; stylo brevissime bifido; drupa globosa, aurantiaca vel rubra, 4-pyrena, pyrenis generis.—In Antillis: *v. s. in herb. Mus. Brit.*, Cuba, circa Havanam et Monte Verde (Wright, 3136); *in herb. Hook.*, Cuba, Monte Verde (Wright, 1365).

A *Lycium*-like shrub, 2 to 5 feet high, with rigid spreading branches; the leaves are fasciculated in each prominent node, 5–7 lines long, $1\frac{1}{2}$–2 lines broad, tapering into a petiole $\frac{1}{2}$ line long; the terminal raceme is less than 1 inch long, with from four to six alternate flowers on short pedicels; the calyx is $1\frac{1}{2}$ line long, the tube of the corolla 2 lines, the lobes 2 lines long; the drupe is 3 lines in diameter.

This plant is strangely complicated by Dr. Grisebach, at different dates, with his *Bourreria spinifex* and *B. montana*, as will be presently shown, which renders the synonyms difficult of explanation.

13. *Bourreria spinifex*, nob. (non Griseb.);—Bourreria divaricata, *Griseb.* (*non Don*) *Cat. Pl. Cub.* 210;—Ehretia spinifex, *R. & Sch.* iv. 805; *DC. Prodr.* ix. 506;—ramis divergentibus, teretibus, ramulis in apice ramorum proximis, glabris, axillis spinuloso-cupularibus; foliis oblongis, apice obtusissimis aut rotundatis, imo obtusis, coriaceis, convexis, in costa valde sulcatis, nervis paucis immersis, arcuatim nexis, marginibus valde revolutis, supra nitentibus, tuberculis albis exasperatis, scabrido-pilosis, subtus fusco-opacis, subglabris, nervis prominentibus; petiolo glabro, limbo 8-plo breviore: racemis terminalibus, brevibus, sub-3-floris; calyce glabro, acute 5-dentato; corollæ tubo cylindrico, calyce duplo longiore, lobis oblongis, patentibus; stylo breviter bifido; drupa globosa.—In Antillis: *v. s. in herb. Mus. Brit.*, Cuba (Wright, 3118, sub nom. *B. divaricata*).

This plant quite agrees with the characters given by Römer and Schulz to their *Ehretia spinifex*. Dr. Grisebach, in 1862, referred a Cuban plant to this species, under the name of *Bourreria spinifex*, quoting the synonym of those botanists; but in 1866 he converted this same plant (Wright, 3123) into a new species, *B. montana*, which he pronounced to be distinct from Römer and Schulz's species; and at the same time he referred Wright's plants 1365, 3118, and 3136 to his *Bourreria divaricata* (not Don's), and synonymous with *Ehretia spinifex*, R. & Sch.: I have shown the latter corresponds with Wright's 3118, while 1365 (in parte) and 3136 belong to Don's *B. divaricata*. Here is a sad confusion, which runs alike through most of the determinations of Dr. Grisebach in this family, all which have been made incautiously and in too much haste.

This is a small shrub, with numerous divaricating branches, which soon become bare and rugose from the decadence of the leaves, the axils becoming somewhat spiniform; the leaves, solitary on each alternate node, are 8–10 lines long, 3–5 lines broad, on a petiole 1–1½ line long. The British-Museum specimen has only a single flower, the others probably having fallen away; its calyx is 3 lines long, the tube of the corolla 5 lines, the lobes 2½ lines long.

14. *Bourreria microphylla*, Griseb. Cat. Pl. Cub. 210;—ramulis tenuibus, teretibus, cinerascentibus, striatellis, glabris; foliis minimis, patentibus vel recurvis, ovalibus vel suborbicularibus, coriaceis, valde convexis, supra profunde

viridibus, tuberculis piliferis albis magnis exasperatis, marginibus valde revolutis, subtus flavescentibus et pulverulento-glaucis; petiolo pubescente, limbo 12-plo breviore: racemis terminalibus, paucifloris; calyce subsericeo, 5-dentato; corollæ tubo calycem æquante, lobis rotundatis æquilongis.—In Antillis in savannis: *v. s. in herb. Mus. Brit.*, Cuba (Wright, 1365 in parte).

This specimen bears a ticket referring it, on the authority of Dr. Grisebach, to his *Bourreria virgata*, a very different plant; but it corresponds with his *Bourreria microphylla.* It is a shrub 4 feet high, with spreading branches, and branchlets about 3 inches long, with axils 1–3 lines apart, bearing solitary leaves $1\frac{1}{2}$–3 lines long, 1–2 lines broad, on a petiole $\frac{1}{8}$–$\frac{1}{4}$ line long. I have not seen the inflorescence; but the above specimen shows two calyces from which the fruit has fallen; these are glabrous, pale outside, the teeth having tomentose margins.

15. *Bourreria linearis*, nob.;—fruticosa, ramis teretibus, striatis, tortuosis, nodosis; ramulis ultimis brevissimis, asperatis; foliis paucis, alternis, aut in nodis fasciculatis, mox delapsis, parvis, linearibus, spathulatis, rigidis, crassiusculis, marginibus valde revolutis, supra in costa profunde sulcatis, tuberculis albis setiferis valde scabris, subtus flavidotomentosis; petiolo fulvo-tomentoso, limbo 10-plo breviore: racemis in ramulis novellis terminalibus, brevibus, paucifloris; calyce persistente, tubuloso, 5-fisso, laciniis obtuse ovatis, utrinque adpresse pilosulis; drupa globosa, rubra, carnosa, piso minore, 4-pyrena, pyrenis generis.—In Antillis: *v. s. in herb. Mus. Brit.*, Cuba, Faralloma Hermitage (Wright, 1365 in parte).

This is another distinct species, the last of the three included by Dr. Grisebach under the specific name of *virgata*—all as dissimilar as can be conceived to Swartz's plant. It forms a low bush, with gnarled rough branches. The axils of the short young branchlets, after the fall of the very deciduous leaves, are spinescent, and so very close together as to give them a muricated appearance. The leaves are 5–6 lines long, $\frac{1}{2}$ line broad, the margins being so greatly revolute as almost to conceal the under surface, the petiole being $\frac{1}{2}$ line long; the calyx is $1\frac{1}{2}$ line long, coriaceous, cleft halfway into five rather obtuse lobes, and supports a red drupe 2 lines in diameter.

[To be continued.]

XXX.—*Notes on the Palæozoic Bivalved Entomostraca.* No. IX. *Some Silurian Species.* By Prof. T. Rupert Jones, F.G.S., and Dr. H. B. Holl, F.G.S.

[Plates XIV. & XV.]

The specimens about to be described were obtained mostly from the calcareous bands of the Woolhope and Wenlock strata near Malvern; and, having for the most part retained their shells, they afford better materials for the determination of species than many of the small Bivalved Entomostraca obtained elsewhere from the Silurian rocks. Some of the well-preserved Silurian Entomostraca found in the neighbourhood of Malvern have been already sorted out and described by us as *Primitiæ*, in the 'Annals of Nat. Hist.' ser. 3. vol. xvi. pp. 414–425.

[The measurements of the specimens described are given in a Table at p. 227.]

1. *Cythere corbuloides*, sp. nov. Pl. XV. figs. 4 *a*–4 *e*, figs. 5 *a*, *b*.

Carapace somewhat egg-shaped, swollen posteriorly, inequivalved, subtriangular in every aspect. Sometimes the right valve and sometimes the left is larger than the other. In fig. 4 *c* the left valve is more convex in its upper portion than the other, rising far above it at the dorsal margin; and the right valve has an oblong outline in side view, with rounded ends. In other specimens, as in fig. 4 *a*, the right valve is large and high. The outline of the larger valve forms a scalene triangle with the upper angle replaced by a bold curve, and the lateral (terminal) angles, especially the anterior corner, less rounded: thus the ventral margin is flattish and the back highly arched, with a steeper downward slope backwards than forwards. Some specimens occur in which there is less inequality of the valves, but the left valve seems usually the larger one.

The hinge-line is straight, about two-thirds the length of the valve, is overhung by the umbo-like convexity of the larger valve, and in the smaller valve its middle third is accompanied by a narrow parallel depression. The ventral margin of each valve is sometimes slightly lipped at the posterior angle (fig. 4 *d*).

The ventral profile of the carapace is broadly ovate, with the narrow end suddenly sharp; the end view (fig. 4 *e*) is broadly cordate, with the apex upwards.

The great inequality of the valves in these specimens is exceptional among Bivalved Entomostraca, especially among the *Cytheræ*, with which and their congeners, in other respects, this species has its alliances. *Leperditia gibbera*, belonging to another group, has a protuberance in the postero-dorsal region of the left valve; but it projects laterally, not vertically; and *Leperditia arctica* has a slight swelling all along the dorsal region of its left valve. It is possible that, both in these cases and with the species under notice, the dorsal swelling characterizes female individuals.

As pointed out to us by our friend Mr. G. S. Brady, this species has much similarity, in some features of its carapace, to *Xestoleberis depressa*, Sars, an existing member of the *Cytheridæ* which is found in the British seas down to about 60 fathoms (see G. S. Brady's "Monograph of Recent British Ostracoda," in the 'Linnean Soc. Transact.' vol. xxvi. p. 438, pl. 27. figs. 27–33). We prefer, however, to retain the generic term "*Cythere*," even if it be in a more extended sense than ought to be applied to living groups, for the sake of convenience to geologists.

We have specimens of *Cythere corbuloides* from the Wenlock Limestone of Croft's Quarry, near Malvern; from the Wenlock Shale of the railway-tunnel, near the Wych, Malvern, where it is not uncommon; and from the calcareous bands of the Woolhope beds, at the same place.

A young (or small male) individual (figs. 5 *a*, 5 *b*), from the Woolhope beds, is smaller and less convex than the others, but has all the essential characters seen in them, including even a predominating dorsal convexity of the left valve, though to a slight extent. Its lateral profile is much more nearly oblong, and its end view is nearly circular; but its ventral aspect is still acute-ovate, like that of the others.

2. *Cythere Grindrodiana*, sp. nov. Woodcut, fig. 1.

Carapace small, subcylindrical, long-ovate in outline, rounded at the ends, but tapering more at one end than the other; dorsal and ventral borders nearly, if not quite, equal in their convexity. End view circular.

Fig. 1. *Cythere Grindrodiana*. Left valve. (Magnified about 20 diameters.)

This approaches the living *Cytheridea elongata*, Brady, and other living and fossil forms in shape; but there is no evidence of specific identity. Dr. Grindrod, F.G.S., of Malvern, after whom it is named, has found three or four specimens of this species in the Woolhope Shales of West Malvern, as casts, sometimes with a thin film of the carapace remaining.

The other known Silurian *Cytheræ* are:—

Cythere Bailyana, J. & H. —— *Jukesiana*, J. & H. —— *Harknessiana*, J. & H. —— *Wrightiana*, J. & H. —— *Aldensis*, M'Coy.	From the Caradoc beds of Kildare &c., Ann. N. H. ser. 4. vol. ii. pp. 54–62 (1868).

—— ? *siliqua*, Jones. From the Trenton Limestone of Canada, described as a *Cytheropsis* (Ann. N. H. ser. 3. vol. i. p. 249, pl. 10. fig. 6).

Other so-called *Cytheræ* and *Cytherinæ* from Silurian rocks, such as *C. sublævis*, Shumard, *C. alata*, De Verneuil, *C. subrecta*, Geinitz (not Portlock), and *C. cylindrica*, Hall, belong probably to *Leperditiæ* and cognate genera.

Bairdia Phillipsiana, sp. nov. Pl. XIV. figs. 7 *a*, *b*, *c*.

Carapace subfalciform, with obliquely rounded, tapering, almost equal ends, highly arched back, and faintly incurved ventral border. The left valve very much overlaps the other, especially on the dorsal edge. Profile acute-oval.

This almost symmetrical *Bairdia* (in lateral aspect not unlike the recent British *B. fulva*, described by Mr. G. S. Brady in his "Monograph of the Recent British Ostracoda," Trans. Linn. Soc. vol. xxvi. p. 474, pl. 28. fig. 21) is from the Wenlock Limestone of Croft's Quarry, near West Malvern, but is not common; and we name it after Prof. John Phillips, F.R.S., who years ago shed much light on the geology and fossils of the Malvern district.

A very similar form to this (and probably identical) occurs in a piece of a drifted Scandinavian block of Silurian Limestone from near Breslau.

The other Silurian *Bairdiæ* are—*Bairdia Murchisoniana*, *B. Griffithiana*, and *B. Salteriana*, from the Caradoc beds of Kildare, described by us in Ann. N. H. ser. 4. vol. ii. p. 58 (1868), and *Bairdia protracta*, Eichwald, Leth. Rossica, livr. vii. (1866,) p. 1338, pl. 52. fig. 19, from the Coral-limestone (Upper-Silurian) of Kamenetz-Podolsk.

THLIPSURA*, gen. nov.

A Cytheroid carapace, indented on its anterior third by a variable and evanescent pit, and posteriorly by a deeper and permanent depression, characterizes the Silurian specimens which we have to place by themselves in this new generic group.

* So called in allusion to the compression of the posterior extremity: *θλίψις*, pressure, and *οὐρὰ*, tail.

1. *Thlipsura corpulenta*, sp. nov. Pl. XV. figs. 1 *a*, *b*, *c*, *d*.

Carapace short, thick, and high; ovate in side view, nearly oblong in profile, and subquadrate in end view. Valves narrowing and compressed at the anterior edge; convex behind, but pinched-in suddenly with an obliquely longitudinal median sulcus (nearly half the length of the valve), and ending with a thick projecting posterior lip or rim. This conformation of the posterior third of the carapace sometimes gives its ventral profile (fig. 1 *b*) a tripartite aspect, when the marginal rim is strong and distinct from the convexity on each side. The end view also is peculiar (fig. 1 *d*), on account of the lateral impress of the furrow on either valve. This caudal notch is liable to some variation, being either broad or narrow, with either straight or curved edges, which are more sharply defined in some specimens than in others. In one of the large specimens from the Woolhope series we have seen a small, shallow, pear-shaped depression a little in advance of and below the centre of the valve; and there is, in an individual of medium size from the Wenlock beds, an anterior notch, short and obliquely transverse, just in front of the centre of the valve. *Thlipsura corpulenta* varies as to the relative proportions both of the carapace and its pits and notches.

Several large specimens have been obtained from the calcareous bands at the base of the Woolhope series, near Malvern, where it is not uncommon. Dr. Grindrod has collected this species in the Woolhope Shales of West Malvern (laminated mudstones full of Polyzoa and small Brachiopods), in which it is rather common. It is common also in the lower beds of the Wenlock Shale, and less frequent in the Wenlock Limestone.

2. *Thlipsura tuberosa*, sp. nov. Pl. XV. figs. 2 *a*, *b*, *c*.

This is nearly related to *Th. corpulenta*, but is more oval than ovate in outline, less oblong in profile, and is characterized by a somewhat compressed ventral margin, and by a prominent boss, on each valve, defined by two slight parallel transverse sulci, rather in advance of the middle of the valve. The sides of the caudal furrow are rather more elevated, as distinct though faint ridges, than is shown in our figure.

This specimen (unique) is from the base of the Wenlock Shale, Elton Lane, near Ludlow. The shell has been dissolved away in its matrix to a thin film, and broken through at the central eminences.

3. *Thlipsura V-scripta*, sp. nov. Pl. XV. figs. 3 *a*, *b*, *c*.

This also is related to *Th. corpulenta*, but it is much smaller, more neatly ovate in outline, and narrower behind. The surface of the carapace is smooth and regularly convex, but impressed distinctly with the two sets of notches, of which the anterior is liable to disappear in *Th. corpulenta.* The caudal notch consists of two oblique pits, usually meeting posteriorly, and forming a subtriangular depression, V-shaped, with the apex pointing backwards, but not reaching the border. The anterior notch is just in front of the middle of the valve, transverse, and equal in length to about a third of the valve's height (or breadth).

Only single valves have been found. The figured specimen is neatly ovate, smoothly convex, with the hinder notch chevron-shaped; suboblong in profile, and nearly circular in end view (if the valves were united).

Rare in the Wenlock Limestone of Croft's Quarry, near Malvern.

This form is not at first sight very dissimilar to some larger and more convex specimens, from the base of the Wenlock series; but the latter have the single caudal furrow of *Thlipsura corpulenta*, they are smaller and neater, and in one instance the transverse anterior notch is plainly seen, though not so well defined as in the little species before us. We have already mentioned that one of the larger specimens (from the Woolhope beds) shows a trace of the anterior notch.

It may be that the chevron notch is lost by the growth of the individual, one of its arms enlarging into the great single furrow of the large forms; but we have not yet found any intermediate stage of growth, and therefore propose to recognize the small form as a distinct species, which has both the anterior and posterior notches notably distinct and peculiar.

CYTHERELLINA, gen. nov.

In the Upper Silurian strata both of Gothland and Britain occur numerous transversely indented casts of little subtriangular Bivalved Entomostraca, to which one of us, in 1855, gave the name of *Beyrichia siliqua*, under the supposition that some of these bisulcate casts (in Scandinavian limestone) were *Beyrichiæ*, though of unusual aspect. The supposed "marginal rim" was supplied by the broken edge of the *imbedded shell*, as will be understood by the reader if he looks at figs. 6 *a*, *b*, *c*, *d*, upside down, comparing them with the older figure, Ann. Nat. Hist. ser. 2. vol. xvi. pl. 5. fig. 22. The appearance of the calcareous cast was sufficiently deceptive to mislead until specimens were found in a different limestone (from near Malvern), which presented both outer tests and internal casts, of different tints and texture, and indubitably related to each other, showing that the outside of the shell is *smooth*, and its interior moulded with the undulated contours that we see on the very common *casts* above mentioned. The undulations of the surfaces of the casts are caused by two oblique transverse sulci, of variable depth and width, rather nearer to the anterior (narrow) than to the posterior or boldly convex extremity, and deepest and broadest on the convex (dorsal) edge. The space between the two furrows is marked out more or less plainly as an obliquely oblong, suboval, or roundish lobe; but whether faint or strong, it has no corresponding elevation on the outside of the shell; nor have the furrows on the cast anything to indicate them externally.

The smooth, bean-like exterior (now recognized) entirely distinguishes the form under notice from *Beyrichia*; and even the furrows in the cast ought to be largest near the straight, and not at the convex margin, for a true Beyrichian character.

Of existing genera, *Cytherella* is the only one that has its carapace-valves smooth externally and excavated on their inner face. The form under notice has a thick shell, as is usual with *Cytherella*; but the internal hollowings in the shell, giving rise to the three obscure lobes of the cast, differ much in shape from those of *Cytherella*; whilst the valves are less oblong and more convex than those of this last-mentioned genus; the overlap of the left valve and the incurved ventral edge are also distinctive. We therefore propose a new genus for its reception, with the name *Cytherellina*, and with the following definition, limited by want of material:—

Carapace-valves elongate, convex, smooth, thick, excavated internally with undulating contours.

Cytherellina siliqua, Jones, sp. Pl. XIV. figs. 1–6.

Beyrichia siliqua, Jones, Ann. Nat. Hist. ser. 2. vol. xvi. p. 90, pl. 5. fig. 22 (1855).

A subcylindrical, smooth, bean-shaped Cytheroid carapace, boldly convex behind, somewhat tapering in front, incurved at the anterior third of the ventral border; strongly and gracefully arched on the back, with a rapid slope to the front. The dorsal arching varies to some extent in different individuals. The left valve overlaps the other on the ventral margin, and in some degree also on the anterior and posterior borders.

Carapace-valves elongate-ovate, contracted at one end (anterior), boldly rounded at the other; arched on the back, nearly straight below; internally thickened by two oblique, transverse, low ridges near the centre (or, conversely, impressed with three unequal shallow excavations), giving rise to a three-lobed cast, which has to some extent the appearance of a *Beyrichia*.

Individuals vary considerably in their relative proportions, and in the depth of the internal excavations of the valves.

The casts of this peculiar species occur in great numbers in the Woolhope Shale near Malvern; but amongst several dozen specimens in this bed, collected by Dr. Grindrod, we have detected only one or two with shells. In the bluish-grey limestone, however, at the base of the Upper Ludlow beds at Hales End, near Malvern, shelled specimens occur in profusion. As above intimated, the Scandinavian specimens, referred to in the 'Annals Nat. Hist.' 1855, though casts, have remains of the shells attached.

Cytherellina siliqua is abundant also in the calcareous bands at the base of the Woolhope beds near the Wych, Malvern; and several large specimens (which we regard as varietal, var. *grandis*) were obtained from the engine-shaft of the railway-tunnel at that place (fig. 1). Some were also got from the base of the Wenlock Shale in that tunnel.

Fig. 2 represents a specimen of medium size, with less convex back and rather more convex sides than fig. 1; such are not uncommon in the Aymestry Limestone at Chance's Pitch, Malvern.

Var. *tersa* (fig. 3) is smaller and more oblong than either fig. 1 or fig. 2, but otherwise it has very much the same features. It is from the Wenlock Limestone near Malvern.

Var. *ovata* (fig. 4), though of relatively large size and closely resembling fig. 1 in general aspect, is higher, shorter, and rather less convex at the ends. It may have been an individual of the other sex. From the base of the Wenlock Shale in the tunnel near Malvern.

Fig. 5 *a* and figs. 6 *a*, *b*, *d*, *e*, are from the Upper Ludlow Limestone of Hales End, near Malvern, and have the most common size and features. Fig. 6 *c* is from the drifted Scandinavian limestone, found near Breslau.

ÆCHMINA*, gen. nov.

Carapace-valves thick, straight at the hinge-line, rounded at the ends, convex at the ventral border, and outdrawn at the surface into a broad-based and sharp-pointed hollow cone, which either involves all the surface, or (as far as at present known) rises from the postero-dorsal or from the centro-dorsal region.

A less pronounced example of this out-drawn condition of

* From αἰχμή, a sharp point.

the surface of the valves is seen in *Cythere* [*Æchmina*?] *umbonata*, Williamson, from the Chalk (Monograph Cretac. Entom. Pal. Soc. 1848, pl. 2. fig. 3), in which the sharp boss is somewhat variable in its position, though mainly affecting the postero-ventral region.

1. *Æchmina cuspidata*, n. sp. Pl. XIV. fig. 8, and woodcut, fig. 2.

Carapace-valve suboblong, convex and produced at the middle (towards the postero-dorsal region) into a stout sharp spike; dorsal edge straight, ventral edge elliptical; one end more broadly rounded than the other.

Fig. 2. *Æchmina cuspidata*. Right valve: the spine is broken. (Magnified about 20 diameters.)

We have here evidently a very close approximation to Professor James Hall's *Cytherina* [*Æchmina*] *spinosa* (Palæont. New York, vol. ii. p. 317, pl. 67. figs. 17–21), from the Niagara Shale at Lockport, in the State of New York; but the latter is more quadrate in outline and somewhat depressed at the root of the spine, which, though nearly central, is near the dorsal margin.

The fragment figured obliquely in Pl. XIV. fig. 8, and more definitely shown in the woodcut, fig. 2, is from the Wenlock Limestone of Croft's Quarry, near West Malvern.

2. *Æchmina clavulus*, sp. nov. Woodcut, fig. 3.

This is smaller and relatively shorter than the foregoing, and has nearly all the surface of the valve taken up with the root of the great spike or spine, which is proportionally larger than that in *Æ. cuspidata*.

Found in the Wenlock Limestone, with the last mentioned.

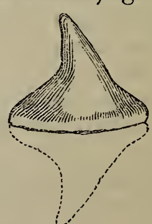


Fig. 3. *Æchmina clavulus*. Both valves, one of them restored. (Magnified about 20 diameters.)

Beyrichia intermedia, sp. nov. Pl. XV. fig. 7.

Carapace-valve small, convex, suborbicular (length to height as 4 to $3\frac{1}{2}$); ventral edge semicircular, ends boldly curved, one rather less so than the other; dorsal edge indicated by the straight portion of the margin and by two short unequal furrows widening out from near the central surface of the valve into the depressed area along the straight edge, thus forming three unequal lobes on the dorsal region, the rest of the valve's surface remaining smoothly convex, bordered by a narrow depressed rim.

The shape of the valve is that common among *Primitiæ*; but, though the sulci are too short for those usually characteristic of *Beyrichiæ* (excepting *B. Wilckensiana*, Jones, Ann. Nat. Hist. ser. 2. vol. xvi. pl. 5. figs. 17 & 18), yet we are unwilling to admit a bisulcate form among the "*Primitiæ*" until further evidence proves the necessity of breaking down the provisional limitation of that genus. In the meantime we regard the pretty little specimen before us as an intermediate form, as its name intimates.

Our figured specimen is from the Aymestry Limestone of Chance's Pitch, Malvern, where specimens are not uncommon; and some few casts of apparently the same species occur in Woolhope Shale from near Malvern, in Dr. Grindrod's collection.

1. *Primitia lenticularis*, sp. nov. Woodcut, fig. 4 *a*, *b*, *c*.

Carapace smooth or slightly rugose (perhaps from weathering), convex, nearly ovate; elliptically rounded below, decidedly arched above, unequally rounded at the ends; the larger (posterior) extremity with a marginal rim and compressed; ventral border slightly lipped. Dorsal aspect elongate-ovate, rather compressed in front of the centre, and acute posteriorly. End view subacute-oval.

This is near to *P. ovata*, J. & H. Ann. Nat. Hist. ser. 3. vol. xvi. p. 423, pl. 13. fig. 13, and *P. obsoleta*, J. & H. *loc. cit.* fig. 12, both Scandinavian. It is shorter, however, more convex, and more ovate (being higher as 32 : 30, and shorter as 43 : 45) than the former, and it has a posterior marginal rim, with very little of it continued on to the ventral border; it has also a different edge view, being less compressed anteriorly. From *P. obsoleta* it differs in having an arched dorsum, much less marginal rim, a more central convexity, and no trace of dorsal sulcus.

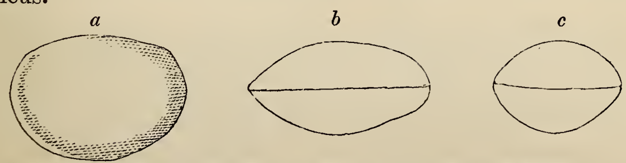


Fig. 4. *Primitia lenticularis*: *a*, carapace, showing the right valve; *b*, dorsal view of carapace; *c*, end view of carapace. (Magnified 20 diameters.)

Common in the calcareous beds at the base of the Woolhope beds near Malvern.

2. *Primitia bipunctata*, Salter, sp. Woodcut, fig. 5.

Beyrichia bipunctata [Salter, MS.], Catalogue Foss. Mus. Pract. Geol. 1865, p. 16.

Mr. J. W. Salter, F.G.S., long ago supplied one of us with specimens of black Llandeilo Flagstone (from Hellpool, Wyeforth, near Builth, in South Wales), bearing numerous impressions and casts of minute subquadrate Entomostracan valves, each having two little pits near the straight edge. The features are obscure, and the specific characters necessarily indefinite; but we wish to place this little Lower-Silurian form on record, with a figure, among its allies.

Fig. 5. *Primitia bipunctata.* Outline of right valve, from a sealing-wax cast of an impression. (Magnified about 20 diameters.)

About a year since, George Reece, Esq., Secretary and Curator of the Worcester Museum, submitted to us for examination a small piece of greenish micaceous shale, collected by himself from the Ludlow beds of Abberley (probably from the middle or Aymestry part of the series), containing Polyzoa, small Brachiopods, one valve of *Primitia ovata*, J. & H., two or three of *P. renulina*, J. & H., and several valves of a semicircular *Primitia*, small and white, of rather variable shape (much crushed), marked with either a single pit, a slight longitudinal sulcus, or two distinct pits near the straight margin. The bipunctate condition reminded us of Mr. Salter's *Beyrichia bipunctata* from Builth; but, on careful examination, we find that the *two pits* are due to the wearing away of some of the valve-substance where it is most convex on either side of the single, longitudinal, furrow-like pit in *Primitia umbilicata.*

Figs. 6 *a* and 6 *b* (Pl. XV.) indicate two of the most distinct of the little specimens, whereby the varying curve of the extremities and ventral border, and the unequal sinuosity of the nearly straight dorsal edge, with its two more or less developed, terminal, horn-like angles, are well shown. In some instances the depression consists of a single, shallow, roundish pit, just above the centre of the valve, as in *Primitia cristata*, J. & H., Ann. Nat. Hist. ser. 3. vol. xvi. pl. 13. fig. 1; sometimes it is lengthened longitudinally, as in *P. umbilicata*, J. & H., *loc. cit.* fig. 2; and frequently this seems to divide into two more or less distinct pits. Fig. 6 *a* shows the extreme condition of the double pit, with a trace only of the longitudinal depression between them. The many stages of variation observable in this little group of specimens do not permit us to divide these different conditions, even as varietal, as they really point to an identity with *Primitia umbilicata* aforesaid.

Figs. 6 *c* and 6 *d* represent some associates of *P. umbilicata* in the specimen belonging to th. Worcester Museum, and were at first thought to be possibly varieties of the foregoing; but their more oblong profile, the relatively higher position of the pit, and its being continued upward as a dorsal sulcus, clearly place these specimens, though differing somewhat in relative height (or breadth), in an already described species, our *P. renulina* (Ann. Nat. Hist. *l. c.* fig. 5).

A suboval *Primitia* also occurs in the same morsel of fossiliferous shale, and seems to be (though not fully exposed) *P. ovata*, J. & H. (Ann. Nat. Hist. *l. c.* fig. 13), hitherto known only in the drifted Scandinavian limestone.

We also recognize an oval *Primitia* in a sandy micaceous shale of the Upper Ludlow series, abounding with small Brachiopods, from Newton Lane, Bradnor Hill, given to one of us some years back by the late Mr. R. Banks, of Kington. It is larger and more oblong-oval than the figured specimen of *P. ovata*; but otherwise it seems to be of the same species.

We may here refer to the existence of two small *Primitiæ* in the Olenus-shales of Shineton*. These we observed in the Cambridge Museum, when examining Prof. M'Coy's *Cythere Aldensis* preserved there (Ann. Nat. Hist. ser. 4. vol. ii. p. 60).

Fig. 6.

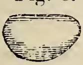
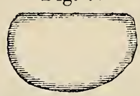


Fig. 7.



Figs. 6 & 7. *Primitiæ* in the Shineton Shales. Cambridge Museum. (Magnified about 20 diameters.)

They are casts, and are shown by woodcuts, figs. 6 & 7, but do not exhibit sufficiently definite characteristics for exact determination. The larger one (fig. 7) is about $\frac{5}{100}$ inch long, $\frac{4}{100}$ high, and somewhat resembles our *P. matutina* (Ann. Nat. Hist. ser. 3. vol. xvi. p. 418, pl. 13. fig. 7).

* The "Shineton Shales" are mentioned by Mr. Salter, in the 'Geological Magazine,' vol. iv. p. 203 (May 1867), as the lowest beds at the Wrekin, and equivalent to "the top of the Llandeilo Flags proper." Shineton or Sheinton is three miles and a half north by west from Much-Wenlock, Shropshire.

3. *Primitia excavata*, sp. nov. Pl. XV. figs. 10 *a*, 10 *b*, 10 *c*.

Valves suborbicular, nearly semicircular on the ventral edge, straight on the short dorsal margin, with nearly equal angles for the well-marked anterior and posterior slopes. This outline is exaggerated in contrast with that of the somewhat Leperditioid *Primitia pusilla*, J. & H., Ann. Nat. Hist. ser. 3. vol. xvi. pl. 13. fig. 11, but is essentially similar. The faint dorsal sulcus of the latter, also, is represented here by an oblique antero-dorsal pit, deep and narrow, with a raised anterior border; and the flattish smooth surface of *P. pusilla* is replaced by an excavated area, broadly semicircular, sculptured with a reticulation of irregular hexagonal pattern. The broad raised margin of this area is longitudinally striated (fig. 10 *c*), and slopes down suddenly outside to the edge of the valve (fig. 10 *a*).

This species is from the Woolhope Limestone, west of the Wych, near Malvern, but is very rare, our specimen being unique.

Primitia excavata has its valves depressed, like those of *Kirkbya* and *Moorea*; but it has neither the outline of the former nor its definite ridges; and it differs from the latter in the presence of a dorsal or subcentral pit, and in the absence of a definite marginal ridge. It more resembles such a *Primitia* as *P. pusilla* (above mentioned), with a surface not only depressed but excavated; and, indeed, unless we were to make a provisional genus for its reception, it is near this form that we must place it.

LIST OF THE KNOWN PRIMITIÆ.

Upper-Silurian Primitiæ.

Primitia Beyrichiana, *Jones & Holl*, Ann. N. H. s. 3. xvi. 422. Wenlock; Sweden.
—— concinna, *Jones*, ibid. xvi. 424. Wenlock; Gothland, Dudley, and Nova Scotia: Trenton; Canada.
—— consobrina, *Barrande*, MS., Thes. Sil. 200. Stage F. f. 2 (Upper Silurian); Konieprus, Bohemia.
—— cristata, *J. & H.* An. N. H. s. 3. xvi. 420. Wenlock; Malvern.
—— excavata, *J. & H.* (in the present paper). Woolhope; Malvern.
—— lenticularis, *J. & H.* (in the present paper). Woolhope; Malvern.
—— mundula, *Jones*, An. N. H. s. 3. xvi. 419. Wenlock; Sweden and Malvern.
—— muta, *J. & H.* ibid. xvi. 425. Wenlock; Beechey Island.
—— oblonga, *J. & H.* ibid. xvi. 423. Wenlock; Sweden.
—— obsoleta, *J. & H.* ibid. xvi. 423. Wenlock; Sweden.
—— ovata, *J. & H.* ibid. xvi. 423. Ludlow; Abberley and Kington: Wenlock; Sweden.
—— pusilla, *J. & H.* ibid. xvi. 424. Wenlock; Malvern*.

* This is from the Upper, and not from the Lower Silurian, as stated inadvertently, Ann. Nat. Hist. ser. 3. vol. xvi. p. 416.

Primitia renulina, *J. & H.* ibid. xvi. 419. Ludlow; Abberley: Wenlock; Malvern.
—— Roemeriana, *J. & H.* ibid. xvi. 422. Wenlock; Malvern.
—— rugulifera, *Jones,* ibid. xvi. 419. Wenlock; Beechey Island.
—— semicircularis, *J. & H.* ibid. xvi. 424. Wenlock; Sweden.
—— seminulum, *Jones,* ibid. xvi. 418. Wenlock; Montgomery.
—— sigillata, *Jones,* ibid. xvi. 418. Wenlock; Beechey Island.
—— tarda, *Barrande,* MS., Thes. Sil. 200. Stage F. f. 2 (Upper Silurian); Konieprus, Bohemia.
—— tersa, *J. & H.* An. N. H. s. 3. xvi. 421. Wenlock; Malvern.
—— trigonalis, *J. & H.* ibid. xvi. 421. Wenlock; Malvern.
—— umbilicata, *J. & H.* ibid. 420. Ludlow; Malvern, Abberley.
—— variolata, *J. & H.* ibid. 418. Woolhope; Malvern.
—— ——, var. paucipunctata, *J. & H.* ibid. 419. Woolhope; Malvern.

Lower-Silurian Primitiæ.

Primitia bicornis, *Jones,* An. N. H. s. 3. xvi. 420. Caradoc; Harnage, Shropshire.
—— bipunctata, *Salter,* MS. (in the present paper). Llandeilo; Builth, South Wales.
—— concinna. See above.
—— gregaria, *Barrande,* MS., Thes. Sil. 200. Stage D. d. 5 (Lower Silurian); Königshof, Bohemia.
—— Logani, *Jones*
—— ——, var. leperditioides, *Jones*
—— ——, var. reniformis, *Jones*
} An. N. H. s. 3. xvi. 417. Calciferous Sandrock; Canada.
—— Maccoyii, *Salter,* sp., ibid. s. 4. ii. 55. Caradoc; Ireland, Westmoreland, and Scotland.
—— matutina, *J. & H.* ibid. s. 3. xvi. 418. Caradoc; Shropshire.
—— nana, *J. & H.* ibid. xvi. 420. Caradoc; Harnage, Shropshire.
—— prunella, *Barrande,* MS., Thes. Sil. 200. Stage D. d. 1, 5 (Lower Silurian); Vosek, Mt. Kosow, Bohemia.
—— rugosa, *Jones,* An. N. H. s. 4. ii. 55. Trenton; Canada.
—— Salteriana, *J. & H.* ibid. s. 3. xvi. 417. Caradoc; Sholes Hook, Pembrokeshire, Wannamois.
—— Sancti-Patricii, *J. & H.* ibid. s. 4. ii. 56. Caradoc; Ireland.
—— semicordata, *J. & H.* ibid. s. 3. xvi. 417. Caradoc; Sholes Hook, South Wales.
—— simplex, *Jones,* ibid. 417. Caradoc; Harnage, Shropshire: Llandeilo; Bussaco, Portugal.
—— Solvensis, *Jones,* ibid. s. 4. ii. 55. Lingula-flags; Solva, South Wales.
—— strangulata, *Salter,* sp., ibid. s. 3. xvi. 416. Caradoc; Lancashire, Wannamois.
—— ——, var. α, *Jones,* ibid. xvi. 417. Caradoc; Pembrokeshire.
—— ——, var. crenulata, *Schmidt,* Untersuch. p. 196. Caradoc; Borkholm and Paggar.

KIRKBYA, Jones.

In 1859 the genus *Kirkbya* was instituted for the reception of some peculiar Entomostracous valves, found in Permian and Carboniferous strata, which had been doubtfully and unsatisfactorily referred to some cognate genera. (See Kirkby and Jones "On Permian Entomostraca," Transact. Tyneside

Nat. Field Club, vol. iv.) Since then, several other *Kirkbyæ* have been recognized in the Carboniferous formations. (See Jones and Kirkby's papers in the Ann. Nat. Hist. ser. 3. vol. xviii. pp. 42, 43, 45, 49, and Transact. Geol. Soc. Glasgow, vol. ii. pp. 216 &c.)

In this genus the carapace-valves are compressed (flattish), thick, oblong, impressed with a subcentral pit and raised into ridges, some concentric with the margin, associated sometimes with longitudinal riblets or wrinkles, and often accompanied by a reticulate ornament. In shape the valves are subob-long, usually higher behind than before; the extremities more or less rounded, but one often much more obliquely than the other; the dorsal border is straight, and its ends are subacute; the ventral border is nearly straight in its middle third, and boldly curved at the ends; the hinge is simple. The ventral edge of the dextral valve overlaps slightly that of the other. The subcentral pit or sulcus is sometimes above and sometimes below the median line of the valve, and varies greatly in its relative size.

Kirkbya, having relationships with *Beyrichia*, *Primitia*, *Moorea*, and *Leperditia*, is one of the *Leperditiadæ* (see Ann. Nat. Hist. 1856, ser. 2. vol. xvii. p. 99). To *Leperditia* it is related through *Beyrichia* and *Primitia*. In general form, hingement, ventral overlap, and even sometimes in a faint bi-lobation of the surface, the valves of *Kirkbya* resemble those of *Beyrichia*; but the double and sometimes threefold ventral rims, and especially the subcentral pit and the longitudinal riblets, distinguish them. The ventral ridges to some extent, and the pit, have their analogues in *Primitia*; but this genus generally presents convex forms; and when flattish, its valves, though sunken in *P. excavata*, have not any costation. *Moorea* presents flattish valves, marginally ridged, but without any subcentral pit or dorsal furrow (see further on, p. 225).

Kirkbya fibula, sp. nov. Pl. XV. figs. 9 *a*, 9 *b*.

Valves oblong, with three of the borders more or less rounded; rather short, flat, bearing a well-marked marginal rim, which in some specimens dies away on the upper border, where the subcentral pit deeply notches the dorsal region somewhat to-wards the anterior angle; and in others it is strong on the dorsal and dies away along the anterior border. A neatly defined longitudinal ridge, slightly sigmoid in outline, and thickest at its middle part, traverses the depressed surface of the valve somewhat obliquely, within the marginal ridge, from near the postero-dorsal angle to the middle of the anterior border, and at its junction with this it bends a little downwards. Near the middle of the valve it touches the lower end of the narrow dorsal sulcus above mentioned. The marginal ridge is in some specimens acute, and in others it scarcely rises above the general surface of the valve.

In a bed of grey micaceous limestone in the Upper Ludlow rocks at Hales End, three miles north-west of Malvern; it is not uncommon.

The other known forms of *Kirkbya* are—

Kirkbya permiana, *Jones*, in King's Monog. Perm. Foss. (Pal. Soc.), 1851, p. 66, pl. 18. fig. 1; Trans. Tyneside Field Club, vol. iv. p. 129, pl. 8. figs. 1–3. Permian and Carboniferous; Britain.

—— ——, var. glypta, *Jones*, Monog. Perm. *l. c.* fig. 12; Trans. Tynes. *l. c.* figs. 4–7. Permian; Britain.

—— ——, var. Richteriana, *Jones*, Trans. Tynes. *l. c.* fig. 8. Permian; Germany.

—— ——, var. Roessleri, *Reuss* (sp.), Jahresb. Wetter. Ges. 1854, p. 70, fig. 11; Trans. Tynes. *l. c.* fig. 9. Permian; Germany.

—— ——, var. Schrenkii, *Keyserling* (sp.), in Schrenk's Reise Nord. Russl. &c. p. 112, pl. 4. fig. 37. Permian; North Russia.

—— ——, var. sticta, *Keys.* (sp.), ibid. fig. 38. Permian; North Russia.

—— ——, var. grapta, *Keys.* (sp.), ibid. fig. 39. Permian; North Russia.

(Some, if not all, of these may be distinct species; for the soft parts may have varied more than the carapaces.—T. R. J.)

—— annectens, *J. & K.* MS., An. N. H. s. 3. xviii. 42, &c.; Trans. Geol. Soc. Glasgow, ii. 220. Carboniferous; Ireland and Britain.

—— costata, M'Coy, sp., Synops. Carb. Foss. Ireland, p. 165, pl. 23. fig. 11; An. N. H. *l. c.* p. 43. Carboniferous; Ireland and Britain.

—— Eichwaldiana, *J. & K.* MS., Trans. Geol. Soc. Glasgow, ii. 221. Carboniferous; Britain.

—— oblonga, *J. & K.* MS., ibid. p. 221. Carboniferous; Britain.

—— plicata, *J. & K.* MS., ibid. p. 221. Carboniferous; Britain.

—— Scotica, *J. & K.* MS., ibid. p. 220. Carboniferous; Britain.

—— spinosa, *J. & K.* MS., ibid. p. 220. Carboniferous; Britain.

—— striolata, *Eichwald*, sp., Leth. Ross. livr. vii. p. 1348, pl. 52. fig. 14. Carboniferous; Russia.

—— umbonata, *Eichwald*, sp., ibid. p. 1347, pl. 52. fig. 10; Trans. Geol. Soc. Glasgow, ii. p. 221. Carboniferous; Russia.

—— Urei, *Jones*, Trans. Tynes. Nat. Field Club, iv. 136; Trans. Geol. Soc. Glasg. ii. 220. Carboniferous; Britain.

Moorea, Jones & Kirkby, MS.

During an examination some time since of a series of bivalved Entomostraca collected by Mr. Charles Moore, F.G.S., from the contents of some fissures in the Carboniferous Limestone of Somersetshire and elsewhere, Messrs. Jones & Kirkby discriminated a few specimens having simple, thick, flattened carapace-valves, longer on the dorsal than the ventral margin, without any subcentral pit, and ornamented with narrow, rounded ridges, following more or less closely and completely the marginal contour. Some *Kirkbyæ* are but slightly convex, and bear superficial ridges, both circular and longitudinal (such as *Kirkbya fibula*, fig. 9, and *K. costata*, M'Coy, sp.); but all have some trace of a subcentral pit or notch, and the group is therefore distinct. These new forms were referred to in the Quart. Journ. Geol. Soc. vol. xxiii. (1867) pp. 494, 523, and 559, as *Moorea obesa* and *M. tenuis*, Jones, MS. (once with a misprint of *obtusa* for *obesa*). We have now to notice another and still older * species of this ancient family of Entomostraca, the members of which seem (as far as the carapace is concerned) to present closely related genera, linking together *Leperditia*, *Primitia*, *Beyrichia*, *Kirkbya*, and *Moorea* by various gradations and resemblances in the structure of the valves. Knowing that existing Entomostraca, with mutually similar carapaces differ among themselves as to essential limb-characters, we feel more and more inclined to lay stress on differences in the features of the fossil valves, and to keep distinct all well-marked forms remaining from among the almost lost tribes of these little primæval Crustacea.

Moorea silurica, sp. nov. Pl. XV. figs. 8 *a*, 8 *b*.

Carapace-valves subovate, one-third longer than high, slightly convex, polished, but coarsely punctate, and bearing a raised marginal rim. Dorsal edge straight; dorsal corners rounded. Ventral border presenting a nearly true segment of a circle. Ends somewhat obliquely rounded, nearly equal in outline. A stout elevated ridge runs along nearly the whole margin of the valve. It may be said to begin on the hinder edge, which is depressed, but strongly lipped by the marginal rim standing out sharply backwards; it thickens on the ventral border, is very thin anteriorly, and rises high along the dorsal region, until it turns suddenly downwards, to lose itself in the general surface of the posterior third of the valve.

In some individuals the raised rim above the ventral border is but faintly marked; in others the marginal rim is strongly developed, both above and below, and almost meets behind.

Only single valves have been met with; but in its ventral aspect the carapace was probably somewhat like a compressed orange-pip, partly split at one end. The greatest convexity is about the centre of the valves.

The ventral border of the figured valve (fig. 8 *b*, probably the right and overlapping valve) is flattened suddenly by the

* I do not fall in with Mr. Charles Moore's belief that the Entomostraca above referred to are of Liassic age, and were deposited in the fissures from the sea of that period, but rather believe them to have been derived by degradation from the fissured limestone.—T. R. J.

projection of the marginal rim, and by being turned inwards for a considerable depth. Its extreme edge has for most of its length a delicate raised rim, which, however, passes outwards and backwards to join the great marginal ridge, where the latter projects as a thick, sharp-edged crest along the posterior edge of the valve. Somewhat analogous features may be traced in *Primitia cristata*, J. & H., Ann. Nat. Hist. ser. 3. vol. xvi. pl. 13. fig. 1.

The dorsal border of *Moorea silurica* is indented along its marginal ridge, so as to form with its fellow, if similarly constructed, a narrow elliptical depression at the back, along the hinge-line, as in *P. cristata* above alluded to.

Our specimens were found in a band of micaceous limestone in the Upper Ludlow rocks, with *Kirkbya fibula*, at Hales End, Malvern, where it was not uncommon.

Table of Measurements in thousandths of an inch.

Name.	Reference.	Length.	Height.	Thickness.
Cythere corbuloides, *sp. n.*	Pl. XV. f. 4, p. 211	41	32*	35
—— Grindrodiana, *sp. n.*	woodcut, f. 1, p. 212	24†	11	10 ?
Bairdia Phillipsiana, *sp. n.*	Pl. XIV. f. 7, p. 213	53	33‡	26
Thlipsura corpulenta, *sp. n.*	Pl. XV. f. 1, p. 214	50	30	33
—— tuberosa, *sp. n.*	„ f. 2, p. 214	43	23	19
—— V-scripta, *sp. n.*	„ f. 3, p. 214	32	20	16
Cytherellina siliqua, *var.* grandis, *nov.*	Pl. XIV. f. 1, p. 217	83	42	39
—— —— (ordinary variety)	„ f. 2, p. 217	53	24	26
—— ——, *var.* tersa	„ f. 3, p. 217	33	17	16
—— ——, *var.* ovata	„ f. 4, p. 217	70	45	40
—— siliqua, *Jones, sp.* (ordinary var.)	„ f. 6, p. 217	53	24	?
—— —— „ (another specimen)	„ f. 5, p. 217	46	20	?
Æchmina cuspidata, *sp. n.*	Pl. XIV. f. 8, & woodcut, f. 2, p. 218	58	33	?
—— clavulus, *sp. n.*	„ f. 3, p. 218	47	38	?
Beyrichia intermedia, *sp. n.*	Pl. XV. f. 7, p. 218	22	17	?
Primitia lenticularis, *sp. n.*	woodcut, f. 4, p. 219	44	33	24
—— umbilicata, *J. & H.*	Pl. XV. f. 6, p. 220	37	27	?
—— bipunctata, *Salter*	woodcut, f. 5, p. 220	50	37	?
—— excavata, *sp. n.*§	Pl. XV. f. 10, p. 222	33	25	22
Kirkbya fibula, *sp. n.*§	„ f. 9, p. 224	32	20	14
Moorea silurica, *sp. n.*§	„ f. 8, p. 226	38	27	24

* Large valve.

† Another specimen, found lately, measures $\frac{60}{1000}$ inch in length, and $\frac{25}{1000}$ in height.

‡ Smaller valve, $\frac{26}{1000}$ inch.

§ The thickness in the last three species is obtained by doubling the thickness of the single valve.

EXPLANATION OF THE PLATES.

Plate XIV.

[The specimens are magnified 20 diameters.]

Fig. 1. *Cytherellina siliqua*, Jones, sp., var. *grandis*, from the Woolhope beds near the Wych, Malvern: *a*, perfect carapace, showing the right valve; *b*, ventral view; *c*, end view (posterior).

Fig. 2. *C. siliqua*, Jones, sp. (common variety), from the Aymestry Limestone of Chance's Pitch, Malvern: *a, b, c*, as the foregoing.

Fig. 3. *C. siliqua*, var. *tersa*, nov., from the Wenlock Limestone near Malvern: *a, b, c*, as the foregoing.

Fig. 4. *C. siliqua*, var. *ovata*, nov., from the base of the Wenlock Shale near Malvern, showing the right valve.

Fig. 5. *C. siliqua*, Jones, sp. (common variety): *a*, right valve; *b*, edge view; *c*, end view. From the base of the Upper Ludlow beds, Hales End, Malvern.

Fig. 6 *a, b, d*. The same; casts with and without remains of the valve: *e*, diagram of the edge view of cast and valve. From the same place.

Fig. 6 *c*. The same: cast of left valve. From drifted Scandinavian Limestone.

Fig. 7. *Bairdia Phillipsiana*, sp. nov., from the Wenlock Limestone near Malvern: *a*, perfect carapace, showing the right valve and the overlapping edges of the left valve; *b*, ventral aspect; *c*, end view (anterior).

Fig. 8. *Æchmina cuspidata*, gen. et sp. nov.; a fragment from the Wenlock Limestone of Croft's Quarry, near Malvern. (See also woodcut, fig. 2.)

Plate XV.

[Fig. 10 *c* magnified 100 diameters; all the others are magnified 20 diameters.]

Fig. 1. *Thlipsura corpulenta*, gen. et sp. nov.; from the base of the Woolhope beds, near Malvern: *a*, perfect carapace, with right valve outwards; *b*, ventral view; *c*, dorsal view; *d*, hind end view.

Fig. 2. *Thlipsura tuberosa*, sp. nov.; from the base of the Wenlock Shale, Elton Lane, Ludlow: *a, b, c*, as the foregoing. (The specimen has lost some of the thickness of its carapace-valves.)

Fig. 3. *Thlipsura V-scripta*, sp. nov.; from the Wenlock Limestone, Croft's Quarry, Malvern: *a*, left valve; *b*, ventral view; *c*, end view.

Fig. 4. *Cythere corbuloides*, sp. nov.; from the Wenlock Limestone, near Malvern: *a*, right valve; *b*, perfect carapace, with its right valve outwards; *c*, dorsal view; *d*, ventral view; *e*, posterior view.

Fig. 5. The same, smaller individual; Woolhope beds near Malvern: *a*, perfect carapace, right valve outwards; *b*, end view (posterior).

Fig. 6 *a, b*. *Primitia umbilicata*, J. & H.; from Middle (?) Ludlow beds, Abberley. Two valves, showing different conditions of the subcentral depression, owing to crush and weathering.

Fig. 6 *c, d*. *Primitia renulina*, J. & H.; from Middle (?) Ludlow beds, Abberley. Two casts (with some remains of shell) of somewhat varying valves.

Fig. 7. *Beyrichia intermedia*, sp. nov.: a right (?) valve. Aymestry Limestone, Chance's Pitch, Malvern.

Fig. 8. *Moorea silurica*, sp. nov.; from the Upper Ludlow beds, Hales End, Malvern: *a*, right valve; *b*, ventral view.
Fig. 9. *Kirkbya fibula*, sp. nov.; from the Upper Ludlow beds, Hales End, Malvern: *a*, right valve; *b*, ventral view.
Fig. 10. *Primitia excavata*, sp. nov.; from the Woolhope Limestone, near Malvern: *a*, left valve; *b*, ventral view; *c*, portion of the depressed area and of its border, highly magnified.

XXXI.—*On the Species of* Veneridæ *found in Japan.* By Arthur Adams, F.L.S. &c.

My list of the Japanese species of the *Venus* tribe is a tolerably long one; but only a few unrecorded species were met with, Reeve and Sowerby both being occupied with seeking out and describing every member, however obscure, of this beautiful family just on my arrival in England. *Meretrix lusoria* and its varieties form a favourite article of diet among the poorer classes of Japan; they call it "Famaguri Hamongudi;" and great heaps of the shells are often found near their houses. It affords them also amusement. From the thousands of odd valves they select numerous pairs which are both marked with a similar pattern, and, sitting round in a circle on their mats, one throws a number of shells down promiscuously; and the object of the simple game is to select pairs of similarly marked valves quicker than any one else!

The habitat of *Chione cardioides*, in the British Museum Catalogue by M. Deshayes, is "Mare Antillarum," and that of *C. histrionica* "America centralis;" but these may be errors.

Fam. **Veneridæ.**

Subfam. *Venerinæ.*

Genus Venus, Linn.

1. *Venus lamellaris*, Schum., Rve. Conch. Syst. pl. 68. f. 4.

V. cancellata, Chemn. (non Lam.).
V. reticulata, var., Lam.
V. subrostrata, Gray.
Dosina Lamarckii, Gray.

Hab. Seto-Uchi, Kuro-Sima.

2. *Venus toreuma*, Gld. Exp. Shells, 1850, p. 84; Sow. Thes. Conch. pl. 161. f. 187–189.

V. crebrisulca, Sow. (non Lam.).
V. Jukesii, Desh. Cat. Conch. Brit. Mus. 1853.

Hab. Gotto Islands, 48 fathoms; Satanomosaki, 55 fms.

Genus Mercenaria, Schum.

Mercenaria Stimpsoni, Gld. Otia Conch. p. 169.

Hab. Hakodadi Bay.

Genus Gemma, Desh.

Gemma gemma, Totten (*Venus*), Gld. Rep. Inv. Mass. p. 88, f. 51.

Hab. Aniwa Bay, 17 fathoms.

Genus Cryptogramma, Mörch.

Cryptogramma squamosa, Linn. (*Venus*), Sow. Thes. Conch. pl. 156. f. 83, 84.

Hab. Cape Nomo, Kiusu.

Genus Chione, Megerle.

1. *Chione marica*, Linn., Sow. Thes. Conch. pl. 157. f. 107–110.

Hab. Tsus-Sima, 26 fathoms; Mososeki, 7 fms.

2. *Chione crenifera*, Sow. (*Venus*), Wood, Suppl. (Hanl.) pl. 16. f. 30.

Venus Portesiana, D'Orb.

Hab. Seto-Uchi.

3. *Chione intersecta*, Sow. (*Venus*).

Hab. Seto-Uchi.

Subgen. *Chamelea*, Klein.

4. *Chione* (*Chamelea*) *japonica*, Gmel., Hanl. Wood's Suppl. pl. 13. f. 46.

Venus literata, Chemn. (non Linn.).

Hab. Japan (teste auct.).

Subgen. *Circomphalus*, Klein.

5. *Chione* (*Circomphalus*) *Isabellina*, Phil. (*Venus*), Abbild. & Beschr. p. 39, pl. 10. f. 5.

Hab. Kuro-Sima.

6. *Chione* (*Circomphalus*) *lamellata*, Lam. (*Venus*), Sow. Thes. Conch. pl. 160. f. 176.

Hab. Satanomosaki.

7. *Chione* (*Circomphalus*) *tiara*, Dillw. (*Venus*), Sow. Thes. Conch. pl. 158. f. 125, 126.

Hab. Kino-O-Sima, Kuro-Sima.

Subgen. *Timoclea*, Leach.

8. *Chione* (*Timoclea*) *cardioides*, Lam. (*Venus*), Sow. Thes. Conch. pl. 155. f. 57, 58.

V. asperrima, Sow.
Cytherea cardilla, Lam.

Hab. Kino-O-Sima.

9. *Chione* (*Timoclea*) *histrionica*, Brod. & Sow. (*Venus*), Sow. Thes. Conch. pl. 55. f. 52.

Hab. Hakodadi.

Genus Meretrix, Lam.

1. *Meretrix lusoria*, Rumph., Sow. Thes. Conch. pl. 128. f. 40–42.

V. lusoria japonica, Chemn.
Cytherea lusoria, Lam.
Meretrix formosa, Sow.
In Japanese, "Famaguri Hamongudi."

Hab. Hakodadi, Yokohama, Simoda.

2. *Meretrix morphina*, Lam., Sow. Thes. Conch. pl. 129. f. 59, 60.

Cytherea morphina, Lam.

Hab. Nagasaki, Simoda, Yokohama.

3. *Meretrix zonaria*, Lam., Sow. Thes. Conch. pl. 129. f. 53, 54.

Hab. Hakodadi, Simoda, Nagasaki.

These three so-called species I believe to consist of one, with which *C. castanea* and *C. Lamarckii* may be united.

Genus Tivela, Link.

Tivela damaoides, Gray (*Venus*), Sow. Thes. Conch. pl. 127. f. 7–9.

Trigona damaoides, Gray.
Cytherea ponderosa, Hanl.

Hab. Kino-O-Sima. Eaten by the poorer classes.

Genus Callista, Poli.

1. *Callista festiva*, Sow. (*Cytherea*), Thes. Conch. pl. 130. f. 72.

Hab. Kuro-Sima.

2. *Callista inflata*, Sow. (*Cytherea*), Thes. Conch. pl. 133. f. 127, 128.

Hab. Tsusaki, Mososeki.

3. *Callista tellinæformis*, Phil. (*Venus*), Abbild. pl. 9. f. 1.
   Cytherea tellinoidea, Sow.
   Hab. Japan (Phil.). I did not meet with this species.

Genus Sunetta, Link.

1. *Sunetta excavata*, Hanl. (*Cytherea*), Wood, Descrip. Cat. Suppl. pl. 15. f. 19.
   Cuneus excavatus, Desh.
   Meroë excavata, Sow. Thes. Conch. pl. 126. f. 13, 14.
   Hab. Satanomosaki, 55 fathoms.

2. *Sunetta subquadrata*, Sow. (*Meroë*), Thes. Conch. pl. 126. f. 9.
   Cuneus subquadratus, Desh.
   Hab. Fat-si-jeu Islands, 25 fathoms.

3. *Sunetta menstrualis*, Mke. (*Cytherea*), Phil. Abbild. pl. 3. f. 3.
   Meroë magnifica, Rve.
   Hab. Kuro-Sima.

Genus Circe, Schum.

1. *Circe scripta*, Linn. (*Venus*), Wood, Ind. Test. pl. 8. f. 97.
   Chama literata, Chemn.
   Cytherea undatina, Lam.
   Hab. Simidsu, Tsus-Sima.

2. *Circe divaricata*, Chemn. (*Venus*), Sow. Thes. pl. 137. f. 8, 9.
   Cytherea testudinalis, Lam.
   Venus discors, Schröt.
   Cytherea æquivoca, Sow. (non Chemn.).
   Chamæformis percites, Meusch.
   Hab. Tanabe.

3. *Circe dispar*, Chemn. (*Venus*), Sow. Thes. Conch. pl. 137. f. 10, 11.
   Cytherea muscaria, Lam.
   C. pulicaris, Lam.
   C. mixta, Lam.
   Hab. Tago, Kino-O-Sima.

4. *Circe æquivoca*, Chemn. (*Venus*) Conch. pl. 202. f. 1980.
   Cytherea placunella, Lam.
   Hab. Simidsu.

5. *Circe nummulina*, Lam. (*Cytherea*), Sow. Thes. Conch. pl. 138. f. 27.
   Hab. Mososeki.

6. *Circe gibbia*, Lam. (*Cytherea*), Sow. Thes. Conch. pl. 137. f. 4–7.

   Cytherea ranella, Lam.
   Circe cælata ?, var.

   Hab. Kino-O-Sima.

Subgen. *Lioconcha*, Mörch.

7. *Circe* (*Lioconcha*) *ornata*, Dillw., Sow. Thes. Conch. p. 642.

   Pectunculus reticulatus, List.
   Cytherea picta, Lam.

   Hab. Tatiyama, Takano-Sima.

Subfam. *Dosiniinæ.*

Genus Dosinia, Scopoli.

1. *Dosinia japonica*, Rve. (*Artemis*), Conch. Icon. pl. 3. f. 7.
   Hab. Hakodadi.

2. *Dosinia biscocta*, Rve. (*Artemis*), Conch. Icon. pl. 9. f. 55.
   Hab. Seto-Uchi, Mososeki.

3. *Dosinia Gruneri*, Phil. (*Artemis*), Zeitschr. für Malak. 1848, p. 132. no. 63.
   Hab. Tsus-Sima.

4. *Dosinia aspera*, Rve. (*Artemis*), Conch. Icon. pl. 9. f. 49.
   Hab. Gotto Islands, 48 fathoms.

5. *Dosinia scabra*, Phil. (*Artemis*), Zeitschr. für Malak. 1849, p. 19. no. 81.
   Hab. Mino-Sima.

6. *Dosinia laminata*, Rve. (*Artemis*), Conch. Icon. pl. 7. f. 41.
   Hab. Tatiyama, Takano-Sima.

7. *Dosinia rostrata*, Chemn. (*Venus*), Rve. Conch. Icon. pl. 7. f. 39.

   Artemis Sieboldii, Rve.

   Hab. Hakodadi.

8. *Dosinia bilunulata*, Hanl. (*Artemis*), Desc. Cat. p. 106; Wood, Suppl. pl. 9. f. 44.
   Hab. Japan. I did not find this species.

9. *Dosinia sericea*, Rve. (*Artemis*), Conch. Icon. pl. 8. f. 36.
   Hab. Seto-Uchi.

10. *Dosinia penicillata*, Rve. (*Artemis*), Conch. Icon. pl. 6. f. 32.
Hab. Tsus-Sima, Oki Islands.

11. *Dosinia Traillii*, A. Ad. Proc. Zool. Soc.
Hab. Yokohama.

12. *Dosinia isocardia*, Dkr. (*Artemis*), Phil. Abbild. Conch. Cyth. pl. 8. f. 5; Rve. Conch. Icon. *Artemis*, pl. 1. f. 1.
Hab. Tatiyama.

13. *Dosinia lirata*, Sow. (*Artemis*), Thes. Conch.
Hab. Gotto, 48 fathoms.

14. *Dosinia gibba*, A. Ad.

D. testa orbiculari, cordata, tumida, lutescenti-albida, solida, concentrice costellata, costellis subdistantibus, in fasciculos dispositis, ad umbonibus subtilissime striata; area ligamenti simplici, lunula perampla, cordata, superficiali.

Hab. Tatiyama.

A species more tumid than any described, with the exception of *D. isocardia*. The concentric ribs are rounded and collected together in bundles, and the lunule is conspicuous, superficial, and narrowly heart-shaped.

Genus Cyclina, Desh.

1. *Cyclina chinensis*, Chemn. (*Venus*), Conch. Cab. pl. 171. f. 1663.
Venus sinensis, Gm.
Cyprina tenuistria, Lam.
Artemis sinensis, Rve.
Hab. Tsus-Sima.

2. *Cyclina orientalis*, Sow. (*Artemis*), Thes. Conch. pl. 144. f. 79.
C. pectunculus, Roem.
Hab. Tsaulian, Tsus-Sima.

3. *Cyclina flavida*, Desh. Cat. Conchif. Brit. Mus. p. 31.
C. bombycina, Roem.
Hab. Tsus-Sima.

Subfam. *Tapesinæ.*

Genus Tapes, Schum.

1. *Tapes exarata*, Phil. (*Pullastra*), Abbild. Conch. pl. 5. f. 6; Sow. Thes. Conch. pl. 145. f. 18.
Hab. Kuro-Sima.

2. *Tapes amabilis*, Phil. (*Pullastra*), Zeitschr. für Malak. 1847, p. 90; Sow. Thes. Conch. pl. 145. f. 11.

   Hab. Tago.

3. *Tapes undulata*, Born (*Venus*), Test. Mus. p. 67.

   Venus rimosa, Phil.
   Tapes ramosa, Sow. Thes. Conch. pl. 146. f. 29.

   Hab. Tatiyama.

4. *Tapes vernicosa*, Gould (*Pullastra*), Otia Conch. p. 168.

   Hab. Hakodadi, Tatiyama, Tsusaki.

Subgen. *Cuneus*, Da Costa.

5. *Tapes* (*Cuneus*) *japonica*, Desh. Cat. Conchif. Mus. Brit. p. 181.

   Hab. Cape Notoro, Cape Tofuts, Saghalien.

6. *Tapes* (*Cuneus*) *philippinarum*, Ad. & Rve. (*Venus*), Zool. Voy. Sam. Moll. pl. 22. f. 10.

   Hab. Hakodadi, Olga Bay, Rifunsiri Island.

7. *Tapes* (*Cuneus*) *variegata*, Sow. Thes. Conch. pl. 151. f. 133–138.

   Hab. Nagasaki, Oki Islands, Tsus-Sima.

8. *Tapes* (*Cuneus*) *indica*, Sow. Thes. Conch. pl. 151. f. 146, 147.

   Hab. Seto-Uchi.

9. *Tapes* (*Cuneus*) *Bruguieri*, Hanl. (*Venus*), Wood, Ind. Supp. pl. 15. f. 59.

   Hab. Kino-O-Sima.

Genus Saxidomus, Conrad.

1. *Saxidomus purpuratus*, Sow. (*Tapes*), Thes. Conch. pl. 150. f. 124.

   Hab. Seto-Uchi, Mososeki.

2. *Saxidomus aratus*, Gld. Otia Conch. p. 168.

   Hab. Hakodadi.

Genus Rupellaria, Fleur. de Bellev.

1. *Rupellaria exotica*, Lam. (*Venerupis*), Wood, Ind. Suppl. pl. 9. f. 29.

   Hab. Tsus-Sima, Kuro-Sima.

2. *Rupellaria carditoides* (*Venerupis*), Deless. Rec. de Coq. pl. 5. f. 3.

Pullastra carditoides, Catlow.

Hab. Tsus-Sima (in oyster-shells), Oki Islands.

3. *Rupellaria macrophylla*, Desh. (*Venerupis*), Cat. Conchif. Brit. Mus. p. 193.

Hab. Kuro-Sima.

4. *Rupellaria monstrosa*, Chemn. (*Venus*), Conch. pl. 42. f. 445, 446.

Hab. Tsus-Sima (in slate-stone), Kino-O-Sima (in Madrepores).

Genus Clementia, Gray.

1. *Clementia? similis*, Sow. Thes. Conch. pl. 151. f. 154.

Hab. Tatiyama.

2. *Clementia moretonensis*, Desh. Proc. Zool. Soc. 1853, p. 18.

Hab. Kino-O-Sima.

Genus Trapezium, Megerle.

1. *Trapezium angulatum*, Lam. (*Cypricardia*), Lam. 2; Wood, Ind. Test. Suppl. pl. 2. f. 2.

Hab. Kino-O-Sima, in Madrepores.

2. *Trapezium rostratum*, Lam. (*Cypricardia*), Lam. 3.

Chama rostrata, Wood.

Hab. Tsus-Sima, in oyster-shells.

Genus Coralliophaga, Blainv.

Coralliophaga lithophagella, Lam. (*Cardita*), Lam. 24; Deless. pl. 11. f. 11.

Hab. Kino-O-Sima, in Madrepores.

XXXII.—*Note on the Varieties of Dogs.* By Dr. J. E. Gray.

The variations of domestic dogs is a subject that has not been sufficiently studied, and one that is well worthy of attention.

Colonel Charles Hamilton Smith devoted the fifth volume of Jardine's 'Naturalist's Library,' to the natural history of dogs. He divides domestic dogs thus:—1, feral dogs;

2, wolf-dogs; 3, watch-dogs; 4, greyhounds; 5, hounds; 6, cur dogs; and, 7, mastiffs.

Prof. Fitzinger, in the 'Sitzungsberichte der kaiserl. Akad. der Wissensch.' for July 1867, has published an elaborately compiled essay on the subject; but I do not consider it satisfactory. He divides them into seven groups, and regards the deformed, short-legged, and the hairless dogs as two of them.

I. *Canes domestici*, containing forty-eight varieties, including the following English-named dogs:—shepherd's dog, terrier, Iceland dog, Pomeranian dog or spitz dog, Siberian dog, pariah dog, watch-dog, New-Zealand dog, Esquimaux dog.

II. *Canes extrarii*: thirty varieties, including the spaniel, comforter or Maltese dog, springer, water-spaniel or poodle, Newfoundland dog, Scotch terrier.

III. *Canes vertagi*: twelve varieties, including the Turnspits.

IV. *Canes sagaces*: thirty-five varieties, including hound, bloodhound, Scotch bloodhound, water-hound, pointer, breac, leviner or lynmer or talbot, foxhound, harrier, setter, staghound.

V. *Canes molossi*, containing nineteen varieties, including mastive or mastiff or ban-dog, pug-dog or mops, terrier or pincher, bull-dog.

VI. *Canes leporarii*: thirty-nine varieties, including the greyhound, boarhound, Danish dog, Dalmatian or coach-dog, Irish wolf-hound, lurcher.

VII. *Canes caraïbœi*: six varieties, as the hairless dog, naked dog, and crested dog.

The varieties of dog are chiefly characterized by the difference in the development of the various parts of the animal, as, for example,—

1. The length of the head, and especially of the nose, compared with its diameter or circumference.

2. The length and strength of the body and limbs, sometimes very slender, as in the greyhound, or massive, as in the mastiff.

3. The size, form, and natural direction of the ears, as:—(1) erect, or projecting outwards; (2) drooping on the sides of the head; (3) folded back on the sides of the neck.

4. The size of the upper lip.

5. The presence or absence of the dew-claw or internal toe.

The varieties characterized by these differences in the relative development of the various parts, without destroying the general symmetry of the animal, are further subdivided—

1. By the variation in the character of the hair, as to whether it is short and smooth, or longer, soft and curly, or stiff and harsh or bristly.

2. By the colour of the skin and the fur that covers it.

These variations are to be found in almost all the varieties produced by a different proportion of the parts: thus there are smooth curly-haired, and rough-haired greyhounds; and it is the same with other varieties.

At the same time, not only can the desired difference in the proportion of the parts, but also the colour and kind of hair be perpetuated by careful breeding and weeding.

The second kind of variation ought rather to be called abnormalities or physical defects, though they are continued by breeding and weeding for special purposes, and are even carried to such a great extent as to be absolute deformities. The principal of these are:—

1. The short and more or less bandy legs of the turnspit and lurchers, which are common to terriers and spaniels.

2. The more or less imperfect development of the upper jaw, found in the bull-dog, pug-dog, and different breeds of spaniels.

3. The great development of the ball of the eyes, so as to become too large for the orbit and exceedingly prominent and liable to accident, found in some breeds of spaniels and terriers.

4. The more or less complete want of hair, which is generally accompanied by a more or less complete want or great imperfection in the development and rooting of the teeth, showing the relation between these two organic productions.

F. Cuvier, in his article on the Dog, proposes to arrange them into *three* groups, according to a difference in the proportion and position of the parietal and other bones, which arrangement is followed by Youatt, in his essay on dogs; but the characters are very indefinite; and I find there is very little difference in the form and character of the skulls of the normal varieties of dogs: they only differ a little in the length and comparative and absolute width of the nose. Indeed it is very difficult to find the slightest difference between the skulls of dogs that are very different in external appearance.

In what I am more inclined to call monstrosities than varieties, such as the bull-dog, which is characterized by the malformation or imperfect development of the upper jaw, the skull varies according to the extent of the deformity. It is the same with the large-eyed breeds of spaniels and terriers.

The skulls of these animals also differ from one another in the completeness or imperfection of the ossification—some skulls having a large fontanel, and others being imperfect in the hinder part, as the skull of the Japanese sleeve-dog, figured in the 'Proceedings of the Zool Soc.' for 1867, p. 41.

The skeletons of the short and bandy-legged dogs of course vary, like the dogs themselves, in the extent of the development of these bones.

The pure breeds of the domestic dog may be arranged, according to the form and development of the ears, thus:—

I. Dogs. *The ears moderate, ovate, erect or spreading.*

Shepherd's dog.
Esquimaux dog.
Spitz dog.
New-Holland dog or Dingo.

II. Terriers. *The ears moderate, broad, more or less elongate, spreading, sometimes drooping at the end.*

The ears of the dogs of this variety are very generally trimmed or cut off more or less near to the base; and some writers, as Youatt, in figuring the breeds, draw the figures from specimens that have the ears so trimmed! The tail also is often more or less truncated artificially.

Terrier or Pincher.
Bull-terrier.
Bull-dog.
Turnspit.
Mops or Pug-dog.

III. Greyhounds. *The ears moderate, wide, more or less elongate and folded back behind on the sides of the head.*

The dogs of this kind vary greatly in the fur, and are very apt to be more or less hairless or naked.

Greyhound, Naked dogs.
Dalmatian or Danish or Coach-dog.

IV. Hounds. *The ears large, broad, flat, and dependent on the sides of the face.*

The legs are generally very large; the hair is short and smooth, or elongate, smooth, more or less curled, or wiry.

Mastiff and Bloodhounds.
Hound, Talbot, Foxhound, Harriers, Beagle.
Pointer.

Spaniels, Setter, Cocker, Springer.
Newfoundland dog. (Smith, Dogs, t. 5.)
Water-Spaniel and Poodles.
Scotch Terrier and stout-legged Spaniel.

The popular nomenclature of dogs is very loose and indefinite: thus both terriers and spaniels are called Scotch terriers; any long and slender-legged dog is called a greyhound, especially if it has a slender nose; and dogs are called different varieties on the most trivial characters, as the extent of the feathering on the legs or of the hair on the feet, the presence or absence of the small internal toe or dew-claw, and the extent of the membrane between the bases of the toes.

By careful breeding and weeding, all the characters of either of these classes of variation may be kept more or less pure, the colour and the nature of the fur being as permanent and necessary for the purity of the breed as the form and proportion of the different parts of the animal.

From the accidental commingling of dogs at large, there are formed hybrids between almost all established and recognized breeds of dogs; but the results of such illicit connexion are much more rare than one might expect, the pups arising from such careless breeding being very commonly destroyed, from the contempt with which they are universally regarded by all classes of persons, the dog-fanciers, even among the poorest classes, always calling such dogs curs and valueless. It is curious to see even young boys, who, no doubt, take their cue from some dog-fancier of their acquaintance, from whom they learn the points of a pure breed, say of such a puppy or dog that it is only a cur and not worth having. It is a general belief that the offspring of such dogs, even of the same litter, have an inclination to return more or less completely to the breed of one of the parents; but of this I have no certain knowledge, and the instances of the breeding of such curs in that manner must be comparatively rare.

I have a friend who has a dog that was bred between a greyhound and a terrier bitch; it is black and tan, most beautifully formed, intermediate in contour between the two pure breeds; but on showing the dog to a country boy, he at once said he would not keep such a dog; it was only a "cur not worth a shilling; it was neither a good greyhound nor a good terrier, a regular mongrel cur;" and, beautiful as the animal is to unsophisticated, or, rather, uneducated eyes, it is regarded with contempt in the village.

MISCELLANEOUS.

On Othelosoma, *a New Genus of African Slugs.* By Dr. J. E. Gray.

Mr. Symonds, jun., when he returned from the Gaboon, left with me a couple of specimens of what he called a terrestrial slug, which he had obtained, on the 24th of December 1865, in the Gaboon. He promised to send to me, at my solicitation, a detailed account of it and of some other Mollusca which he had drawn from life, and for that purpose took with him the drawings and other specimens. The descriptions have not arrived, and I am now told that he has left the country again. As the animal is very unlike any other that I have seen, I have determined to give as distinct an account as I can of it, without injuring the specimen, in the hope that other travellers will obtain more examples of it, so that its anatomy may be studied and its proper place in the system determined. It is much more like the terrestrial leech of Ceylon called *Dunlopia**; but it has no appearance of a lunate head, such as characterizes that genus; and Mr. Symonds, who had seen it alive, said that it had the habit and appearance, when alive, of a slug, and he considered it more allied to the slug than to any other animal; among the genera that he had collected, there were some slugs. Unfortunately he took the drawings away with him, so that I have them not to refer to.

One specimen is rather more than an inch, and the other about $\frac{3}{4}$ inch long. They are fusiform subcylindrical, rather depressed, tapering at each end. In one specimen it is the head, and in the other it is the other end that is rather the longest and more tapering. There is a flat, narrow, linear foot in the middle of the underside, extending the entire length of the body, with a very slight linear central longitudinal impression. There are indications of some very obscure cross folds on the sides of the body, but not forming any distinct rings. The upper surface is reddish brown, with three rather broad, black, longitudinal lines—one down the centre, and the others on the sides of the back. The underside of the body is pale, and the foot white; the foot is only indistinctly defined, except by its whiter colour, as the lateral edge is scarcely raised from the under surface of the body. The head is very small, hemispherical, white, semitransparent, with a small black dot-like eye in the middle of each of its two sides; the head is separated from the front of the foot by a ring almost as wide as the head is long, of the same colour as the rest of the body, but brown beneath. The hinder end of the body is rather depressed and gradually contracted to the tip.

Mr. Symonds's figure of the animal when alive, represented it as having a small dot-like aperture in the side, which he said was the aperture for respiration; but I have not been able to observe any indication of an aperture in the animals in their contracted state in spirit, and I do not like to cut into the specimens until more have been obtained; and they are not now in a very good state.

* The animal called *Dunlopia* was first described under the name of *Planaria? lunata*, Gray, Zool. Misc. v. (1831).

I propose to name the animal *Othelosoma Symondsii.*

In the smaller specimen there is a small conical prominence in the middle line of the foot, about one-sixth of the entire length from the caudal extremity. This may be the vent or generative organ. I cannot find any indication of a similar organ in the larger specimen; but that is, unfortunately, broken across in the part where it ought to be situated. This may be the same as the minute aperture which occurs near the middle of the body in the foot of *Dunlopia.*

Othelosoma is very like *Dunlopia,* or the land-leech of Ceylon and India, in colour, texture, and appearance, and in the narrow foot; but it differs in being much more cylindrical and worm-like in the form of the body, and in the head being small, hemispherical, and pellucid in spirit, instead of being more or less lunate or broad and opaque white, and having many eyes.

New Species of Hyrax. By Dr. J. E. Gray.

In the Ann. & Mag. Nat. Hist. ser. 4. vol. i. p. 35, I published a "Revision of the Species of *Hyrax.*" The British Museum has received some other specimens, which belong to three, if not four, species not mentioned in that revision. The Museum purchased from Mr. Jesse three specimens and one skeleton of *Hyrax,* collected during the expedition to Abyssinia. They are all normal *Hyraces* as the genus is restricted in the paper above quoted, and belong to the section of it marked by having soft fur and a yellow dorsal streak.

One, which I have named *H. ferrugineus,* has an elongate well-marked yellow dorsal streak, the hair of the dorsal spot, as in all the other species of the section that I have described, being yellow the whole of its length to the base; the hair of the back is grey and black, with white tips; and the hinder part of the back and rump is washed with a ferruginous tint, which I have not observed in any other species of the genus: hence the specific name I have chosen.

The second species, which I have called *H. irroratus,* is coloured much like the preceding; but the hair is longer, and the dorsal spot is small and inconspicuous, the hair of the spot being blackish for the lower half of its length, and yellow at the upper half; the chin and under part of the body is white.

The other skin is very like the above; but the fur is rather shorter, and the chin and underside of the body are yellowish grey. There is in the British Museum another specimen, which agrees with this in every particular, which was purchased from Brandt of Hamburg as *H. syriacus* from Africa; so that I do not know its exact habitat, and very probably it was received from Abyssinia. The dorsal spots of both these specimens are like that of *H. irroratus*: I have therefore considered them a variety of it, which I have called *luteogaster*; but I strongly suspect that, when more specimens are examined, it will prove to be a distinct species, which may be designated by that name.

Senhor Barboza du Bocage sent me a specimen of *Hyrax* from Angola, under the name of *H. arboreus.* It is a most distinct species of the restricted genus *Hyrax,* belonging to the section with soft fur, but is peculiar for having minute black tips to the hairs and an elongated well-developed dorsal spot of a pure white. It differs from all the other species of the restricted genus in the length and narrowness of the nose of the skull. I have called the species *Hyrax Bocagei*.

On the mode of Development of Bothriocephalus latus. By M. Knoch.

According to a report by M. C. Robin, presented to the Academy of Sciences in Paris, M. Knoch has perfectly demonstrated that the embryo of *Bothriocephalus latus* passes through no cysticercal stage in the course of its development.—*Comptes Rendus*, January 11, 1869, p. 90.

Teeth of Streptaxis, Chilina, &c.

Dr. F. D. Heynemann, in the 'Malak. Blätter' for 1868, has described and figured the teeth of different terrestrial Mollusca, as, for example, the genera *Streptaxis*, *Pellicula*, *Simulopsis*, and *Chilina*. The teeth of *Streptaxis* are fusiform, with a more or less distinct rounded lobe on the front of each side near the base, somewhat like the teeth of *Testacella* and other worm-eating slugs; I had some time ago predicted that the teeth would be of that form, from the carnivorous habits of the genus. The Brazilian collectors of shells know that these snails will eat the animals out of the shells of the *Helices* that are shut up in a box with them. The animal of *Chilina* has a strong lunate jaw with a grooved front surface and a crenated lower edge; and the outer lateral teeth are large and pectinated on their upper edge. The teeth of the other genera are like those of the other herbivorous Helicidæ.—J. E. Gray.

Naultinus lineatus, *a New Lizard from New Zealand.* By Dr. J. E. Gray, F.R.S.

Mr. W. Adams has just returned from New Zealand and brought with him a new species of *Naultinus*, which I propose to call *N. lineatus*, as it differs from the other species in having three yellow dorsal streaks—one central, and the others on the outer part of the sides of the back. The lateral streaks are well marked in all the three specimens, which are of different ages; the central dorsal streak is indistinct in the two young, but more distinct and well marked in the adult, which is said to be a female and mother of the other two. They were procured at Otraroa, the French settlement in Canterbury, New Zealand.

Marine Animals of Southern Labrador.

Dr. O. S. Packman, jun., has published a list of marine animals dredged, during a fifty days' visit, near Caribou Island, Southern Labrador, in the Gulf of St. Lawrence, in which several new species are described, with most interesting observations on the distribution of the more common species,—interesting as they seem to afford very satisfactory evidence that there are three distinct assemblages of marine invertebrates intermingled on the coast of Northern Labrador.

The Keitloa (Rhinaster keitloa). By Dr. J. E. Gray.

The Keitloa, which was first described by Camper from a head received from the Cape of Good Hope, was regarded by Cuvier as the adult of the common Bovili (*R. bicornis*); but he had only seen the figure of the skull which he copies as that of an adult Cape-Rhinoceros in his work on fossil bones. Dr. Andrew Smith described it from living specimens, and showed, by the development of its horns, the general form of its body, and habit, that it was a distinct species, recognized by the natives; but cabinet zoologists who have even visited Africa, and must have seen the animal alive, persisted in regarding it as the same as the Bovili or *R. bicornis*.

The British Museum has lately purchased a complete skeleton of an adult female which Mr. Jesse obtained in Abyssinia; and the comparison of the skull with that of the Bovili (*R. bicornis*) in the British Museum, which was obtained from Mr. Petherick, proves that they are most distinct species, and that Camper's figure is a correct representation of the skull of the Keitloa. The skull of the Keitloa is much more solid and heavy than that of the Bovili, though this is partly dependent on the age of the animal; but still I am inclined to regard it as characteristic. The face, forehead, and crown are much wider than in the skull of the Bovili, the sides of the face being convex, and not flat as in that species; and the forehead under the hinder horn is convex and shelving on the sides, and this part is flat in the skull of the Bovili. In fact the Keitloa is evidently a most distinct and well-marked species, the skull having a very different appearance, especially when looked at on the crown.

Though the natives give the two Rhinoceroses each a distinct name, the generality of African travellers confound the two browsing species together under the name of the Black Rhinoceros of the forest and bush, as distinct from the Mahoohoo or White Rhinoceros of the grassy plains.

Organogenic investigation of Eupomatia. By H. Baillon.

The *Eupomatiæ*, the exceptional organization and multiple affinities of which have occupied so much of the attention of botanists since the time of Robert Brown, may be studied from an organogenic point of view now that one species of the genus is cultivated in our hot-houses. This investigation reveals some unexpected facts, which, indeed, could only be made known by it.

It shows, among other things, that the flowers of these plants lodge in their concave receptacle a truly *polycarpic* gynæcium; that what has been described as a single areolated stigma merely represents a portion of the dorsal wall of the ovaries; that the stigmata are independent of each other and equal in number to the carpels; and, what would be most inadmissible *à priori*, that these flowers are destitute of a true perianth, a single modified leaf acting the part of the protective agent of the sexual organs. As the consequence of these observations we obtain this fact, that the *Eupomatiæ*, an abnormal genus among the Annonaceæ, both in the form of their floral receptacle and in the mode of insertion of their stamina, serve as a transition between this group and that of the Monimieæ, to which they likewise approximate the Calycantheæ through *Chionanthus*, and indirectly the Magnoliaceæ through the Trochodendreæ. A branch of *Eupomatia* which is about to flower swells at its apex into a little club, which becomes concave above and gradually undergoes all the changes of form which are observed in the receptacle of a fig. From the aperture at the bottom of this receptacular sac, the pieces of the andrœcium and gynæcium appear successively in a spiral order.

Hitherto that conical hood which detaches itself circularly at the moment of anthesis has been regarded as a perianth, produced by the fusion of the sepals and petals. The study of its development proves that this sac is produced as a single leaf in the form of a crescent, and that it remains long open on one side. It is a sort of amplexicaul bract, following, in the spiral order, the much narrower bracts which are inserted upon the peduncular portion of the branch. This is a demonstration of the axial nature of the portion of the flower of *Eupomatia* which remains basilar. The last of the modified leaves of this dilated branch (that which is inserted at the level of the margin of the receptacle) becomes inordinately developed, in order to fulfil the function of the perianth, which is wanting; and, like many other cauline leaves of plants allied to this, it finally becomes detached, in the direction of the base of the axis upon which it was borne.—*Comptes Rendus*, July 27, 1868, p. 250.

Note on Rhizocrinus lofotensis.

Prof. Louis Agassiz, in a note to Count Pourtales's paper entitled "Contributions to the Fauna of the Gulf-Stream at Great Depths," observes that the Crinoid that Count Pourtales had called *Bourgueticrinus Hotessieri*, from great depths in the Gulf of Mexico, is evidently the same as Prof. Sars's *Rhizocrinus lofotensis* from the coast of Norway. He further observes that it is highly probable that *Lophohelia affinis* of Count Pourtales, from Florida, is identical with *L. prolifera* from the northernmost coast of Europe, to which it has very likely been transported by the Gulf-stream.

Quoy and Gaimard's Species of Corals.

A considerable number of species of *Alcyonia* are figured and shortly described by MM. Quoy and Gaimard, in the 'Voyage of the Astrolabe.' From the official report on the collection made at the time, and from the Expedition having been a Government Expedition, I had believed that the specimens on which these species are founded would be in the collection of the Jardin des Plantes. Though MM. Milne-Edwards and Haime mention the species in their work on the Corals, the account of them is copied from Quoy and Gaimard's work, and no reference is made showing that the specimens have been seen or examined. It is to be hoped that they have not been lost to science, more especially as Quoy and Gaimard's descriptions are short and sometimes do not contain particulars of the species (as spicules &c.) that are represented on the plates.—J. E. Gray.

Berbyce mollis, *a new British Coral.* By Dr. J. E. Gray.

A few years ago Mr. M'Andrew gave to the British Museum a specimen of a Coral he had collected in Loch Toridon, in Ross-shire. It has been regarded, I believe, as a young specimen of *Gorgonia verrucosa.*

Dr. Perceval Wright the other day gave to the British Museum a specimen of *Berbyce mollis* that he had dredged at Syracuse; and on comparing Mr. M'Andrew's specimen from Scotland with the Gorgonoid from Syracuse, there can be no doubt they are the same species, and very distinct from *Gorgonia verrucosa.*

Berbyce mollis, ever since it was described by Dr. Philippi (Arch. für Naturg. 1842, p. 35, t. 1. f. *a, b, c*), has been a paradox to zoologists; but the examination of the figure ought to have settled the difficulty. Dr. Philippi described the genus as having *non-retractile* tentacles, and, to enforce the importance he attached to the character, printed *non-retractile* in italic. He figures the coral with completely retracted polypes; and the specimens in the British Museum, from Syracuse and Loch Toridon, exactly agree with the figure.

M. Valenciennes, in his very hasty observations on *Gorgonia,* probably misled by the description, states his belief that the genus *Berbyce* was founded on a *Sympodium* parasitic on the axis of a common *Gorgonia*! (See M.-Edw. Corall. i. 187.)

Berbyce is a true Gorgoniad, and chiefly differs from the genus *Gorgonia,* as restricted by modern authors, by the polype-cell being shorter and the stem and branches compressed, and in the form of the spicules.

On the Bats collected in Sarawak by the Marquis Giacomo Doria. By Prof. W. Peters.

Prof. Peters enumerates fourteen species of Cheiroptera as inhabitants of Sarawak (and describes one of them as a new species and the type of a new subgenus), namely:—

1. *Pteropus hypomelanus,* Temm., var. *Tomesii* (=*P. hypomelanus,* Tomes, Proc. Zool. Soc. 1858, p. 536).
2. *Cynopterus brevicaudatus,* F. Cuv.
3. *Macroglossus minimus,* Geoffr.
4. *Megaderma spasma,* L.
5. *Rhinolophus luctus,* Temm.
6. —— *trifoliatus,* Temm.
7. *Phyllorhina labuanensis,* Tomes.
8. —— *bicolor,* Temm.
9. *Emballoneura monticola* (Kuhl), Temm.
10. *Nyctinomus plicatus,* Buchanan.
11. *Chiromeles torquatus,* Horsf.
12. *Vespertilio adversus,* Horsf.
13. *Vesperugo imbricatus,* Temm.
14. *Vesperus* (*Hesperoptenus*) *Doriæ,* sp. et subgen. nov.

The inferior three-lobed incisors stand obliquely to the margin of the jaw, so that they partially cover each other in front. The first superior incisor is elevated and terminated by a single point; the second, lying outwards, is low and projects but little from the gum.

The ears are rounded quadrangular, entire, margined, clothed with short hairs within; the outer margin terminates sharply a little behind the angle of the mouth, and bears there a distinct lobe. The auricle is bent inwards, rounded at the apex, broadest below the middle, and furnished with a small notch at the base. The metacarpal joints of fingers 3 to 5 differ but little from each other in length. The wing-membranes are thin, naked, and adherent as far as the roots of the toes. The interfemoral membrane encloses the tail as far as its apex, and is sparingly furnished with hair both above and below to the end of the first third. The spur bears a distinct membranous lobe. The penis of the male is provided with a bone.

Pale brown, the hairs of the back rather darker at the base; wing-membrane dark brown.

Measurements of an adult male.

	metre.
Total length	0·092
Head	0·016
Entire elevation of ear	0·015
Anterior margin of ear	0·010
Breadth of ear	0·0125
Length of auricle	0·007
Length of tail	0·042
Humerus	0·024
Forearm	0·0365

Length of fingers:—

1st metacarpal, 0·0025;	1st phal. 0·003;	2nd ph. 0·0025			0·0075
2nd „ 0·034;	„ 0·0004				0·038
3rd „ 0·035;	„ 0·015;	2nd ph. 0·0185;	Cart. 0·005		0·076
4th „ 0·034;	„ 0·011;	„ 0·0105	„ 0·002		0·067
5th „ 0·033;	„ 0·010;	„ 0·006	„ 0·0015		0·049

Thigh	0·018
Leg	0·018
Foot	0·007
Spur	0·017

Monatsb. Berl. Akad. Wiss. Dec. 7, 1868, p. 626.

Nudibranchs in Fresh Water.

Mr. Kent described, at the last meeting of the Zoological Society, a new Nudibranch under the name of *Embletonia Grayii*, discovered in the Victoria Docks at Rotherhithe. When I mentioned the circumstance to Dr. Möbius at Kiel, he observed:—

"It was very interesting to me to find that a mollusk of the family Æolididæ had been discovered in brackish water near London Bridge. In the Baltic Sea, *Embletonia pallida* extends as far as East Prussia, near Königsberg, where the water has only 7 of salt in 1000. In like manner, *Protolimax capitatus* (=*Limapontia nigra*) endures almost fresh water at Bornholm and Gothland in the Baltic."

Mr. Kent informs me that *Embletonia Grayii* is very nearly allied to *E. pallida*, and it was found in company with *Daphnia*, *Floscularia*, and many other freshwater Entomostraca and Rotifera.—J. E. Gray.

Siliceous Spicules of Solanderia.

Since I sent the extract from Dr. Möbius's description of *Solanderia* to the 'Annals,' Dr. Möbius most kindly sent to me a small portion of the specimen he described, for comparison with those in the British Museum. When I examined the fragment, I found that the surface was covered with a parasitic *Halichondria*; and as it formed a whitish coat, I feared that it might have been regarded as part of the coral. I have since received from Dr. Möbius the following correction of his description:—

"The specimen of *Solanderia verrucosa* described by me was overspread on all its twigs with the sponge whose needles I have figured on tab. 1. fig. 6. I found this parasitical sponge (which I erroneously regarded as a dermal formation of the polype) not merely on the lower part of the stem, but going up to the very points of the twigs. Your *Homophyton Gattyiæ* (Proc. Zool. Soc. Jan. 9, 1866) appears to me to be very like my *Solanderia verrucosa*. This comes also from the coast of South Africa (Algoa Bay)."—J. E. Gray.

On the Anatomy of the Test of Amphidetus (Echinocardium) Virginianus, *Forbes*; *and on the Genus* Breynia. By P. Martin Duncan, M.B., F.R.S., Sec. G.S., &c.

The Miocene *Amphidetus* from the Virginian Tertiaries and the recent species of the genus from the European and Australian seas form a group of very closely allied forms. The Crag specimen of *A. cordatus* described by Forbes could not be found; but the examination of a series of recent specimens decided that they were not specifically different from the Miocene form.

The unusual form of the ambulacral spaces, the nature of the fasciole crossing them, and the resulting absence (more or less) of pores within the fasciole, were asserted to be of a third-rate character as regards structural importance; and the author did not consider that the genera *Echinocardium*, *Breynia*, *Lovenia*, &c. had a common origin, or that there was a close genetic relationship between them, because they had this fasciolar structure. He considered the fasciole to be an appendage to several generic groups which were distinctly separated by other structural distinctions. The result of an examination of the Nummulitic *Breyniæ* in the Society's collection satisfied Dr. Duncan that there were only race characters separating them from *Breynia Australiensis*—a recent Echinoderm. The persistence of these species, widely distributed and of great geological age, was very remarkable.—*Proc. Geol. Soc.* Nov. 25, 1868.

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XXXIII.—*Notes on Filigerous Green Infusoria of the Island of Bombay.* By H. J. CARTER, F.R.S. &c.

[Plate XVII. figs. 10–24.]

MANY species of *Euglena* have been described, and allusion made to their occasionally tessellate-encysted and frond-like forms, but in no previous instance, I think, has the cyst been shown to present a trumpet-shaped extension like the following, which peculiarity, more than anything in the *Euglena* itself, seems sufficient to entitle it to a distinct appellation.

Euglena tuba, mihi.

Active state.—Fusiform, cylindrical, fish-shaped; obtuse anteriorly, where it terminates in the so-called double lip and single cilium; posteriorly terminating in a short, pointed, transparent caudal prolongation. Eye-spot, contracting vesicle, nucleus, and general contents the same as in *Euglena viridis*, Ehr. (Pl. XVII. fig. 13).

Encysted state.—Cyst gelatinous, globular, transparent, colourless, with polar elongations corresponding to the anterior and posterior extremities of the *Euglena*: posterior one short, pointed, closed; anterior one extended into a tubular prolongation, which ends in an open trumpet-shaped expansion. Size of body of largest cyst 1-600th of an inch in diameter; tubular extension of equal length (figs. 10–12).

Hab. Fresh water, spreading by division, during encystment, over the surface of the water in a deep quarry-pit tank, in the island of Bombay, throughout the dry season. Forming frond-like aggregations, one cell deep, united net-like by constricted portions, and surrounded generally by a soft gelatinous envelope; finally extending over the whole of the tank, to whose surface it imparts a more or less ferruginous tint, arising from the increasing red colour of the contents of the *Euglenæ* generally (fig. 10).

Obs. The peculiarity of this *Euglena*, as before stated, consists entirely in the trumpet-shaped extension of the cyst (11 *a*), which, no doubt, allows the cilium to play freely in the water beneath, probably for aëration and nutriment during the time that the *Euglena* is multiplying itself in the way above mentioned. I observed this phenomenon for two successive years, in the deep tank formed out of an old quarry in the trap-rock of the garden of the Hope Hall hotel at Bombay, where the brilliant red colour which it presented was most remarkable. There did not appear to be any rule for the commencement or extension of the process of reddening in the chlorophyll; for sometimes it began in the middle, sometimes at one end, and sometimes at the other, of the *Euglena.*

Euglena agilis, Cart. (Ann. ser. 2. vol. xviii. pl. 6. fig. 62, *a–d*).

So named from its active movements. It is further characterized by its flask-like form, the enlarged end being posterior; by its double spherical nucleolar cell, and its short, blunt, caudal prolongation when this is present, which is not always; also by its remarkable tendency to multiply itself both in the active and passive or encysted state—that is to say, dividing longitudinally or transversely in the former, and crucially and linearly in the latter, the linear division resulting in short filament-like forms, in which each cell has an eye-spot. Add to this its brackish-water habitat in the island of Bombay.

I ought to have given this detail with my figure in the 'Annals' of 1856, vol. xviii., as the remark in the last edition of Pritchard's 'Infusoria' (1861) justly indicates. Hence its publication now.

Uvella bodo, Ehr.

Those who are acquainted with the great tribe of green filigerous Infusoria, of which *Euglena viridis* is at once the commonest and most beautiful type, are aware that the course of individual increase, both with and without the true process of generation, in this tribe is effected by division of the cell-contents, within the cell, into a greater or less number of parts.

In the true process of generation, the division for the female element ceases while the divided portions are yet large, but goes on to a more or less minute degree for the spermatic element, when the two, afterwards meeting under favourable circumstances (that is, while both the elements are still plastic, and neither surrounded by a *closed* cellulose wall), complete the first step towards the performance of the mysterious function. That is to say, the contents of the original cell undergo more or less dividing into a greater or less number of parts for the multiplication of individuals by each process.

Now, when the original cell yields to the internal pressure so caused, and its divided contents are thus liberated into the water, they may, under abnormal or abortive circumstances, continue for a longer or shorter time more or less grouped together before they ultimately separate, and in this state, collectively or individually, assume forms so different from the original cell that they have in many instances received different names for their different phases, as though they had been distinct species. *Uvella bodo* appears to me to be one of these.

This extended nomenclature does not matter so long as the names are known to apply to the parts of a species otherwise indicated; indeed they are as necessary as convenient. Hence I do not hesitate to describe the following phase under the name given to it by the illustrious microscopist of Berlin.

Uvella bodo (Ehr. tab. 1. fig. 21, 'Infusionsthierchen').—Conical, grouped in the form of grapes, green. Anterior extremity obtuse, provided with a bunch of many cilia, which project forwards from the centre; posterior extremity acute; general surface presenting the pointed ends of the cells which compose the mass. Cells sixteen in number, developed upon a central or axial cavity, which is conical; each cell pyriform, of a deep-green colour, fixed by its obtuse end to the central cavity, and having its pointed one free and floating backwards; monociliated, with red eye-spot; contracting vesicle and contents of the body generally consisting of protoplasm charged with chlorophyll, nucleus, and sundry granules. Size of the largest group observed (viz. that figured) 1-415th inch long by 1-540th broad; individual cell 1-900th inch long by 1-1800th broad (fig. 14).

Hab. Island of Bombay, in shallow freshwater pools which soon dry up after the cessation of the rainy monsoon, from June to August inclusive; in company with almost the whole tribe of green filigerous Infusoria. Progression oscillatory, with the large end of the group foremost.

Obs. I have often seen *Uvella bodo*, and as often figured and described it, in the months mentioned, always thinking that, as Ehrenberg's figure did not by any means portray sufficiently this beautiful organism, I would one day attempt to supply the deficiency. The groups vary greatly in size; and the cilia sometimes float backwards between the caudal extremities of the cells, as well as project in front of the group;

sometimes, indeed, I have not been able to see them at all in front. But in none of my figures is the individual cell represented with more than one cilium; and the sketch which beyond all others bears under it the term "correct" is that now chiefly described and figured.

On this occasion, too, there were large, elliptical, unciliated cells present, measuring 1-675th inch long by 1-1080th broad, containing thirty-two cells; but the cells so formed and so arranged are altogether so like *Uvella bodo* that, although the division had gone one degree further, and they were still enclosed in the parent deciduous envelope or cell, there can be little doubt that they were respectively so many groups of *Uvella bodo*, which, on being liberated, would have assumed the same characters, only in the 32- instead of the 16-cell form. It is worthy of remark, too, that there was an indication of a tail to this cell (fig. 15 *a*).

Finally, the last note, with a figure, which I possess on the subject runs as follows:—

"June 11, 1861. Found the 16-cell *Uvella bodo* numerous with *Eudorina elegans*. There seems to be very little doubt that it is nothing more than one of the forms assumed by the 16-cell packets of young *Eudorinæ*. The different sizes of the groups, the central cavity or elongated central cell upon which the green cells of the *Uvella* are fixed (fig. 14 *b*), and their general development, altogether favour the view now taken. I never thought that it was a distinct species or organism. When the tails are very short, rendering the cells almost round, it is close upon a 16-cell *Eudorina*. There is no other green organism in the water (which is from a little temporary pool) with the *Eudorina* but *Uvella bodo* and the other forms of *Eudorina*-packets, viz. *Gonium pectorale* &c."

This observation seems to indicate that *Uvella bodo* is at least one of the forms assumed by the cells of *Eudorina* when they divide up into the 16- and 32-cell groups respectively.

But, to return to the one which I have figured and more particularly described: this, as before stated, was accompanied by a whole host of filigerous green Infusoria, among which were many kinds of *Euglena*; while the eye-spot (and this is essential) was at the base of the cilium, which was also single in each individual of the group (fig. 14 *d*), at the same time that there were other groups of *Uvella bodo* present still unliberated from the parent cell, which, be it remembered, had a kind of tail or caudal prolongation (fig. 15 *a*). Hence *Uvella bodo* here appeared to have been derived from a subdivision of the contents of a *Euglena* like *E. viridis*, and not from a cell of *Eudorina*, which has two cilia, two contracting vesicles at their base, and an eye-spot *laterally* placed—that is, away from the contracting vesicles and cilia.

In the division of the cell-contents of the green filigerous Infusoria, the eye-spot is at first seldom so well marked in the daughter or subdivision cells which are inferior as in those which are superior or close to the eye-spot in the parent. Indeed it is frequently absent altogether in the former, while it may be markedly present only in the latter, as in my figure of *Uvella bodo* (fig. 14 *d*); but although, when not visible, it may, in point of position, lead to doubt as to the organism to which the cell belongs, when it is at the base of the cilium the cell certainly appertains more to *Euglena* than to *Eudorina*, *Volvox*, or *Chlamydococcus*, wherein the eye-spot is lateral, and not anterior or terminal (figs. 22 & 24).

Again, the *single* cilium is more typical of *Euglena* than of either *Eudorina*, *Volvox*, or *Chlamydococcus*, in each of which it is dual. At the same time it should also be noted that, in the still forms or passive state of each of the latter, the cilia appear to be altogether absent—that is, deciduous or retracted, these organisms having the power to reproduce them in the active state.

Thus the *Uvella bodo* which I have figured seems more nearly allied to *Euglena* than to *Eudorina*.

It would, *now*, have been more satisfactory if in my note of 1861, where *Uvella bodo* was found almost exclusively with *Eudorina*, I had set down the number of cilia and position of the eye-spot in each member of the group. But I suppose, at the time, I saw all that was conclusive, and therefore, in the absence of this now desired detail, must present the note as it is and for what it may prove hereafter to be worth. Upon the *number*, however, of the cilia, as will presently appear, there is not much reliance to be placed.

Ehrenberg found *Uvella bodo* in company with *Euglena viridis*, *Chlorogonium euchlorum*, &c., and figures something like it in connexion with the latter (fig. 17, t. 7, *op. cit.*). Perty simply states that it "seems" to be a developmental stage of *Euglena viridis* (Zur Kenntn. klein. Lebensformen, p. 177), and Stein "that each individual appertaining to a group of *Uvella bodo* possesses several (four or five) flagelliform cilia implanted on a short rostrum" (*ap.* Clap. et Lach. 'Etudes sur les Infusoires,' &c. vol. ii. p. 63).

As above stated, I have often seen a bunch of cilia on the front part of the *group*, but never more than one cilium on the *individual*, although I think that sometimes the latter may have possessed two, and that I have overlooked this occurrence.

Crumenula texta, the Thecamonads, *Eudorina*, *Volvox*, *Chlamydococcus*, and most, if not all, the green filigerous Infusoria undergo more or less subdivision within their cells respectively, for simple multiplication or multiplication by sexual increase; and the groups of cells thus formed often continue together after having been liberated; so that each species may assume different phases, and thus each have its own *Uvella bodo*.

I have, however, never seen a subdivision of this kind in *Euglena viridis* and its like, although I can easily conceive that *its* family does not differ in this respect from the other green filigerous Infusoria; while certainly the figures of the *Uvella bodo* which I have given, both in the active and unliberated state, appear to be more nearly allied to *Euglena viridis* than to any other organism.

Volvocina.

Hereto may also be added the conclusions at which I have arrived respecting the different groups of cells figured and named by Ehrenberg as distinct organisms in connexion with *Eudorina* and the two *Volvoces*—conclusions to which long and attentive study of these Infusoria, at different times for several years successively, have brought me.

And first as regards *Eudorina elegans* (tab. 3. fig. 6, 'Infusionsthierchen'), which is represented with one cilium to each cell. I have always observed two. Of figs. 1, 2, 3, 4, 5, viz. *Gonium pectorale*, *G. punctatum*, *G. tranquillum*, *G. hyalinum*, and *G. glaucum* respectively, the first three appear to me to be all cell-group forms or phases of *Eudorina elegans*; figs. 4 & 5 seem to me to be almost too small for *E. elegans*, and, being without colour, to be groups of some other organism, if not parasiticized cells of *Eudorina*—that is, cells altered by the presence of some endophyte (Mycetozoon).

Of figs. 31 and 32, tab. 2, viz. *Gyges granulum* and *G. bipartitus*, given in connexion with *Pandorina morum* (which, as will hereafter be observed, I consider a phase of *Eudorina*), the former appears to me to be the still form of the primary cell of *Eudorina elegans*, and the latter the same under binary division. According to Perty's view, *Gyges* might be the still form of several kinds of Algæ (p. 102, *op. cit.*); but, be this as it may, a large ovoid cell like this (fig. 24), but in the active state, with four cilia projecting from its smaller end, two contracting vesicles at their base, an eye-spot lateral, and single nucleus central (parietal?), together with the usual green and granular contents, was found in abundance, with *Eudorina elegans* and *Uvella bodo*, in a recent excavation of the trap-rock in the island of Bombay, on the 17th June 1861, some days after the rainy monsoon had commenced and this excavation had become filled with rain-water. Size of the cell 1-981th inch long by 1-1350th broad.

In some of these cells the single nucleus had been replaced by several, as if preparatory to subdivision; while in others there were a great number of contracting vesicles scattered throughout the cell-contents for the same purpose, if they did not belong to parasitic cells (endophytes) otherwise invisible. Lastly, some of these cells were observed to be encysted binarily as in *Gyges bipartitus*, and some quaternarily, but not further; at the same time each subdivision was observed to be provided with four cilia within its compartment respectively.

And here my observations of this cell would have ended, had there not also been binary compounds present, where one of the 4-ciliated cells had been arrested in its further development, while the other had become subdivided into the 16-cell form, each cell of which was attached to the transparent globular capsule enclosing the whole, with the *two* cilia of each cell projecting externally and all widely separated, as in *Eudorina*. (I regret that there is not room in the plate for a figure of this; but probably I may have an opportunity of supplying it hereafter.)

Thus the transparent capsule was studded over with the subdivisions of one of the 4-ciliated cells on one side; while in the other the 4-ciliated cell remained undivided, with its contents shrunken and retracted from its own cell-wall (probably owing to the poisonous presence in it of some endophyte).

Hence I inferred that this 4-ciliated cell, which somewhat resembled *Gyges*, was the primary active cell of *Eudorina elegans*, viz. that stage which, when my figures and description of *Eudorina* under impregnation were published (Annals, vol. ii., Oct. 1858), I was not able to supply.

Add to this evidence the fact that for four successive years, in the months of June and July respectively, the same ovoid cell precisely stands figured in my journal, in connexion with *Eudorina elegans*, obtained in abundance and under almost all forms from different pools of water widely separated.

An ovoid 4-ciliated cell, such as I have above described, then, appears to be the primary active cell or sporozoid of *Eudorina*.

So far as my observation extends to the *Chlamydococcus*, also figured with *Eudorina* (*op. et loc. cit*), its subdivisions, even when still more numerous than there shown, remain free and entirely *within* the parent capsule, whereas in both *Eudo-*

rina and the *Volvoces* the divisions are fixed to the inner surface of the parent cell, with their two cilia projecting externally, affording still further probability that the 4-ciliated cell is the primary phase of *Eudorina.*

Cells of this kind with *four cilia* are very common both in fresh and salt water; and thus the ciliated character is of less consequence than the form and size of the cell itself, which varies much, and perhaps may be found indicative in many instances of the species of which it may be the sporozoid.

It may be also a question whether the ovoid cell which I have just described may not sometimes assume a different form; for on one occasion I find figured with it a spherical one, but identical with the ovoid one in size and all other respects.

Still, be this, too, as it may, we shall never know anything definitively about these forms, or the species to which they respectively belong, until they are all brought together into their respective groups; for then, and then only, shall we be able to clear up the utter confusion of phasial differences which may exist in even one drop of water, in this department of the filigerous Infusoria.

Perty places the 4-ciliated cells among his "Sporozoidia" (p. 102), and figures an oval one (tab. 10. fig. 9) with a notch in front, but with no red eye-spot, which he likens to *Chlamydomonas.* He also, as before stated, likens Ehrenberg's *Gyges* to the latter. Lastly, Cohn (*ap.* Pritchard, p. 524, ed. 1861) considers *Gyges* to be the still form of a cell of *Protococcus.* But, whatever *Gyges* may be, Ehrenberg's figures of it are naturally so meagre that further conjecture respecting them becomes useless.

Of what value, it may now be asked, is the number of cilia characteristically, when, as we have just seen, the *small* subdivisions of a 4-ciliated cell are only provided with two cilia each? Certainly it does not militate against the view that the 2-ciliated *Eudorina*-cell does not originally arise from the *small* subdivisions of the 4-ciliated one. Moreover the 4-ciliated cell is the sporozoid of several filamentous Algæ, which, of course, have no cilia as such, any more than the still forms of the unicellular Algæ.

To return to our subject of the phasial forms of *Eudorina* in Ehrenberg's plate 2. figs. 33 & 34, viz. *Pandorina morum* and *P. hyalina*, both appear to me to be large parasiticized cells of *Eudorina.* The first represents the cells of *Eudorina* under different degrees of subdivision, and the latter where they have passed into the spermatoid condition. Here, again, there is only one cilium. I think there should be two.

Lastly, Perty's *Synaphia Dujardinii* (fig. 8 G, tab. 11) appears to me to be that abnormal form of *Eudorina elegans* where several of the cells here and there take on the spermatoid development while the rest become abortive. In the normal form of *Eudorina* it is only the four anterior cells which are developed into spermatozoids, while the rest remain all female cells (see Annals, *l. c.*). Besides, Perty's description of the cells generally and individually which form the groups, his figures, too, of their subdivisions, and, lastly, his placing this form in his family "Volvocina" lead me to the above inference. The gelatinous envelope of *Synaphia* is common to many cells of this kind under similar conditions, but persistent in none.

As regards the *Volvoces*, *Volvox aureus* (fig. 2, tab. 4, Ehr. Infus.) appears to me to be *V. globator* after impregnation of the spore-cells, or with parasites in the spore-cells causing the chlorophyll to become yellowish. Fig. 11, tab. 3, *Uroglena volvox*, represents the small or spermatic cell, which, having passed into spermatozoa, has become liberated from the parent, but still swims about entire in an abortive form or monstrosity. Fig. 8, tab. 3, *Sphærosira volvox*, is the male cell of *V. globator* (which is diœcious), with most of the spores passing into spermatozoa. Fig. 7, tab. 3, viz. *Syncrypta volvox*, appears to me to be spermatic cells of *Volvox* in different degrees of division, in the 4, 16, and 64 divisions; but of this I am not quite certain. Fig. 9, tab. 3, *Synura uvella*, appears to be another form of the divided spermatic cell of *V. globator*, in which the spermatozoa are fully formed and have more or less left the cell, to which their tails still adhere.

Such is the result of my study of *Eudorina* and the two *Volvoces* at different times, in water taken from pools which swarmed respectively with these three Infusoria, both in their normal and abnormal forms, the latter representing normal forms in stages of development which, having from some cause or other failed of their object, have assumed abortive or abnormal dimensions, since, as before stated, if the male and female elements of generation do not come together quickly in their plastic state, they are soon surrounded by a layer of cellulose, which, although it does not lead immediately to their death, prevents them in most instances from fulfilling their purpose; and thus living on for a certain time, they grow into monstrosities, which nevertheless after this manner represent so many phases of the species to which they belong; while the true type of the latter can only be established by the presence in it, monœciously or diœciously, of the elements of generation.

The general cell in *Eudorina elegans* (Ann. *l. c.*) is *elliptical*, almost the same as that represented by the sporozoid which I have inferred to be its primary active form, the resting impregnated spore being probably spherical, as it is when undergoing impregnation (see fig. Ann. *l. c.*) in the well-known elliptical figures of *Eudorina.*

The cell of *Volvox globator*, which is diœcious, is *spherical*; and the cell of *V. stellatus* is obtusely *elliptical* (see Annals, *loc. cit.*).

To these three species respectively I conceive the whole of the forms in Ehrenberg's 3rd and 4th plates, together with figs. 31 to 36, in plate 2, inclusive, to belong.

I think that a German naturalist has already witnessed and described the development of one of the *Volvocina* from the resting-spore; but my means of reference are now too limited to enable me to find out this more satisfactorily.

Glenoclosterium, nov. gen.

Glenoclosterium varians, n. sp.

Cell-wall fusiform, spindle-shaped, elongated, acuminated, transparent. Body more or less inflated and more or less confined to the centre, filled with protoplasm, granules, and chlorophyll; presenting a nuclear cell in the centre, a red eye-spot at one end, and four or more large chlorophyll- and starch-bearing utricles arranged longitudinally, decreasing in size from the centre towards each extremity. Extremities attenuated, pointed, colourless, transparent. Size, 1-257th of an inch long by 1-1800th broad in the centre. (Fig. 16.)

Hab. Island of Bombay; freshwater pools during the rainy monsoon; in company with *Chlamydococcus* and many other green filigerous Infusoria.

Obs. This is a very interesting form, inasmuch as it is a link between *Euglena* and *Closterium.* It has the eye-spot of *Euglena* (fig. 16 *a*), but not the cilium, and the form generally, together with the chlorophyll- and starch-bearing utricles (*b*), of *Closterium*, without its characteristic circulation. I cannot, however, help thinking that it is a form of the *Chlamydococcus* which I have already described and figured (Annals, 1858, vol. ii. pl. 8); for this species, as I may have to show hereafter, appears to be exceedingly sportive in its developments. In one instance it was found in the still form, with a conical, transparent, comet-like elongation of its cell *on one side only*, which form it maintained through all its groups and subdivisions (fig. 21). That which I have just described owes its *Closterium*-figure to this conical extension into an attenuated form being added to both sides. In fig. 17 the inflation is almost spherical, and confined to the centre. In fig. 18 the whole form is spicular, and in fig. 19 also spicular, but bifid at one extremity. Fig. 20 represents a sigmoid form; and all appear to me to be derived from fig. 22, which is the active form of the *Chlamydococcus* that was in company with them.

No difficulty, however, can arise from my having made for the time being a separate genus for this hybrid organism, since, if hereafter it should be proved to be merely a sportive form of *Chlamydococcus*, the generic name can be erased, and the specific one alone retained for the variety. Meanwhile the record as it is may not be without its advantages in the history of this cell.

Halteria, Duj.

Halteria pulex, Clap. et Lachm. Pl. XVII. fig. 23.

This infusorium, described and figured by the eminent authors of the 'Etudes sur les Infusoires' (p. 370, pl. 13. figs. 10, 11), has always attracted my attention, from its being so exquisitely sensitive (I might almost say timid), in combination with its extreme minuteness—since the instant it comes in contact with another animalcule, it leaps backwards, with the appearance almost of instinctive fear, although it is hardly one-thousandth of an inch long, and less than this in breadth. Its body is globular, surmounted by a neck, which is inflated below (where it joins the body) by the presence of two actively contracting vesicles (*c c*), beneath which, again, is a frill of straight radiating cilia, arising from the constriction which marks the union of the neck with the body (*a*). In front the neck is truncated, supporting several short parallel straight cilia arranged brush-like—that is, all of one length, like the so-called teeth in *Chilodon* (*b*). I could see no nucleus; and both the body and neck were charged with transparent corpuscles reflecting a yellow-greenish light. Size, 1-1080th inch long (including teeth-like cilia) by 1-1800th broad.

Hab. Island of Bombay; freshwater tanks. Progression rapid, rotatory, produced by a spinning motion of the frill of cilia, which can also be used as legs for creeping; leaping here and there, especially backwards, when coming in contact with another animalcule. Anterior part of the neck and tooth-like cilia retractile.

Obs. The infusorium described and figured by the authors above mentioned as existing in salt water would hardly merit further mention, had I not often found it also in the fresh-water tanks of the island of Bombay, and with two contracting vesicles, which these authors had not seen. Like these naturalists, however, I was not able to discover the nucleus.

The same doubt exists here with respect to *Halteria pulex* that accompanies the observation of many Infusoria, viz. whether or not it be the adult form of the animalcule which it represents. The presence, as before stated, of true generative elements can only decide the question. Until this be determined, all that can be said of *Halteria pulex* is that its form and habits are strikingly like those of a young podophryan *Acineta.*

EXPLANATION OF PLATE XVII. figs. 10–24.

N.B. All the figures in this Plate are drawn upon the scale of 1-12th to 1-5400th of an inch, unless where otherwise mentioned.

Fig. 10. *Euglena tuba*, n. sp. Portion of the encysted, passive, or still state, forming a red crust on the surface of the water: *a*, *Euglenæ*; *b*, trumpet-shaped cysts; *c*, general investing membrane. (Scale 1-24th to 1-5400th of an inch.) Some of the cysts have not been coloured, and the trumpet-shape tube is not added in all, for convenience.

Fig. 11. The same, more magnified, encysted: *a*, trumpet-shaped elongation of the cyst.

Fig. 12. The same, empty cyst.

Fig. 13. The same, in active state.

Fig. 14. *Uvella bodo*, Ehr. The 16-cell form: *a*, cell bearing eye-spot and contracting vesicle; *b*, dotted line showing axial cavity round which the cells individually are fixed; *c*, cilia; *d*, separate cell, showing red eye-spot, contracting vesicle, and single cilium; *e*, individual cell belonging to a group where the cilium floated backwards.

Fig. 15. The same, 32-cell form, still within the cell-wall of the parent: *a*, caudal prolongation.

Fig. 16. *Glenoclosterium varians*, nov. gen. et sp.: *a*, red eye-spot; *b*, nucleus; *c*, starch-utricles surrounded by chlorophyll, as in *Closterium* and the bands of *Spirogyra.*

Fig. 17. The same (?), with the body more confined to the centre of the cell (approaching the form of *Chlamydococcus*): *a*, red eye-spot.

Fig. 18. The same (?), assuming a spicular form; no eye-spot. Filled with chlorophyll and transparent vesicles attached to amylaceous (?) granules.

Fig. 19. The same, with bifid extremity.

Fig. 20. The same, of a sigmoid form, with central utricles, but no eye-spot.

Fig. 21. The same, with a pointed conical extension of the cell on *one side only.*

Fig. 22. *Chlamydococcus* ——? (active state), of which figs. 16–21 inclusive appear to be passive states.

Fig. 23. *Halteria pulex*, Clap. et Lach.: *a*, frill of propelling cilia; *b*, retractile cilia; *c c*, contracting vesicles. (Scale 1-6th to 1-5400th of an inch.)

Fig. 24. Primary active cell (sporozoid) of *Eudorina elegans*: *a*, red eye-spot; *b*, contracting vesicles; *c*, nucleus.

XXXIV.—*Strange Phenomena in a Microscopic Cell.* By H. J. Carter, F.R.S. &c.

[Plate XVII. figs. 1–9.]

There is, or was, a slight depression in the rice-fields of the island of Bombay which are situated on the eastern side of the main road leading from Ghorpudevi to Chinch Poogly (now laid down as the "Frere Land Company"), close to a shed in which buffaloes were kept; and during the rainy monsoon (that is, in our summer) this depression was always filled with water, into which the buffalo-shed drained itself. By the end of June a pool was thus formed; and by the month of August it abounded with many species of Infusoria, together with some aquatic plants, among which were *Anacharis* and *Chara*. To this pool I was often wont to go for microscopic objects, bringing away some of its water with me, and finally depositing it in basins for more deliberate examination.

On the 9th of August, 1856, while looking at the sediment of a basin of this water, which with a hair-pencil had been swept off the side and placed under the microscope, I perceived a transparent, oblong, colourless cell containing protoplasm charged with starch-granules, which protoplasm was circulating round it precisely like that in a living cell of the Characeæ; and after watching it for some time, a nipple-like portion began to project from one end of the cell, which, gradually extending itself into a long tube, was also accompanied by a corresponding diverticulum of the stream or cell of rotating protoplasm and starch-granules to its extremity, so long as it continued to grow. This cell was tolerably abundant in the water; and having often seen it during the month of August of two successive years, I concluded that it usually made its appearance in this pool about the time mentioned; but I never found it in the water of any other pool or tank in the island of Bombay. (Plate XVII. figs. 1, 2.)

To meet with a colourless transparent cell not more than the 500th part of an inch long and much less in breadth, presenting an active, rotatory protoplasm densely charged with starch-granules of a peculiar shape, and putting forth a tubular prolongation, into which was extended the same circulation so long as the tube continued to grow, was at once so novel and so enigmatical, that I determined to record all that I could about it, although I might fail to find out its real parentage.

The detail of this record I will now give, beginning with a description of the cell, and then adding the phenomena which attended it, in order that others who have heretofore met, or may hereafter meet, with the same kind of organism, may also find their observations thus corroborated, even if, like myself, they may not be able to decide on the class of beings to which this strange atom of vitality belongs.

Description of the Cell.—Cell-wall for the most part oblong, cylindrical, rather bent upon itself, sometimes elliptical and even globular; for the most part rigid, but sometimes flexible, and so plastic even as to exhibit a low degree of polymorphic, locomotive, and reptant power; transparent, colourless. Lined with a transparent film or inner cell, within which, again, is a layer of protoplasm, charged with starch-granules, sundry molecules, and a nucleus which revolves longitudinally (spirally?) around an axial (aqueous?) cavity. Mean size of cell 1-500th of an inch long by 1-1120th broad (Pl. XVII. figs. 1 & 5).

Hab. Freshwater pool in the rice-fields of the island of Bombay, which pool only contains water from about June to November inclusive. In company with a great number of species of Infusoria of all kinds, Algæ, and some aquatic plants, among which may be enumerated *Anacharis* and *Chara.*

Obs. The peculiarities of this cell were especially its reniform starch-granules, by which it might be recognized at any time (fig. 3, *f*), its rotating protoplasm, including the nucleus (fig. 1, *b*, *c*), and its sometimes plastic, reptant state, in which it was once observed to put forth one or two short processes (fig. 6, *a a*). Add to this its tendency to germinate (if we may apply the term to its tubular extension), which was so rapid that, under the microscope, it might be almost seen to grow (figs. 3, 4). That of fig. 3, *e e* (which, together with all the other figures of this cell, is drawn on a scale of 1-12th to 1-5400th of an inch) grew 1-70th of an inch in one hour, when the rotatory power of the protoplasm ceased (that is, became exhausted), the tubular extension stopped, and probably the whole perished. In no instance was this tubular prolongation, either taking place under the microscope or in specimens where it had already taken place in the water previously to examination, observed to go, or to have gone, beyond the tubular extension figured. Here the growth appeared to be always arrested. Whether or not it ever went further in the natural habitat of the organism I am unable to decide.

Another common occurrence in this cell was its proneness to become affected by endophytes, which (after causing in their usual manner the starch-granules to disappear, and to be followed by the presence of glairy oil-like albuminous (?) globules) developed the contents of their respective cysts, probably into monociliated monads, and, piercing the cell-wall of their host, thus discharged their progeny into the water (figs. 7, 8, 9).

The question now comes "What was this cell?" Had not the starch-granules invariably been reniform instead of circular, I should have inferred that the rotating protoplasm, including the nucleus, pointed out the *Chara* of the same pool as the only organism from which it could have originated; but the cocked-hat or kidney-like form of the starch-granule is so far opposed to this, that in no instance did I ever see the like in the Characeæ.

Again, the presence of the endophyte, which so commonly developes itself in the algal cell, and especially in that of the Characeæ, while it still further assimilates this remarkable cell to the latter, at once places it on the side of the algal and not on the side of the fungal cell. The presence of the starch-granules and their great number, together with the rotatory protoplasm, is also opposed to its being a fungal cell (whether Saprolegniean or Myxogastrean), of the flexible cellulose cell of Algæ &c. or of the rigid woody one of timber.

Of the absence of the green chlorophyll vesicles I take no account, because I have often seen the circulation of the protoplasm going on in the older internodes of *Nitella*, where the green layer has been absent; and, indeed, this is the normal state of the root-cell.

Montagne, in a back number of the Ann. des Sc. Nat. (Bot. 3e sér. t. xviii. p. 65), states that he found little cells (*bulbels*) in the nodes of *Chara* (white, from being filled with starch-granules), which germinated; and the vitality of such little cells I know, from actual observation, to be so extremely durable that for 8–10 months I had a single living green one of microscopic minuteness, which, situated in the midst of an otherwise dead node of *Chara* (by whose means alone it could be kept under observation), presented at the end of this period a circulatory movement of the protoplasm equally quick with what it had been at the commencement. Then it should be remembered that this cell retained the green layer throughout, and was sufficiently large to be viewed with an inch, while those above-described could only be seen with a quarter-of-an-inch compound power. Montagne's "*bulbels*," too, which germinated, probably merited strictly the term applied to them, viz. "little" rather than "microscopic," the only term which correctly designates mine.

Here, then, I leave the record, whose publication I a long time postponed in the hope of obtaining more satisfactory information about this curious cell, merely adding to those who may consider this communication worth reading, "Beware how, without direct evidence, you set down this cell as belonging to the Characeæ, when I, who have given much study to them elementarily, as may be seen in the pages of this periodical, hesitate to come to such a conclusion."

EXPLANATION OF PLATE XVII. figs. 1–9.

N.B. These figures are on the scale of 1-12th to 1-5400th of an inch.

Fig. 1. Transparent cell, with rotatory protoplasm, charged with starch-granules. Usual form: *a*, cell-wall, flexible; *b*, rotating protoplasm, of which the current is indicated by the arrows; *c*, nucleus surrounded by starch-granules; *d*, axial cavity.

Fig. 2. The same, but a little larger. Cell-wall rigid.

Fig. 3. The same, germinating (?): *a*, cell-wall; *b*, rotating protoplasm charged with starch-granules, current indicated by the arrows; *c*, nucleus and starch-granules rotating *in situ* in the direction indicated by the arrows; *d*, axial cavity; *e*, tubular extension, which grew out to 1-70th of an inch in one hour; *f*, starch-granules, more magnified to show their characteristic shape.

Fig. 4. The same, with tubular extension less advanced.

Fig. 5. The same (but elliptical in form and larger) under the effect of iodine, to show:—*a*, outer cell-wall; *b*, inner cell-wall; *c*, starch-granules, rendered dark blue by the iodine; *d*, nucleus.

Fig. 6. The same, of a globular form, to show that state in which the cell-wall was sufficiently plastic to admit of the protrusion of short processes: *a a*, processes.

Fig. 7. The same, in which five cysts of an endophyte had developed themselves, and had enclosed nearly all the cell-contents. The reniform starch-granules replaced by oil-globules, some of which still remain outside the cysts. *a a*, cysts; *b*, oil-globules.

Fig. 8. The same, in which the cysts (three) of the endophyte had developed themselves, had pierced the cell-wall of their host, according to their custom, and had discharged their progeny into the water: *a a*, empty cysts; *b*, remaining oil-globules.

Fig. 9. The same, with three cysts of the endophyte, under iodine: *a a*, cysts containing protoplasm (sarcode?) and oil-globules, all rendered brown by the iodine; *b*, remainder of starch-granules and protoplasm outside the cysts rendered dark blue.

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

Dr. Nylander makes the following additions to our British Lichens in the 'Flora,' Aug. 30, 1868, and Nov. 8, 1868:—

1. *Pyrenopsis homœopsis*, Nyl.

Similis *P. grumuliferæ* Nyl. in Flora 1867, p. 369, sed sporis majoribus (longit. 0·011–0·018 millim., crassit. 0·007–0·010 millim.) et thallo intus (præsertim sub apotheciis) pallidiore, gonimiis majoribus (crassit. circiter 0·007 millim.). Thallus fuscus, tenuis, subgranulosus; apothecia in humido statu latit. circiter 0·2 millim.; epithecium incolor; paraphyses graciles. Iodo gelatina hymenea vinose rubens vel vinose fulvescens.

Supra saxa micaceo-schistosa in Ben Lawers Scotiæ (Jac. Crombie).

Observetur etiam, in *P. grumulifera* thalamium esse supra lutescens.

2. *Lecanora leucospeirea*, Nyl.

Thallus albus, opacus, e squamulis subcrenatis tenuibus adnatis dispersis (latit. circiter 0·5 millim.) constans, sæpe granuliformibus; apothecia fusca, subopaca, plana (latit. 0·5–0·9 millim.), margine thallino albo integro cincta; sporæ 8[næ], incolores, oblongæ vel ovoideo-oblongæ, 1-septatæ, longit. 0·011–0·013 millim., crassit. circiter 0·0035 millim.; paraphyses gracilescentes, clava (haud crassa) luteo-infuscata; (epithecium luteo-fusco-inspersum;) hypothecium incolor. Iodo gelatina hymenialis cærulescens, deinde violacee tincta.

Supra terram sabulosam in insula Cæsarea (Jersey), legit Ch. Larbalestier.

Affinis *L. holophœœ* (Mnt.), et varietati ejus *glaucopsoræ*, Nyl. in Flora, 1868, p. 164 (ubi errore typographico legitur "glaucospora"); convenit arthrosterigmatibus, spermatiis et plurimis notis analyticis, sed differt thallo albo disperso et minus evoluto; forsitan modo tanquam subspecies consideranda sit. Habemus hic adhuc exemplum typi (*L. holophœœ*), qui in certa habitatione facile in typos secundarios dissimiles abit.

3. *Lecidea subturgidula*, Nyl.

Thallus albidus vel virescens, tenuissimus, effusus; apothecia livida vel pallide sordide livida, opaca, convexa (latit. circiter 0·5 millim. vel paulo majora), immarginata, sectione hypothecium fuscum et pars supera sectionis stratum albicans sistentia; sporæ 8[næ], incolores, oblongæ, simplices aut tenuiter 1–3-septatæ, longit. 0·008–0·014 millim., crassit. 0·003–0·004 millim.; paraphyses non discretæ; epithecium album (vel versus lucem visum flavescens); hypothecium fuscescens. Iodo gelatina hymenea cærulescens (dein sæpe fulvescens).

Ad lignum *Ilicis* vetustum in Anglia, New Forest (Crombie).

Tangere videtur *L. apochrœellam* Nyl. in 'Flora,' 1865, p. 6, et 1867, p. 373, sed differt præsertim sporis majoribus et demum 3-septatis, hypothecio fusco vel fuscescente (nec luteofuscescente).

4. *Lecidea mœstula*, Nyl.

Thallus obscure cinerascens, tenuis, depresso-subgranulatus vel evanescens; apothecia nigra, minuta (latit. 0·2–0·4 millim.), planiuscula vel convexiuscula, immarginata (interdum margine obsoleto), intus incoloria; sporæ $8^{\text{næ}}$, incolores, ellipsoideæ, simplices, longit. 0·007–0·008, crassit. 0·0025–0·0035 millim.; paraphyses non discretæ; epithecium incolor (vel passim vage nonnihil obscuratum); hypothecium totum fusco-obscuratum. Iodo gelatina hymenea vinose rubens (præcedente cærulescentia levi).

Supra ligna fabrefacta vetusta prope vicum Lyndhurst in New Forest (Crombie).

Apothecia sat conferta. Maxime accedere videtur ad *L. myriocarpoidem* Nyl. (cf. 'Flora,' 1866, p. 86), quæ vero apothecia habet magis sparsa laminaque tenui visa epithecio distincte luteo-fuscescente, hypothecio fusco infra (et perithecio) pallidiore, gelatinam hymenialem iodo cærulescentem (dein lutescentem), etc. Accedit quoque versus *L. dispansam* Nyl. (cf. Lich. Lapp. Or. p. 186) et versus *L. turgidulam* Fr. Spermatia oblonga (longit. 0·0040–0·0045 millim., crassit. 0·0015 millim.), sterigmatibus brevibus.

5. *Lecidea leptostigma*, Nyl.

Apothecia (parasitica verisimiliter in thallo albido mediocri rimuloso) fusco-nigricantia, plane innata (latit. circ. 0·4 millim. vel minora), tenuia, gregaria; sporæ $8^{\text{næ}}$, globosæ vel globoso-ellipsoideæ (diam. 0·005–0·009 millim.), in thecis cylindraceis uniseriatæ; paraphyses mediocres, sursum sensim crassiores (et versus apicem sordide lutescentes); hypothecium vix lutescens. Iodo gelatina hymenialis non tincta.

Supra saxa micacea in Scotia (Crombie).

Forte sit fungillus.

6. *Lecidea Crombiei*, Jones.

Thallus sulphureus vel albido-sulphureus (hydrate kalico flavotinctus), mediocris, inæqualis, rimoso-diffractus vel passim subareolatus, hypothallo nigro limitatus; apothecia nigra, mediocria (latit. circiter 1 millim.), innata, convexiuscula, immarginata, intus cinerascenti-obscurata; sporæ $8^{\text{næ}}$, incolores, ellipsoideæ, longit. 0·010–0·012 millim., crassit. 0·006–0·007 millim., thalamium cærulescens; epithecium cæruleo-nigricans; paraphyses non bene discretæ; hypothecium incolor (vel dilute rufescens). Iodo gelatina hymenialis cærulescens (thecæ apice magis tinctæ).

Supra saxa in monte Scotiæ Glen Callaben (Crombie).

Hypothallus niger passim inter areolas thalli visibilis. Species hæc, a beato Jones distincta, prope *L. theiodem* Smmrf. locum habet.

7. *Lecidea postuma*, Nyl.

Thallus cinerascens, evanescens; apothecia nigra, minutula (latit. 0·2–0·3 millim.), planiuscula, marginata, intus concoloria; sporæ 6–8næ, incolores (vel fuscescentes), ellipsoideo-oblongæ, 3-septatæ (additis sæpius septulis obliquis vel longitudinalibus parcis), longit. 0·015–0·016 millim., crassit. 0·006–0·007 millim.; epithecium et hypothecium fuscescentia.

Ad rupes maritimas in Scotia (Crombie).

Vix est nisi varietas depauperata, deminuta *Lecideæ petrææ*, etiam sporis minoribus.

8. *Lecidea lithophiliza*, Nyl.

Thallus cinerascens, firmus, inæquali-deplanatus, areolato-diffractus vel areolato-rimosus, sat tenuis (crassit. circiter 0·3 millim.); apothecia fusco-nigra, innata (latit. 0·5–0·8 millim.), planiuscula vel convexiuscula, immarginata, intus alba (linea tenui nigra infra limitata); sporæ 8næ, incolores, oblongæ, simplices, longit. 0·009–0·017 millim., crassit. 0·0035–0·0045 millim.; paraphyses mediocres, apice lurido-fuscescentes; hypothecium strato medio cretaceo-albo opaco (non hyalino), strato infero conceptaculari tenui nigro. Iodo gelatina hymenea bene cærulescens.

In Scotia prope Abredoniam supra saxa micaceo-schistosa maritima (Crombie).

Notis datis facile distincta a *L. lithophila* et satius inter *Biatoras* locum tenens prope *L. phæopem*. Spermogonia non vidi. Thallus rhagadiosus hydrate kalico nonnihil flavescens.

9. *Lecidea subviridescens*, Nyl.

Thallus virescens vel sordide virescens, tenuissimus, opacus, vel obsoletus; apothecia fusca, opaca vel fusco-livescentia, convexa (latit. 0·3–0·6 millim.), immarginata, intus sordide tincta; sporæ 8næ, incolores, oblongæ, simplices aut 1–3-septatæ, longit. 0·011–0·018 millim., crassit. 0·004–0·006 millim.; paraphyses non distinctæ; epithecium et hypothecium sordida. Iodo gelatina hymenialis cærulescens, dein vinose rubens.

Supra terram in insula Cæsarea (Larbalestier).

Accedit ad stirpem *L. vernali-sphæroidis*, sed facie est fere *L. viridescentis*.

10. *Lecidea infidula*, Nyl.

Thallus albidus, tenuis vel tenuissimus, opacus, interdum subleprosus, passim rimulosus; apothecia livido-nigricantia, minuta (latit. 0·5 millim. vel minora), convexula, immarginata, intus cinerascentia; sporæ 8^{næ}, incolores, ellipsoideæ, simplices, longit. 0·008–0·011 millim., crassit. 0·0035–0·0045 millim.; paraphyses non discretæ; epithecium vage et hypothecium dilute sordida. Iodo gelatina hymenialis vinose rubens.

Ad saxa in insula Cæsarea (Larbalestier).

Facie est *L. turgidulæ*, sed notis datis et præsertim reactione iodica differt. Spermogonia extus nigra verrucariiformia; spermatia recta, longit. 0·006 millim., crassit. 0·001 millim.

11. *Lecidea mesoidea*, Nyl.

Thallus cinerascens, sat tenuis, subopacus, inæqualis, subareolato-rimosus; apothecia nigra, mediocria (latit. fere 1 millim. vel minora), juniora marginata, demum convexiuscula margine evanescente, intus concoloria; sporæ 8^{næ}, incolores, oblongæ, 3-septatæ, longit. 0·014–0·017 millim., crassit. circiter 0·006 millim.; paraphyses mediocres, clava nigricante; hypothecium nigrum, strato medio luteo-rubricoso (vel cerasino-rufescente). Iodo gelatina hymenialis cærulescens, dein violacee tincta.

Supra lapides micaceo-schistosos in insula Sargia (Sark), legit Larbalestier.

Accedit ad *L. acclinem*, sed hypothecio differt; etiam thallo et hypothecii strato supero distincto nigro differt a *L. squamulosa* Deak.

12. *Lecidea sarcogyniza*, Nyl.

Thallus obscure cinereo-virescens vel subolivaceus, opacus, tenuis, indeterminatus; apothecia nigra, plana (latit. circiter 1 millim.), marginata, margine sæpe flexuoso, intus obscura; sporæ 8^{næ}, incolores, oblongæ, longit. 0·007–0·011 millim., crassit. circiter 0·003 millim., thalamium incolor; paraphyses mediocres, apice nigricanti-clavatæ (inde epithecium crassiuscule nigrum); hypothecium subhymeniale distincte fuscescens, stratum ejus medium subincolor; perithecium (cum strato infero conceptaculi) nigricans vel nigrum. Iodo gelatina hymenialis intense cærulescens.

In Scotia prope Abredoniam ad saxa quartzosa maritima (Crombie), rimulas saxi potissime sequens.

Accedit ad *L. sarcogynoidem* Krb., sed differt jam thalamio incolori, præter notas alias allatas.

13. *Lecidea commaculans*, Nyl.

Thallus fusco-niger vel nigricans, tenuis, opacus, subareolatus, depressus, sæpius dispersus, indeterminatus; apothecia atra (latit. fere 1 millim. vel nonnihil minora), convexula, margine vix ullo, intus concoloria; sporæ 8ⁿᵃᵉ, incolores, oblongæ, longit. 0·008–0·011 millim., crassit. 0·003–0·004 millim.; paraphyses non discretæ; epithecium nigricans; hypothecium crassiusculum rubricose fuscum (colore hoc superne vage in thalamium transeunte). Iodo gelatina hymenea cærulescens.

In Scotia, ad saxa calcarea montium Braemar (Crombie).

Accedere videtur ad *L. kajanitam*, cui vero sporæ aliæ nec thalamium rubricose tinctum; magis affinis sit *L. dispansæ*, sed variæ notæ divergunt. Hypothecium in thalamium omnino sensim transit absque limite distinguendo. Spermatia cylindrica, recta, longit. 0·009–0·011 millim., crassit. 0·001 millim.

14. *Lecidea aphanoides*, Nyl.

Thallus obscure olivaceo-cinerascens, tenuis, subverrucose vel subgranulose inæqualis, indeterminatus vel subevanescens; apothecia nigra, parvula (latit. 0·3 millim. vel minora), convexula, immarginata, nuda, intus albida; sporæ 8^{nae}, incolores, ellipsoideæ, simplices, longit. 0·009–0·013 millim., crassit. 0·0045–0·0055 millim.; paraphyses non discretæ; thalamium (cum epithecio) cærulescens; hypothecium incolor (vel nonnihil infra vage rubricose rufescens). Iodo gelatina hymenialis cærulescens, dein violacee rubescens.

Supra saxa calcarea in Scotia, Braemar (Crombie).

Species accedens ad *L. aphanam* Nyl. in 'Flora,' 1867, p. 327, sed thalamio aliter tincto, sporis paullo tenuioribus, etc.

15. *Opegrapha Cæsareensis*, Nyl.

Thallus albus, tenuis, rimulosus, indeterminatus; apothecia nigra, cylindracea, prominula (latit. 0·20–0·25 millim.), simplicia, subflexuosa (longit. circiter 1 millim.); epithecio rimiformi-constricto; sporæ 8^{nae}, incolores, oblongæ, 5-septatæ, longit. 0·016–0·022 millim., crassit. 0·004–0·005 millim.; hypothecium atrum. Iodo gelatina hymenialis vinose rubescenti-fulvescens.

Supra saxa quartzosa in insula Cæsarea (Larbalestier).

Differt jam sporis quinque-septatis a comparanda *O. atra* f. *Chevalieri*. Differt etiam ab *O. vulgatæ* formis saxicolis mox sporis crassioribus. Spermatia recta, longit. 0·006–0·007 millim., crassitiem haud 0·001 millim. adtingentia.

16. *Rimularia limborina*, Nyl.

Thallus cinereus, tenuis, rimulosus vel subareolatus; apothecia nigra vel fusco-nigra, opaca, rugulosa, depresso-convexiuscula (latit. 0·2–0·4 millim.), rotundata vel oblongo-rotundata, medio depressiuscula et rimula subtili (sæpe subradiante) fissa, intus cinerascentia; sporæ $8^{næ}$, incolores (demum fuscescentes vel fuscæ), ellipsoideæ, simplices, longit. 0·018–0·025 millim., crassit. 0·011–0·016 millim.; paraphyses gracilescentes, irregulares et sæpe ramosæ; perithecium (peridium) etiam supra nigrum, infra (hypothecium) fusco-nigricans. Iodo gelatina hymenialis fulvo-rubens (præcedente cærulescentia levi).

Supra saxa granitosa in Gallia, Haute Vienne (Ripart, 1865), socia *Lecanoræ gibbosæ*. Etiam supra saxa calcarea in Scotia, Braemar (Crombie).

Genus peculiare novum, *Mycoporo* quodam modo affine, sed apotheciis supra demum rimula subradiosa vel simpliciore dehiscentibus. Inter Pyrenocarpeos hic Lichen locum obtinere non potest, nam nullum habet ostiolum punctiforme. Ceteroquin *Mycoporum* et *Rimularia* apothecii typum offerunt proprium, qui nec apothecium discocarpum nec pyrenocarpum sistit; ab illo scilicet differt perithecio supra continuato totumque hymenium involvente; ab hoc (pyrenio) differt ostiolo non regulari contractoque nec anaphysibus intus munito, sed rimula vel varie dehiscente. Adest hic *peridium*, fere sicut in Fungis variis. Distinguenda est duobus generibus allatis, tribus propria, quæ dicatur *Peridiei*.

XXXVI.—*Notes on the Dragonflies of the Seychelles.* By E. Perceval Wright, M.D., F.L.S., Professor of Botany and Zoology in Trinity College, Dublin. *With a List of the Species and Descriptions of a new Genus and some new Species;* by the Baron E. de Selys-Longchamps.

During my six months' residence at the Seychelles I was very much struck by the apparent absence of insect-life. Ants and musquitoes, indeed, abounded: the former were busy everywhere, and nothing that could be carried off was left very long alone by them; the latter were a constant source of discomfort. To all appearance they contrived to live happily while often rendering human life miserable. But there were no butterflies to be seen flying by day; and the cocoanut-oil lamps were let burn uninterruptedly by night, there being no big moths to flap over and extinguish them. This was especially the case during the months from June to September. Towards October insects began to appear, the Cicadæ were heard in the trees, and I have little doubt that if I had stayed at the islands for the whole of the rainy season I should have collected or seen a fair proportion of species. A large number of my specimens collected at Praslin and Mahé were destroyed by ants, and in several instances I could not succeed in again capturing some of the more local forms. This was especially the case with my first collection of dragonflies; the store-box in which I had packed a lot of specimens was entered by the ants, and the whole series destroyed. As it was a very carefully made English store-box, without any apparent place of exit or entrance for the smallest insect, I was at a loss to account for this disaster. At last, determined to find out how the ants got in, I left the box tightly fastened as before, with half-a-dozen cockroaches pinned inside; and in a few hours I was able to trace the swarm of ants to the side of the box, and I then found that they got in along the side of one of the small screws which fastened on the hinge, and which unfortunately came through. These facts must be borne in mind when drawing any conclusion from the paucity of species met with by me: first, I was at Mahé at the wrong season of the year; and, secondly, I only saved a small portion of my collection.

On the eastern side of Praslin there is a large extent of flat land, nearly the whole of which is under cultivation as a cocoanut-tree plantation under the charge of Mr. Osughrue. Through this plain a little stream, coming down from the mountains, wanders; in some places it spreads out into large-sized ponds, but in very many places it is so small as to be easily stepped over. Where it flows into the sea there is, in the dry season, a large sand-bank which in the wet season is swept again into the sea by the force of the current of fresh water. The water is sweet, but becomes a little brackish where it approaches the sea-sands; and in this portion it abounds with many small fish, upon which *Ardeola lepida* (Manik) feed; now and then a Poule d'eau (*Gallinula chloropus*) is to be seen under the bamboo-canes; attached to the framework of a small bridge over this stream near the sea I collected several fine masses of *Spongilla alba* of Carter, hitherto known only as from the tanks of Bombay. All along this river, in the month of October, dragonflies abounded, and all the species collected by me were met with here. One species only of several which I collected at Mahé, *Libellula hemihyalina*, survived the ravages of the ants. Knowing that Mr. M'Lachlan was interested in the study of the Neuroptera, I took the opportunity of sending him a few common species collected in the spring of 1868 at Syracuse, to send also the remnants of my Seychelles collection. This he forwarded to Baron E. de Selys-Longchamps, who has most kindly not only named all the species, but in the following paper has described a new genus, *Allolestes*, and several new species. While it is a matter of regret that the material placed in the Baron's hands was not sufficiently large to give him a fair idea of the number of species to be met with in the Seychelle Islands, still it is a source of some satisfaction to me to think that it has been the means of obtaining so interesting a communication as the following from so very excellent an authority on the Odonata; and my especial thanks are due to Mr. M'Lachlan for his valuable assistance in obtaining it, and in looking over and correcting my translation of it. The types of the species I have given to Mr. M'Lachlan.

List of Species and Description of a new Genus and five new Species of Dragonflies (Odonata) *from the Seychelles*. By the Baron E. de Selys-Longchamps.

Professor E. Perceval Wright, of Dublin, forwarded to me through Mr. M'Lachlan the Odonata which he had collected during the summer and autumn of 1867, in the little-known islands of the Seychelles.

The specimens, but fifteen in number, are very interesting; they belong to nine species, of which five are new. I give below the characters of the undescribed species.

With regard to the geographical distribution of these species there are several points of interest. Four of them are plainly of an African type, viz. *Libellula hemihyalina*, Desj.; *L. Wrightii*, sp. n.; *Agrion senegalense*, Ramb.; *Brachybasis glabra*, Burm. The other five species represent forms which inhabit India and Malasia. These are, *Libellula trivialis*, Ramb.; *Allolestes M'Lachlani*, gen. et sp. nov.; *Trichocnemis cyanops*, sp. n.; *T. bivittata*, sp. n.; *Zygonyx* (?) *luctifera*, sp. n. This latter species approaches the genus *Cordulia*. *Libellula hemihyalina* comes from Mahé; all the species, including it, come from Praslin, one of the most easterly of the islands.

1. *Libellula hemihyalina*, T. Desjardins.

L. disparata, Ramb.

Two males, quite like those from the Mauritius, from Natal, and from Senegal. It will be necessary to refer to this species *L. separata*, De Selys, from Algeria, which appears to be nothing more than a well-marked variety.

2. *Libellula Wrightii*, sp. n.

This species belongs to the African group, to which pertain also *L. brachialis*, Beauvois, *L. contracta*, Ramb., and *L. Marchali*, Ramb.

Length of abdomen 24–25 millim., hind wing 27, pterostigma $2\frac{1}{2}$.

♂ adult characterized by the coloration of the front, of which the excavated upper portion is greenish blue, not metallic, surrounded with blackish. The upper lip is yellowish, encircled with blackish, and with a median blackish line; the lower lip yellowish, with the median lobe entirely blackish and, with the inner borders of the lateral lobes, forming a median space of that colour. Abdomen strongly powdered with bluish; third segment greatly constricted.

In the ♂ non-adult, and in the ♀ (which was taken by the late M. Julien Desjardins in the island of Mauritius), the thorax is not powdered with bluish; it is blackish, with an antehumeral band, two lateral ones on each side, and several spots beneath orange-coloured. In the ♀ the abdomen (which is not pulverulent) has a double median orange-coloured spot on the first to the seventh segments; the eighth much dilated at the sides.

3. *Libellula trivialis*, Ramb.

One female, which does not differ from Rambur's types indicated from Bombay and Macao. *A priori* I was induced to unite with it the allied species *L. flavistyla* of Africa, or *L. tetra* of the Mauritius; but the number of the "posttrigonal" cells and of the cells in the interior triangle of the superior wings are opposed to this, as well as the form of the abdomen and of the vulvar scale, which are quite like those of *L. trivialis.*

4. *Zygonyx* (?) *luctifera*, n. sp.

♂. Abdomen 32 millim., inferior wing 35, pterostigma $1\frac{1}{2}$. Wings hyaline, scarcely tinted; membranule long, pale brown; discoidal triangles free, that of the upper wing narrow, acute at the lower angle, followed by two rows of posttrigonal cellules; the internal triangle of the superior wings of two cellules, but scarcely to be distinguished from those adjoining; a single transverse basal nervule in the space between the submedian nervure and the postcosta in all the wings; the nodus nearer to the apex than the base of the wings; ten antecubital nervules in the superior wings, the last isolated; seven to eight in the inferior. Almost entirely coal-black (with steel-blue reflections on the front and fore part of the thorax). Some dull yellowish markings, indistinctly indicated, as follows:—a transverse band on the face, comprising the nasus and the rhinarium; five or six spots on each side of the thorax, and a vestige on the sides of the second abdominal segment. Femora dull brown externally.

Eyes prominent, somewhat contiguous. Prothorax with the posterior lobe subtriangular, rounded. Abdomen slender, cylindrical, not constricted, becoming narrower from the base to the extremity. Legs slender, ciliated. Anal appendices simple, thrice the length of the tenth segment.

♀ unknown.

This species appears to me to belong to the genus *Zygonyx*, of which the type (*Z. Ida*, Selys) comes from Java, and has the base of the second to the eighth segments encircled with yellow. The analogy between the two species is very great, and I think that affinity equally exists; however, there are three characters which cause me to hesitate as to its definite position: *Z. luctifera* has a smaller head, it possesses only one nervule in the median basal space, and the lower division of the tarsal claws, although well marked, is shorter than the upper; the equality of the two divisions of the claws is the character on which I founded the genus *Zygonyx*.

Z. Iris, Selys, from the Malayan archipelago, forms another section, in which the discoidal triangles are traversed by a nervule, and the divisions of the claws are equal. This constitutes the type of the genus, such as it has been adopted by Herr Brauer.

Genus Allolestes, De Selys, gen. nov.

Pterostigma thick, oblong, surmounting two to three cellules. Reticulation rather dense; the sectors curved near the base, from the short sector (*secteur bref*) to the ultranodal with two supplementary sectors interposed between each. Wings strongly petiolated (as far as the apex of the quadrilateral), the postcostal basal nervule placed under the first antecubital; quadrilateral very long (the upper side one-fourth shorter than the lower), occupying all the space between the second antecubital and the nodus; a single cellule between the quadrilateral and the vein which descends from the nodus; postcostal space with a single row of cellules.

Lower lip oblong, roundly emarginated in its final third, the extremities distant. Antennæ with the first joint very short, the second one-half longer, the third slender, equalling the two first united.

Abdomen moderate, slightly longer than the inferior wings.

Legs rather long, with long ciliations; tarsal claws bifid.

♂ unknown; ♀ with the tenth segment very short, the ninth shorter than the eighth.

This genus, which resembles *Argiolestes* by the pterostigma, the lower lip, the claws, and the strongly petiolated wings, differs from it by the postcostal space formed of a single row of cellules, and by one supplementary sector less from the short sector to the ultranodal.

Allolestes differs from *Podolestes* by the less emarginated lower lip, by the bifid claws, by the more strongly petiolated wings, and by one more supplementary sector between the short sector and the ultranodal.

It differs from both neighbouring genera by the very long quadrilateral extending from the second antecubital as far as the nodus; in this character it has analogy only with *Paraphlebia* (from Mexico), which belongs (as does *Allolestes*) to the legion of *Podagrion*.

5. *Allolestes M'Lachlani*, n. sp.

♀. Abdomen 23 millim., inferior wing 20.

Wings hyaline. Pterostigma brown, darker in the centre, encircled by a thick black nervure. Nineteen to twenty-one postcubital nervules in the superior wings, seventeen to eighteen in the inferior.

Yellowish brown, blackish behind the eyes. Prothorax obscure laterally, the posterior lobe slightly sinuated. Thorax with the dorsal keel blackish, as well as three lateral bands; a yellow band anteriorly.

Segments one to seven terminated by a blackish ring, three to seven communicating by a yellow ring, eight to ten brown.

Legs yellowish, the femora with a basal, median, and terminal blackish ring.

Appendices brown, broad, triangular, short; vulvar valvules yellowish, ciliated, reaching beyond the apex of the abdomen.

Resembling *Podolestes orientalis* by the coloration, but differing by the size being one-half less, by the reticulation, &c.

6. *Trichocnemis cyanops*, n. sp.

♂. Abdomen 37 millim., inferior wings 25.

Pterostigma blackish brown, elongate lozenge-shaped, covering almost two cellules. Fifteen to sixteen postcubital nervules in the inferior wings.

Head black; rhinarium, internal border of the eyes, cheeks, and upper lip blue, the latter bordered with black. Prothorax blackish, with a blue lateral spot; the posterior lobe rounded, spotless. Front of the thorax blackish brown up to the first lateral suture, with a pale posthumeral line; the sides and the underside pale, with a brownish-black band, which is dilated at the second suture.

Abdomen very long and slender, blackish above; first segment short, bluish, with a black dorsal band; fourth to sixth encircled with livid at the base (the circle interrupted at the dorsal crest); sides of the eighth, ninth, and tenth bluish, the latter very short.

Legs pale red, with long ciliations; exterior of the femora blackish.

Anal appendices—superior dull bluish, longer than the tenth segment, thick at the base, distant, afterwards compressed, slightly curved inwards and downwards near the apex, ciliated; inferior darker, one-half shorter, thick at the base, contiguous, drawn out at the apex into two little elevated points.

♀ unknown.

This species is remarkable for its long pterostigma, blue face, the pale humeral line not reaching beyond the hind part of the thorax, and terminating before the base, finally by the absence of pale spots at the base of the thorax. The inferior anal appendices have not the lower internal tooth, as in *T. silenata* from the Malayan archipelago.

7. *Trichocnemis bilineata*, n. sp.

♂. Abdomen 36 millim. (♀, 34), inferior wing 22.

Pterostigma blackish brown, lozenge-shaped, elongated, covering one and a half (♂) or two (♀) cellules. Thirteen to fourteen postcubital nervules in the inferior wings.

Head blackish above, the back of the eyes pruinose; an elongated livid mark on each side parting from the antennæ and directed towards the occiput.

Prothorax blackish, the base and a lateral border at the median lobe yellow; posterior portion without spots.

Front of the thorax bronzy black as far as the lateral sutures, having in front, against the prothorax on each side of the dorsal keel, a yellow cuneiform spot; a blue humeral line not descending beneath; sides bluish, with an undulated black band at the second lateral suture. Underside livid.

Abdomen long and slender; sides of the first segment broadly bluish; a vestige of a pale interrupted basal ring at the dorsum on the third to the sixth segments.

Legs livid, with long brown ciliations; exterior of femora and interior of tibiæ blackish.

♂. Posterior lobe of the prothorax rounded; rhinarium, internal margin of the eyes, cheeks, and upper lip blue, the latter finely bordered with black: sides of the eighth to the tenth segments bluish, the latter very short.

Anal appendices—superior brown, longer than the tenth segment, slightly thickened at the base, distant, afterwards compressed and somewhat curved inwards and downwards towards the apex, ciliated; inferior dull, thickened and contiguous at the base, afterwards drawn out at the extremity into two points suddenly straightened, somewhat distant at first, afterwards approaching each other, and at last slightly divergent.

♀. Posterior lobe of the prothorax deeply divided by an oval excision; rhinarium and upper lip blackish; inner border of the eyes and the cheeks yellowish. (The last three segments of the abdomen are missing.)

This species is allied to *T. Dictynna*, but very distinct by the two pale spots of the front of the thorax being very much smaller, the lateral bands more dilated, and the pterostigma longer. The ♀ is remarkable for the oval excision which divides the posterior lobe of the prothorax. The appendices of the ♂ are formed like those of *T. cyanops*; only the superior are rather more excavated internally, and the inferior rather less contiguous before the apex.

Until the present time the genus *Trichocnemis* was known only from South Asia and the Malayan archipelago.

8. *Agrion senegalense*, Rambur.

Two males similar to those of the African continent and islands.

9. *Brachybasis glabra*, Burm. (*Agrion*).

Agrion ferrugineum, Rambur.

Two males, similar to those of the African continent, Madagascar, and Mauritius.

Liége, 9th Feb., 1869.

XXXVII.—*Descriptions of new Genera and Species of* Tenebrionidæ *from Australia and Tasmania.* By Francis P. Pascoe, F.L.S. &c.

[Continued from p. 153.]

[Plate XII.]

The three following appear to be degraded Tasmanian forms of *Cestrinus*, Er.*, and are closely allied; they are narrower and more feebly constructed, and the prothorax wants the expanded margin. *Opatrum piceitarse*, Hope, belongs to this genus; with this species his *Isopteron opatroides* exactly agrees, only the latter has clear ferruginous antennæ. The same author's *Platynotus insularis* is, I believe, another member of the genus. The descriptions of these insects and some others, in the 'Transactions of the Entomological Society' (ser. 1. vol. iv.), were very concise; and they were left un-

* Wiegm. Arch. 1842, i. p. 172.

ticketed, as Prof. Westwood informs me; so that they had afterwards to be determined by these descriptions. As the vast collection of Mr. Hope was at his death in some disorder, it is not impossible that in some instances the true types may have been overlooked.

Cestrinus aversus.

C. elongatus, subdepressus, fuscus, subnitidus, subtiliter sparse griseo-pubescens; elytris striato-punctatis, obovatis.

Hab. Tasmania.

Elongate, subdepressed, dark brown, slightly nitid, finely and remotely pubescent, the pubescence composed of very small stiff greyish bristles; head closely punctured, clypeus separated from the front by a slightly arched, deeply impressed groove; prothorax a little broader than long, closely punctured, widely emarginate at the apex, the sides slightly rounded and obsoletely crenated, the base truncate; scutellum small, transverse; elytra broader than the prothorax at the base, the greatest breadth towards the apex, striate-punctate, the punctures approximate and deeply impressed; body beneath and femora pitchy brown, finely punctured, tibiæ paler; antennæ and tarsi ferruginous. Length 3 lines.

Cestrinus punctatissimus.

C. elongatus, subdepressus, rufo-fuscus, opacus, subtiliter griseo-pubescens; elytris striatis, creberrime punctatis, lateribus parallelis.

Hab. Tasmania.

Elongate, subdepressed, reddish brown, opaque, with scattered greyish bristles; head and prothorax as in the last; scutellum curvilinearly triangular; elytra broader than the prothorax, the sides nearly parallel, striated, each of the striæ filled with two or three rows of closely impressed irregular punctures; body beneath, legs, and antennæ pale reddish ferruginous, the former and femora punctured. Length 3 lines.

The closely arranged punctures on the elytra, many of them impinging on the lines between the striæ, will readily distinguish this species from the former.

Cestrinus posticus.

C. elongatus, fuscus, subtiliter sparse griseo-pubescens; elytris striato-punctatis, apicem versus elevatis.

Hab. Tasmania.

Elongate, subdepressed, dark brown, with scattered greyish bristles; head and prothorax as in *C. aversus*, but narrower, and the punctures smaller; scutellum confounded with the elytra; the latter gradually broader behind, and, towards the apex, prominently raised at the suture, striato-punctate, the punctures large, squarish, and regularly arranged; body beneath pitchy, finely punctured; legs and antennæ paler. Length $2\frac{3}{4}$ lines.

I have only a single specimen of this insect; but the peculiar elevation of the elytra posteriorly seems to mark it out as a good species.

Nearly related to *Cestrinus* is *Asida serricollis*, Hope*; it differs generically in the epipleuræ of its elytra being broader and horizontal or subhorizontal, and the mesosternum entire anteriorly, the last joint of the labial palpi oblong-ovate and somewhat acuminate, and the mentum trapeziform. I propose to call this genus *Achora*. *Opatrum denticolle*, Blanch.†, is probably another species.

Typhobia.

Subfamily *Diaperinæ.*

Antennæ art. omnibus obconicis, ultimo excepto.
Tarsi postici art. primo elongato.

The character of the antennæ at once separates this genus from *Diaperis*; to this may be added the peculiarly deep opacity of the coloration and the more flattened form. There is a slight transverse elevation on the forehead of one of my specimens‡.

Typhobia fuliginea.

A. ovalis, subdepressa, nigra, opaca; corpore infra, antennis pedibusque rufo-testaceis, nitidis.

Hab. Queensland; Victoria.

Rather narrowly oval, subdepressed, black, opaque; head somewhat pitchy, finely punctured; prothorax impunctate, anterior angles slightly produced, the lateral marginal line glossy reddish testaceous; scutellum transversely triangular; elytra finely striate-punctate, the punctures minute, the intervals of the striæ broad and very slightly convex; body be-

* Trans. Ent. Soc. ser. 1. iv. p. 108.

† Voy. au Pôle Sud, Ins. Col. pl. 10. fig. 13.

‡ The males of a great many species of the subfamily, especially in the genera *Platydema* and *Arrhenoplita*, have the head furnished with two short horns, either between the eyes or a little above them. But in a species from Brazil, lately given me by Alexander Fry, Esq., these horns are transferred, so to say, to the apex of the prothorax. This remarkable insect will form a new genus. I have adopted the name *Arrhenoplita* of Kirby (Faun. Bor.-Amer. Ins. p. 235) instead of *Hoplocephala*, which had been used years previously by Cuvier for a genus of Ophidians.

neath, legs, and antennæ glossy reddish testaceous. Length $2\frac{1}{4}$ lines.

Platydema aries.*

P. ovalis, modice convexa, nigra, nitida; elytris striato-punctatis, fasciis duabus, ad suturam interruptis, luteis.

Hab. Brisbane.

Oval, moderately convex, black, shining; head finely and rather closely punctured, on the inner side and a little above each eye, in the male, a short vertically compressed horn, obliquely truncate at the apex and densely fringed with short yellowish hairs; prothorax twice as broad at the base as long, finely punctured, an oblong fovea on each side posteriorly; scutellum curvilinearly triangular; elytra more convex behind the middle, striate-punctate, the striæ very shallow, the intervals between them broad, flat, and minutely punctured; near the base a broad yellow band, and a similar one near the apex, both interrupted at the suture; body beneath, legs, and antennæ dull luteous, the former clouded with brown. Length $2\frac{1}{4}$ lines.

Resembles *P. tetraspilota*, Hope, in coloration, but a vastly more bulky insect, and remarkable for the form of the horn, with which the male only is armed.

Platydema oritica.

P. ovalis, modice convexa, nigra, nitida; elytris striato-punctatis; antennis pedibusque pallide ferrugineis.

Hab. Victoria?

More broadly oval than the last, glossy black; head of the male with two horizontal triangular and acuminate horns, tipped with ferruginous, between the eyes; prothorax as in the last, but narrower and more convex; scutellum curvilinearly triangular; elytra more convex at the middle, striate-punctate, the intervals between the striæ convex, minutely punctured; body beneath dark glossy brown; legs and antennæ yellowish ferruginous. Length $2\frac{1}{2}$ lines.

Dr. Howitt has not given me the locality of the above, nor of the following, which differs in some degree generically from *Platydema* in that the fourth, fifth, and sixth joints of the antennæ are obconic, and not transverse, although gradually thicker outwards.

Platydema limacella.

P. breviter ovata, nigra, nitida; elytris striato-punctatis, humeris luteis.

Hab. Victoria?

* De Cast. et Brullé, Ann. d. Sci. Nat. xxiii. p. 350.

Shortly ovate, moderately convex, black, shining; head of the male with two short pointed horns, antennary ridges, apex of the clypeus, and antennæ luteous; prothorax finely punctured, twice as broad as long at the base, a little depressed near the scutellum, the margins luteous; scutellum curvilinearly triangular; elytra striate-punctate, the intervals of the striæ minutely punctured, broad, and convex, the shoulders luteous; epipleuræ of the elytra and body beneath dull luteous; legs clear luteous. Length 2 lines.

The following is, no doubt, a *Platydema*; but there is no trace of horns in either of my two specimens: probably they are both females.

Platydema thallioides.

P. elliptica, convexa, rufo-testacea, nitida; prothorace utrinque macula arcuata, elytrisque (sing.) maculis tribus magnis nigris; antennis basi exceptis nigris.

Hab. Sydney.

Elliptic, convex, reddish testaceous, shining; head finely punctured, rather depressed between the antennary ridges; prothorax smooth, slightly expanded at the lateral margins, a large black arched spot or stripe extending from the anterior to the posterior angles on each side, leaving in the middle of the disk a nearly triangular patch; scutellum curvilinearly triangular; elytra minutely seriate-punctate, on each a round black scutellar spot, and two transverse, also black, the first in the middle, the second near the apex, both large and approaching the suture; body beneath brownish testaceous, the metasternum clouded with black; legs testaceous; antennæ black, the two basal and base of the third joint fulvous testaceous. Length 2½ lines.

Ceropria? valga.*

C. breviter ovalis, nigra, subnitida, antennis art. duobus basalibus, labro tarsisque fulvis; tibiis intermediis et posticis valde curvatis.

Hab. Queensland.

Shortly oval, black, subnitid, the two basal joints of the antennæ, upper lip, and tarsi fulvous; head very short in front; the clypeus broad, truncate anteriorly, the antennary ridges impinging only slightly on the eyes; antennæ with the fourth and following joints to the tenth inclusive more or less obconic, and only slightly dilated on one side, the last ovate; prothorax nearly twice as broad as long, widely emarginate at

* De Cast. et Brullé, Ann. des Sci. Nat. xxiii. p. 396.

the apex, nearly impunctate; scutellum transversely triangular; elytra rather broader than the prothorax, the sides nearly parallel, striate-punctate, the intervals of the striæ flattish; body beneath dark glossy brown; femora and tibiæ pitchy, tibiæ curved, especially the intermediate and posterior. Length 4 lines.

Differs from *Ceropria* in the antennæ, which are scarcely serrated on the inner edge, and in the shortness of the head anteriorly, the eyes nearly free, &c. As the genus has a very extended geographical range, and there are only two described species from Australia, it seems best for the present to consider this one an aberrant member.

Pteroheläeus nitidissimus.*

Pterohelæus striato-punctatus, De Brême, Essai &c. p. 31, pl. 2. fig. 6 (*nec* Boisduval).

P. ovalis, nitidissime niger; elytris subtilissime seriatim punctatis.

Hab. South Australia.

Oval, moderately convex, very glossy deep black; head finely and closely punctured, clypeal groove broad and shallow; prothorax very minutely and rather closely punctured, rounded at the sides, the edge of the expanded margin anteriorly recurved, an irregular well-marked groove at the base interrupted in the middle; scutellum curvilinearly triangular; elytra a little contracted behind the shoulders, very finely seriate-punctate, the punctures less regularly arranged near the suture; body beneath and legs very glossy black, propectus opaque, granulate; antennæ reaching to the base of the prothorax, third joint half as long again as the fourth. Length 5–5½ lines.

A typical specimen, I believe, in the Oxford Museum shows that this is *P. striato-punctatus*, De Brême; and his description, with one exception, fairly enough accords with it; I hold, however, that it cannot be the same species as that described (?) by Dr. Boisduval in the following words:—"Elongato-ovata nigra; thorace lævi; elytris elongatis, punctis majoribus impressis striatim digestis"†. The exception alluded to is the phrase "fortement ponctué," which may be a slip of the pen for "faiblement ponctué." Dr. Boisduval's "striatim" might in the same way have been intended for "seriatim," but for the specific name "*striato-punctatus*" and the French translation "alignés en stries." There are no striæ whatever in

* De Brême, Essai &c. p. 27.
† Voy. de l'Astrol. p. 266.

the species before us, nor are there any mentioned by M. de Brême.

Pterohelæus vicarius.

P. sat late ovalis, fusco-niger, nitidus; sulco clypeali distincto; elytris leviter seriatim punctatis.

Hab. Queensland; New South Wales; Victoria.

Rather broadly oval, brownish black, shining; head thickly and roughly punctured, clypeal groove well defined, narrowly and sharply limited, the transverse portion above curved downwards; prothorax minutely but not very closely punctured, rounded at the sides, the expanded margins not recurved, the irregular basal groove on each side nearly obsolete; scutellum broadly triangular, its apex rounded; elytra a little contracted behind the shoulders, finely, but not minutely, seriate-punctate, the punctures less regularly arranged near the suture and base; body beneath and legs glossy brownish black, the propectus opaque, granulate; antennæ short, third joint nearly twice as long as the fourth. Length 6–7 lines.

Broader and much less finely punctured than the last species, and not particularly glossy, &c. In some collections it is labelled *P. striato-punctatus*, Boisd.; but the same objection applies to this as to *P. nitidissimus.* Both species have the abdominal segments finely striated longitudinally (a character common to many Tenebrionidæ) and the clypeal grooves well marked.

Pterohelæus litigiosus.

P. paulo anguste ovalis, ferrugineo-fuscus, nitidus; clypeo antice late emarginato, sutura indistincta; elytris tenuiter striato-punctatis.

Hab. Sydney.

Rather narrowly oval, rusty-brown, shining; head finely punctured, a little concave in front; clypeus broadly emarginate anteriorly, separated from the front by a narrow indistinct line; prothorax very minutely punctured, a short longitudinal groove near the apex, none at the base, the expanded margins not recurved; scutellum transversely triangular; elytra callous at the base, rather finely seriate-punctate, the intervals of the rows slightly raised, the fourth and eighth intervals rather more so than the others, the expanded margins narrow; body beneath, legs, antennæ, and margins of the prothorax and elytra reddish ferruginous. Length 7 lines.

In colour and outline resembling *P. silphoides*, but rather broader, and not dull brown as in that species, the intervals of the striæ more elevated, the punctures larger, and, above all, a broad callosity at the base of the elytra.

Pterohelæus alternatus.

P. subanguste ovalis, niger, nitidus; clypeo antice vix emarginato, sutura fere obsoleta; elytris in medio planatis, leviter seriatim punctatis, interstitiis alternis elevatis.

Hab. "Interior."

Rather narrowly oval, black, shining, somewhat depressed; head finely punctured; clypeus scarcely emarginate in front, its suture nearly obsolete; prothorax minutely punctured, a broad shallow fovea on each side at the base, no groove, the expanded margins not recurved; scutellum curvilineariy triangular; elytra flattish at the middle and base, finely seriate-punctate, the alternate intervals of the rows raised, the fourth, eighth, twelfth, and sixteenth (the last) much more so than the others, the expanded margins broad at the base, gradually narrower to the apex; body beneath and legs black, slightly glossy, tibiæ covered with short spinous hairs; antennæ short, not reaching to the end of the prothorax, black. Length 8 lines.

A very distinct species, in outline resembling *P. Reichei*, but the elytra with expanded margins and strongly marked elevated lines, &c. Dr. Howitt merely gives "Interior" as its locality.

Pterohelæus minimus.

P. oblongo-ovalis, piceus, subnitidus, marginibus clypeoque pallidioribus; prothorace confertissime oblongo-punctato; elytris subtuberculatis, subtiliter et vage punctatis.

Hab. Cooper's Creek.

Oblong-oval, pitchy brown, subnitid, the margins of the prothorax and elytra, and the anterior part of the head paler, yellowish brown; head densely punctured, the clypeal groove very indistinct; prothorax rather short, covered with fine oblong punctures, the intervals very narrow, and in certain lights causing the surface to assume a delicately corrugated appearance, the expanded margins narrow and slightly reflected; scutellum transversely triangular; elytra minutely and irregularly punctured, with scattered minute tubercles, especially near the suture, the expanded margins very narrow; body beneath and legs glossy reddish testaceous; antennæ short, inclining to testaceous. Length $3\frac{1}{2}$ lines.

The smallest species of the genus, and very distinct on account of the sculpture of the prothorax and elytra. I have placed it after *Pterohelæus peltatus*, Er., which it resembles in outline.

The three following are closely allied in general appearance, but are distinguished by several small but well-marked points of difference. They seem to lie between *P. Walkerii* and *P. silphoides*, not so broad as the first nor so narrow as the last, and all moderately convex. Two of these species have the sutural margin raised; one (*P. laticollis*) has the expanded margins of the elytra rather broad, the broadest part in the middle; the other (*P. hepaticus*) has them much narrower, very slightly contracted behind the shoulders, the rest to beyond the middle of nearly equal breadth; the third (*P. dispar*) affects two forms, apparently depending upon sex, the male being elliptic, the female obovate; in this the sutural margin is without any elevation.

Pterohelæus laticollis.

P. fuscus, nitidus, marginibus dilutioribus; oculis approximatis; prothorace elytris latiore, his postice gradatim angustioribus.

Hab. Melbourne.

Dark glossy brown, the expanded margins of the elytra and prothorax considerably paler; head rather narrow behind the antennary ridges, concave between them; the eyes rather large and approximate; clypeus very convex, except at its anterior angles, its suture indistinct; prothorax short, broader than the elytra at its base, minutely punctured, the margins broad and only very slightly reflected, the basal foveæ strongly impressed; scutellum curvilinearly triangular; elytra gradually and rather rapidly narrowing from the base, seriate-punctate, the alternate intervals of the rows forming slightly elevated lines, the suture strongly elevated from below the scutellar striola, the punctures rather small, the expanded margins, owing to a contraction of the sides of the disk, broadest at the middle, behind very distinctly reflected; body beneath and femora very glossy chestnut-brown; antennæ, tibiæ, tarsi, and epipleuræ of the elytra reddish ferruginous. Length 10 lines.

Pterohelæus hepaticus.

P. fuscus (aliquando rufo-brunneus), subnitidus, marginibus dilutioribus; oculis distantibus; prothorace elytris haud latiore, his postice gradatim angustioribus.

Hab. Melbourne.

Dark brown (or sometimes light reddish brown), paler at the margins, less glossy than the last; head rather narrow behind the antennary ridges; the clypeus very convex, its suture above indistinct, but forming a well-marked groove on each side; the eyes widely apart; prothorax not broader than the elytra at their base, much longer and narrower than in the last, the basal foveæ represented by a large shallow depression on each side; scutellum transversely triangular, the sides curvilinear; elytra gradually narrowing from the base, the sides of the disk not contracted, seriate-punctate, the intervals of the rows not raised, the punctures rather small, the expanded margins of nearly equal breadth, or only very gradually narrowing behind, the suture raised as in the last; body beneath and legs glossy chestnut-brown; antennæ glossy ferruginous. Length 8½ lines.

Pteroheleus dispar.

P. breviter ellipticus (♂), oblongo-obovatus (♀), piceus, nitidus, marginibus dilutioribus; oculis haud distantibus; elytris basin versus parallelis (♂ in medio paulo latioribus), lineis elevatis nullis.

Hab. Swan River.

Shortly elliptic in the male, oblong-obovate in the female, shining pitchy brown, the margins much paler; head rather narrow in front; clypeus convex, its suture rather indistinct; the eyes not remote; prothorax shorter proportionally in the male, the basal foveæ shallow, between them opposite to the scutellum an indistinct groove; scutellum triangular; elytra nearly parallel at the sides, and not broader than the prothorax in the female, broader in the middle in the male, finely seriate-punctate, the intervals without raised lines, the suture not elevated, the expanded margins of nearly equal breadth at the sides, and a little reflected at the edge; body beneath and femora dark chestnut-brown, shining; antennæ, tibiæ, and tarsi paler. Length (♂) 7, (♀) 9 lines.

Heleus squamosus (Howitt's MS.). Pl. XII. f. 4.

H. oblongus, parallelus, ferrugineo-fuscus, opacus, sparse fulvo-squamosus; elytris sing. unicostatis.

Hab. Cooper's Creek; Darling River.

Oblong, parallel at the sides, impunctate, rusty-brown, opaque, sparsely covered with fulvous hairs simulating scales; head a little prolonged anteriorly; clypeus rounded; prothorax rather transverse, with a strongly marked carina in the middle, the foliaceous margins broad and reflexed; scutellum transversely triangular; elytra moderately convex, depressed along the sutural region, the suture finely raised, and near it on each side a strongly marked carina, which terminates abruptly at a little distance from the apex, a line of small tubercles towards the foliaceous margins, which are moderately broad, but expanded inwardly near the shoulders; body beneath and legs opaque rusty-brown clothed with fine scattered hairs. Length 12 lines.

A very distinct species, having no similitude to any of its congeners. Unfortunately, it is not quite perfect as to its antennæ and anterior tarsi; and their reproduction in the figure must be taken with a slight reservation. In fresh examples, it is very likely the flattened hairs (they are not true scales) are more numerous than I have represented.

Saragus limbatus.

S. late ovalis, modice convexus, nigrescens vix nitidus; elytris leviter seriatim punctatis, interstitiis alternis paulo elevatis, latera versus sensim minus conspicuis.

Hab. Melbourne; Gawler.

Broadly oval, moderately convex, brownish black, scarcely nitid; head and prothorax finely punctured, the latter slightly convex, the basal foveæ nearly obsolete, the anterior angles rounded, posterior produced and recurved, foliaceous margins moderately broad, a little reflexed, and edged with a thickened border; scutellum transversely triangular; elytra not broader than the prothorax, finely seriate-punctate, the intermediate spaces between the rows raised, three or four on each side the suture the most so, those towards the sides gradually disappearing, foliaceous margins narrowing gradually posteriorly, transversely corrugated; body beneath and legs dark chestnut-brown, a little glossy, the abdominal segments longitudinally corrugated; antennæ ferruginous brown. Length 7 lines.

In outline resembling *S. simplex*, Hope (= *S. asidoides*, Pasc.), but differing in the sculpture of the elytra, &c. Dr. Howitt sends me another *Saragus*, from Port Augusta in South Australia, unfortunately without head or legs, but certainly one of the most remarkable of the subfamily. *S. australis*, Bois., seems to be not the same described under that name by the Marquis de Brême.

Dr. Howitt has sent me not less than four new genera of that handsome and almost exclusively Australian* subfamily, Cyphaleinæ. As a considerable addition has now been made

* The only exception is a Sumatran insect, which I have recently characterized under the name of *Artactes nigritarsis* (Proc. Ent. Soc. 1868, p. xii). It will be more fully described and figured hereafter.

to the group since M. Lacordaire's volume was published in 1859, the following tabulation may be useful:—

Prosternum prolonged and compressed anteriorly (carinated).
  Antennæ rather short, joints gradually thicker and shorter from 7th or 8th to 10th.
    Tibiæ dilated at the end .... *Lepispilus*, Westw.
    Tibiæ not dilated.
      Body glabrous.
        Epipleuræ of the elytra entire.
          Intercoxal process broad, slightly rounded anteriorly .... *Platyphanes*, Westw.
          Intercoxal process narrower and triangular.
            Antennæ with the three penultimate joints obconic .... *Hectus*, n. g.
            Antennæ with the two penultimate joints transverse .... *Opigenia*, n. g.
        Epipleuræ of the elytra incomplete or suddenly narrowed behind.
          Body oblong, depressed.
            Antennæ with the penultimate joints oblong .... *Olisthæna*, Er.
            Antennæ with the penultimate joints transversely obconic .... *Decialma*, n. g.
          Body hemispherical .... *Hemicyclus*, Westw.
      Body pilose .... *Altes*, n. g.
  Antennæ rather long, the penultimate joints little thicker than the rest.
    Basal joint of posterior tarsi as long as the rest together .... *Chartopteryx*, Westw.
    Basal joint of posterior tarsi shorter .... *Oremasis*, Pasc.
Prosternum not prolonged or compressed anteriorly.
  Mesosternum notched for the reception of prosternal process.
    Tarsi pilose beneath.
      Body oblong.
        Epipleuræ of the elytra suddenly narrowed behind .... *Prophanes*, Westw.
        Epipleuræ of the elytra gradually narrowed behind.
          Eyes partially covered by the prothorax *Lygestira*, Pasc.
          Eyes clear of the prothorax .... *Cyphaleus*, Westw.
      Body hemispherical .... *Artactes*, Pasc.
    Tarsi partially pilose beneath .... *Barytipha*, n. g.
  Mesosternum not notched .... *Mithippia*, n. g.

Opigenia.

Subfamily *Cyphaleinæ*.

Oculi liberi.
Antennæ breviusculæ, art. 9°, 10° transverse obconicis.
Mesosternum breve, profunde incisum.

Head not inserted in the prothorax so far as the eyes; clypeus truncate in front, its suture obsolete. Eyes moderate, distant above. Antennæ rather short, the third joint twice as long as the second, fourth to eighth gradually shorter and broader, ninth and tenth transversely obconical, the last rounded. Mentum trapeziform, narrow at the base, strongly convex on the median line; lower lip transverse, rounded at the sides, slightly emarginate in front. Maxillary lobes narrow, the inner falciform, not produced into a hook. Labial palpi with the last joint very large, broadly obconic. Prothorax transverse, broadly emarginate at the apex, anterior angles rounded. Elytra oblong, convex; epipleuræ gradually narrower behind. Legs rather short; basal joint of the posterior tarsi longer than the two next together. Mesosternum deeply notched. Intercoxal process narrowly triangular.

The type of this genus has no very obvious affinity to, and is different in habit from all others of this subfamily, although its technical characters are not very special. The internal maxillary lobe, unlike most of the genera of the Cyphaleinæ, is not produced into a hook, although the apex is pointed.

Opigenia iridescens.

O. oblongo-ovata, modice convexa, aureo-viridis, in certo situ purpureo resplendens.

Hab. Victoria.

Oblong-ovate, moderately convex, golden-green, with rich purple reflections; head rather finely and closely punctured; antennæ glossy ferruginous; prothorax finely but less closely punctured than the head; scutellum triangular, black; elytra broader than the prothorax, their greatest breadth a little behind the middle, seriate-punctate, the punctures small and not approximate, the intervals of the rows broad and finely punctured; body beneath and legs glossy black, the former finely punctured. Length 6 lines.

HECTUS.

Subfamily *CYPHALEINÆ.*

Prosternum antice productum, carinatum.
Processus intercoxalis brevis, antice rotundatus.
Oculi liberi.

In other respects this genus agrees with *Lygestira*, except that it has no raised lines on the elytra—if that be a generic character. My specimen, the only one I have seen, appears to be a male, but it has the anterior tarsi only dilated; in *Lygestira*, judging from the few examples I have been able to examine, the intermediate tarsi as well are dilated, although but slightly.

Hectus anthracinus. Pl. XII. fig. 6.

H. modice convexus, æneo-niger, nitidissimus; elytris vage et sparse punctatis.

Hab. Rockhampton.

Moderately convex, not depressed, brassy black, very glossy; head and prothorax finely punctured, anterior angles of the latter strongly produced and acuminate; scutellum nearly equilaterally triangular; elytra a little broader than the prothorax at the base, their sides slightly parallel, not broader behind, sparingly and irregularly punctured, the punctures of moderate size; body beneath and legs brownish black, very glossy; antennæ dark ferruginous. Length 6 lines.

Lepispilus Stygianus.*

L. niger, nitidus; prothorace brevi, valde transverso, angulis anticis haud producto, rotundato.

Hab. "Alps of Victoria."

Entirely black, glabrous, shining; head small comparatively; clypeus not distinctly separated from the front, its punctures not more crowded than those on the rest of the head; prothorax short, very transverse, minutely punctured, anterior angles not produced, broadly rounded; scutellum equilaterally triangular; elytra large, very convex, much broader behind (probably in ♀ only), with rather fine punctures irregularly crowded, and here and there almost obliterated, with no traces of lines or foveated impressions; body beneath and legs glabrous and glossy, the tibiæ thickly punctured and strongly dilated at the tips. Length 10 lines.

Radically distinct from its only congener (*L. sulcicollis*, Hope) in its colour, sculpture, absence of pubescence, and form of prothorax. My specimen appears to be a female.

ALTES.

Subfamily *CYPHALEINÆ.*

Corpus longe pilosum.
Antennæ breves, art. duobus penultimis transversis.
Tibiæ lineares, ant. et interm. haud calcaratæ.
Tarsi postici art. basali breviusculo.

These characters separate this genus from *Chartopteryx*, Westw., to which I had doubtfully referred the species (*C. binodosa*) constituting its type. It is perhaps the most remarkable of all the Cyphaleinæ, on account of the large hump at the base of each elytron, precisely as in the Brazilian genera

* Westwood, Arcan. Ent. i. 44.

Dicyrtus and *Thecacerus*. *Altes binodosus*, represented on Plate XII. fig. 2, is an ovate, convex, dark copper-brown insect, sparsely furnished with long flying hairs on the body and legs. *Chartopteryx* has erect scale-like hairs, rather thickly clustering at the base of the elytra, very different in their character and distribution from those on *Altes*.

Decialma.

Subfamily *Cyphaleinæ*.

Antennæ art. penultimis breviter obconicis.
Tibiæ obsolete calcaratæ.
Tarsi lineares, art. ult. elongato.

Head exserted; clypeus broad, separated from the front by a straight groove. Eyes not contiguous to the prothorax, prominent, broad, nearly entire. Antennæ short, slender, the last six joints thicker than the rest, third shorter than the two next together, all, except the last, more or less obconic, the last ovate. Mentum trapezoidal, narrow at the base. Prothorax transverse, broadly emarginate at the apex, slightly foliaceous at the sides. Elytra oblong, slightly depressed; epipleuræ obliquely descending, nearly obsolete towards the apex. Legs short; femora thickened; tibiæ linear, very shortly spurred; tarsi slender, the claw-joint elongate. Prosternum produced behind. Mesosternum with a V-shaped notch.

It is with some hesitation that I propose this as a genus distinct from *Olisthœna*, Er.*, which is unknown to me, but with which it agrees, so far as he has characterized it, with the exception of the antennæ: these he describes as having the penultimate joints longer than they are broad, by which character he differentiates it from *Pachycœlia* (=*Lepispilus*). On the contrary, in *Decialma* the penultimate joints are broader than they are long; and in a subfamily like the Cyphaleinæ, remarkable for a difference of habit without a correlative difference of structure, a character like the above becomes of importance.

Decialma tenuitarsis.

D. oblonga, modice convexa, nitida; capite prothoraceque nigris; elytris fuscis, vage punctatis.

Hab. Victoria.

Oblong, moderately convex, shining; head black, very closely and rather finely punctured, but with few punctures on the clypeus; prothorax black, minutely and sparsely punc-

* Wiegm. Arch. 1842, Bd. i. p. 177.

tured, very short, the sides nearly parallel, but a little rounded anteriorly, anterior angles slightly produced; scutellum brown, curvilinearly triangular; elytra a little broader than the prothorax, parallel at the sides, irregularly covered with small approximate punctures; body beneath and legs glossy chestnut-brown, with minute scattered punctures; antennæ not reaching to the base of the prothorax, and, with the tarsi, dull glossy ferruginous. Length 5 lines.

Barytipha.

Subfamily *Cyphaleinæ.*

Antennæ breviusculæ, art. 8°, 9°, 10° transversis.
Epipleuræ elytrorum postice vix angustiores.
Tarsi subtus apice breviter pilosi.

Head deeply inserted in the prothorax, convex in front; clypeus strongly emarginate, its groove arched. Eyes narrow, transverse, constricted in the middle, distant above. Antennæ rather short, third joint twice as long as the second, fourth to seventh gradually shorter, eighth, ninth, and tenth transverse, the last rounded. Mentum broadly subcordiform, its face concave; lower lip rounded anteriorly. Maxillæ short, the inner lobe strongly hooked. Maxillary palpi securiform, labial subobconic. Prothorax transverse, apex broadly emarginate, anterior angles not produced. Elytra slightly broader than the prothorax at the base, their sides subparallel; epipleuræ, except at the base, nearly equal in width throughout. Legs rather short; tibiæ gradually broader below; tarsi shortly pilose at the apex, basal joint of the posterior not longer than the two next together. Metasternum rather short; interfemoral process narrowly triangular.

The peculiar vestiture of the tarsi (composed of short stiff hairs confined to the apices of the joints) is exceptional, and at once differentiates this genus. Dr. Howitt tells me that the species described below is gregarious in old deserted swallows' nests in hollow and decaying trees.

Barytipha socialis. Pl. XII. fig. 5.

B. fusca (aliquando brunnea), subnitida; elytris fere opacis, subtiliter substriato-punctatis.

Hab. Victoria.

Dark brown, sometimes reddish brown; head and prothorax subnitid, very minutely punctured, the latter regularly but not very convex above; scutellum rather broadly triangular; elytra somewhat opaque, lightly striate-punctate, the punctures minute, approximate, the intervals of the striæ slightly convex, the alternate ones rather more raised; body beneath brownish, the abdomen marked with delicate longitudinal lines; antennæ and tarsi ferruginous, shining. Length 7 lines.

MITHIPPIA.

Subfamily *CYPHALEINÆ.*

Oculi prothorace haud liberi.
Antennæ art. haud transversis, tribus ult. gradatim crassioribus.
Mesosternum amplum, declive, haud excisum.

Head deeply inserted, rounded anteriorly; clypeus separated from the front by a shallow groove. Eyes partly covered by the prothorax, transverse, broad, remote. Antennæ slender, none of the joints transverse, the last three a little stouter than the rest. Mentum trapezoidal, narrowed at the base. Prothorax subquadrate, flattish, broadly emarginate at the apex, with the anterior angles produced, the sides forming a narrow carina. Elytra oblong, slightly depressed; epipleuræ obliquely descending, entire. Legs rather short; femora slightly thickened; tibiæ linear; tarsi with the basal joint of the intermediate and posterior elongate, the last joint of all short. Prosternum rather broad, depressed, not produced behind. Mesosternum large, declivous, not notched.

A degraded form of the Cyphaleinæ, differing from the rest in its simple mesosternum, not notched for the reception of the prosternal process; the mesosternum, notwithstanding, preserves the peculiar hollowed surface which forms one of the characteristics of the subfamily.

Mithippia aurita. Pl. XII. fig. 3.

M. oblonga, depressa, brunnea, subnitida.

Hab. Adelaide.

Oblong, depressed, clear reddish brown, somewhat nitid; head and prothorax very closely covered with oblong, rather small but deep punctures; the latter subquadrate, slightly rounded at the sides anteriorly, but a little incurved behind the middle, a shallow transverse impression towards the base; scutellum semicircular; elytra very closely striate-punctate, the punctures large, square, and placed nearly at equal distances both transversely and longitudinally, and each giving rise to a single recurved hair; body beneath brownish testaceous, shining, with rather crowded piliferous punctures; femora and tibiæ darker, closely punctured; tarsi and antennæ yellowish ferruginous. Length $4\frac{3}{4}$ lines.

*Achthosus** *laticornis.*

A. fusco-castaneus, nitidus; clypeo haud cornuto; prothorace (♂) in medio apicis leviter excavato; antennis art. 6 penultimis valde transversis.

Hab. Clarence River.

Dark chestnut-brown, glossy, slightly convex; head small, a broad triangular excavation between the eyes; clypeus very convex, not horned; antennæ reddish, gradually broader to the seventh joint, the six penultimate very transverse; prothorax broader than long, moderately convex, slightly rounded at the sides, finely punctured, the middle of the apex with an irregular excavation; scutellum small, triangular; elytra deeply striate-punctate, the punctures rather small and not approximate; body beneath reddish brown, glossy; legs paler; anterior tibiæ dilated, serrated externally, and emarginate internally near the base; middle tibiæ rather spined than serrated. Length $5\frac{1}{2}$ lines.

The female differs in the prothorax being without any excavation, the anterior tibiæ without the internal emargination, and the somewhat smaller size. The type of the genus is a much larger and almost cylindrical insect, with a deep excavation occupying nearly the whole anterior portion of the prothorax, and with a short broad horn on the clypeus. I have another species, from New Zealand†, closely resembling the above, but, from its simple prothorax, a lowering of the type. This genus is represented in South America by *Antimachus*, which also includes similarly degraded forms.

Tyndarisus.

Subfamily *Strongyliinæ.*

Antennæ breviusculæ, ad apicem sensim crassiores, art. ultimo præcedente duplo longiore.
Prothorax transversus, lateribus marginato-productus.
Tarsi longissimi, lineares, omnes æquales.

Head small, subvertical, narrower anteriorly; clypeus truncate at the apex; labrum prominent. Eyes broad, vertical, not approximate. Antennæ rather short, a little thicker outwards, the third joint longer than the fourth, the last oval, twice the length of the preceding. Mentum trapeziform; lower lip as large as the mentum, rounded in front, slightly emarginate at the apex; its palpi stout, with the last joint large and subsecuriform. Maxillæ small, outer lobe transverse,

* Pascoe, Journ. of Entom. ii. p. 42. It belongs to the Ulominæ.
† Probably *Uloma lævicostata*, Blanch.

strongly fringed, inner lobe narrow, elongate, and unarmed; the palpi with the last joint narrowly securiform. Prothorax small, transverse, a little expanded at the sides, the pronotum separated from the flanks by a well-marked carina. Elytra very ample, oblong, convex, slightly incurved at the sides; epipleuræ entire and channelled nearly throughout. Legs slender; femora rather short, fusiform; tibiæ thicker below, manifestly spurred, the posterior longest; tarsi slender, as long as or longer than their tibiæ, the anterior as long as the intermediate and posterior, thickly pilose beneath. Prosternum elevated, a little produced behind; mesosternum V-shaped. Intercoxal process triangular.

The state of the subfamily to which this genus belongs is at present one of the most unsatisfactory of all the Heteromera. The typical genus *Strongylium**, which has been recently elaborately monographed by M. Mäklin†, contains 266 species, exclusive of those in English collections; and, as may be supposed, there is no more definite generic idea to be obtained from such a number than there would be from the same number in any one of the so-called genera of the Linnean epoch. Putting, therefore, *Strongylium* aside as merely a designation for a collective number of discrepant forms, the genus before us may be at once distinguished from all others of the subfamily by the great length of the anterior tarsi, which if anything rather exceed the rest in that respect. The prothorax is also very different from anything that obtains in the other genera of this group, except *Dicyrtus* and *Psydus*. I am unable to give the sex of my specimen, or to say if there are any sexual differences. Dr. Howitt has not given me its exact habitat.

Tyndarisus longitarsis. Pl. XII. fig. 1.

T. cupreo-brunneus, nitidus; elytris substriato-punctatis.

Hab. Australia.

Copper-brown, glossy; head distinctly and closely punctured; clypeus imperfectly separated from the front; antennæ extending a little beyond the prothorax, joints five to ten gradually thicker and shorter, of a paler colour, and pubescent; prothorax finely punctured, almost twice as broad as long, rounded at the sides anteriorly, a little incurved behind the middle, with the posterior angles acuminate, the apex slightly emarginate, the base with a broad middle lobe; scutellum curvilinearly triangular, the middle pilose; elytra much broader than the prothorax, and about five times its length, oblong, a

* Established by Kirby, in 1818, in the Trans. Linn. Soc. xii. p. 417.
† Acta Soc. Sci. Fennicæ, viii. p. 117 (1866).

little narrower in the middle, nearly obsoletely striate-punctate, punctures minute, intervals of the striæ feebly raised; body beneath and legs dark brown, glossy, with a thin greyish pubescence. Length 9 lines.

EXPLANATION OF PLATE XII.

Fig. 1. *Tyndarisus longitarsus.*
Fig. 2. *Altes binodosus*: 2 *a*, the same in profile.
Fig. 3. *Mithippia aurita*: 3 *a*, meso- and metasterna.
Fig. 4. *Helæus squamosus.*
Fig. 5. *Barytipha socialis.*
Fig. 6. *Hectus anthracinus.*

[To be continued.]

XXXVIII.—*Notes on a few Hebridean Sponges, and on a new* Desmacidon *from Jersey.* By the Rev. A. M. Norman, M.A.

At the time when my report on Hebridean Dredging was published * the few sponges which had been obtained were still unexamined. So little is yet known of the distribution of the Porifera that any contribution towards a knowledge of their geographical range, however slight, has its value; and for this reason I publish the following brief notes of the species observed in the expedition referred to, not without the hope that the extreme imperfection of this record may induce naturalists who may hereafter visit the Hebrides to pay some attention to this much neglected branch of marine zoology.

Class **Porifera.**

Order Calcarea.

Grantia compressa (Fabr.).

G. ciliata (Fabr.). This and the foregoing common between tidemarks, Tobermory and Oban.

G. ensata, Bow. A rare species, only previously observed in the Channel Islands. A specimen found between tidemarks at Tobermory identified by Dr. Bowerbank.

Leucosolenia coriacea (Montagu). This species seems to vary marvellously in colour. In other localities I have found it white and of a bright lemon-colour; but as found at Tobermory it was violet; and yet further in the 'British

* "Report of the Committee appointed for the purpose of Exploring the Coasts of the Hebrides by means of the Dredge.—Part II. On the Crustacea, Echinodermata, Polyzoa, Actinozoa, and Hydrozoa," Report of the British Association, 1866 (1867), pp. 193–206.

Spongiadæ' it is recorded as dark crimson, dirty bluish-grey, and deep nut-brown!

Leuconia nivea (Grant). Tidemarks, Tobermory.

Order Silicea.

Normania crassa, Bowerbank. This is a new genus, of which a description will be found in my Shetland Dredging Report [*vide* British Association Report, 1868 (1869)]. The type specimen measures six inches long, two and a quarter high, and rather less across. It is massive, but shows a tendency to assume a cup-like form. The Minch specimen is one inch and a half long and as much in height, and is massive. It is not in such fine condition as the type, having been rolled and somewhat water-worn. The genus is intermediate in character between *Pachymatisma* and *Ecionemia*.

Polymastia mamillaris (Müller). Dredged in the Minch; specimens small.

Tethea cranium (Müller). Dredged in the deeper parts of the Minch, where it occurs in company with many other species which are found associated with it in the Shetland seas,—e. g. *Phakellia ventilabrum*, *Isodictya infundibuliformis* and *laciniosa*, *Normania crassa*, *Trochus occidentalis*, *Chemnitzia eximia*, *Scissurella crispata*, *Crangon serratus*, *Hippolyte cultellata*, *Caberea Ellisii*, *Lepralia polita*, *laqueata*, and *crystallina*, *Idmonea atlantica*, *Hornera borealis*, &c., which species, with three exceptions, are not as yet known to occur further south than the Minch.

Dictyocylindrus stuposus (Ellis & Sol.). Young specimens, but in very fine condition, dredged in the Minch.

Phakellia ventilabrum (Linn.). Very fine in the Minch.

Hymedesmia radiata, Bow. On a valve of *Pecten islandicus* dredged in the Minch. The type and only other known specimens are from the Shetland Haaf.

Hymeniacidon aurea (Montagu). Between tidemarks, Tobermory; the specimens of a scarlet colour.

H. ficus (Esper). A small specimen, between tidemarks, Oban; the first time that I have met with the species under such circumstances.

Cliona celata, Grant. Dredged in the Minch and Sleat Sound.

Halichondria panicea (Pallas). Tidemarks, common, as everywhere.

H. Pattersonii, Bow. Off Loch Ewe, in company with *Antedon celticus*, *Holothuria intestinalis*, *Poromya granulata*, and other interesting animals, in some abundance. Colour a very dark brown.

"*Halichondria expansa*, Bowerbank, n. sp.

"Sponge compressed, expanding laterally, parasitical. Surface smooth and even. Oscula simple, minute, dispersed. Pores inconspicuous. Dermis furnished with a stout irregular network; rete composed of broad flat polyspiculous fasciculi; spicula fusiformi-cylindrical, terminations incipiently spinous, spines very minute; tension-spicula acerate, long, and slender, frequently flexuous, basal terminations incipiently spinous, few in number; retentive spicula bidentate, inequianchorate, minute, and few in number. Skeleton rather compact; rete variable, containing from one or two to five or six spicula; spicula fusiformi-acerate, rather stout, incipiently entirely spinous, base prominently spinous. Interstitial membranes pellucid; tension and retentive spicula the same as those of the dermal membrane, few in number. Gemmules membranous, aspiculous.

"Colour in the dried state dark brown.

"*Hab.* Skye (Rev. A. M. Norman).

"Examined in the dried state."

The type specimen is attached to the hydrocaulus of *Diphasia pinaster*, dredged in the Sound of Skye, in the form of two triangular expansions, each about three-quarters of an inch in the greatest diameter.

Isodictya cinerea (Grant). This is another species which seems to vary greatly in colour. The Tobermory examples were brown.

I. infundibuliformis (Johnston). In deep water, the Minch.

I. laciniosa, Bowerbank, n. sp. [*vide* Norman, Shetland Dredging Report, Brit. Assoc. Report, 1868 (1869)]. The Shetland type on which this species is established is one of the largest and, at the same time, one of the most elegant of British Porifera. A small water-worn fragment procured in the Minch gives proof of the existence of the species among the Hebrides.

Order Keratosa.

Chalina seriata (Grant). Tidemarks, Tobermory, on the underside of large stones.

Dysidea fragilis (Montagu). A very curious form of this species occurred between tidemarks at Tobermory. It incrusts stones with a thin layer, and is almost entirely devoid of the particles of sand which are generally found abundantly incorporated in the substance of the Sponge.

It will be seen in the foregoing list how strongly the northern influence shows itself in the Sponges of this part of the west of Scotland; at the same time I think that we may perhaps see, in the presence of *Leuconia nivea*, *Grantia ensata*, and *Chalina seriata*, evidence of the same intermixture of southern and northern forms among the Porifera which we know to occur in other classes of the Hebridean invertebrata.

I take this opportunity of publishing the description of a new sponge from Jersey. The specimen was procured in 1859; and having recently examined it I found it to differ from other species known to me, and therefore sent it to Dr. Bowerbank for his opinion. He has kindly supplied me with the following description:—

"*Desmacidon copiosus*, Bowerbank, n. sp.

"Sponge sessile, coating. Surface rugged and uneven. Oscula simple, dispersed. Pores inconspicuous. Dermis subcrustaceous; dermal membrane pellucid, profusely spiculous, furnished with a stout irregular network; rete polyspiculous, areas abundantly supplied with spicula; tension-spicula tricurvate, acerate, small and slender, equicurvate, rather numerous; retentive spicula simple, contorted, and reversed bihamate, very numerous and rarely biumbonate-bihamate, large and stout; also inequidentato-palmate anchorate, and bidentate inequianchorate, both forms very minute and few in number, dispersed. Skeleton irregular and very open; fibre stout; spicula subclavate, fusiformi-acerate, stout, and very fusiform; areas large and profusely spiculous; tension-spicula subclavate, fusiformi-acerate, long and slender, exceedingly numerous and closely matted together; also tricurvate acerate, small and slender, few in number; retentive spicula the same as in the dermal membrane, but more copiously distributed. Gemmules membranous, aspiculous.

"Colour in the dried state cream-white.

"*Hab.* Jersey (Rev. A. M. Norman, 1859).

"Examined in the dried state."

XXXIX.—*On the* Ehretiaceæ.

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

[Continued from p. 210.]

Crematomia.

I have already alluded to this group of plants, which I have separated from *Ehretia*: it forms a series distinguished by very salient characters, the type of which is the *Bourreria exsucca* of Jacquin, a plant hitherto very indistinctly described and confounded with others. From a flower of the original typical plant, contributed by Jacquin himself, from herbarium specimens, and assisted by an analytical drawing of the structure of the fruit taken from a living plant, I have been enabled to complete the characters of the genus here proposed under the title of *Crematomia*, a name derived from *κρεμάω*, *suspendo*, and *τομή*, *sectio*, on account of its four carpellary achenia, suspended by stiff threads from the summits of a divided free axile column, somewhat after the manner of the suspended carpels in *Gouania*, many *Cruciferæ*, *Umbelliferæ*, and *Geraniaceæ*. The calyx is constructed as in *Bourreria*, only that its valvate segments adhere more firmly together, often splitting irregularly, by the swelling of the corolla and fruit, into two or three unequal divisions. The corolla is tubular and fleshy, with a border of five orbicular segments; shortly unguiculated and cordately auriculated at their base; the stamens are often pilose at their base, with anthers like those of *Bourreria*; so also is the style, only that it is always more deeply cleft for a distance never less than one-fourth of its length. The ovary is subconical, seated on a fleshy disk, and has a placentation similar to that already described in *Rhabdia*, *Cortesia*, *Ehretia*, and *Bourreria*. The drupaceous fruit has a thick coriaceous pericarp, that falls away, leaving a quadrately obovate cremocarp, which ultimately splits along its four angles, at first into two and afterwards into four equal achenia, angular within, flattish on the dorsal face, and somewhat winged on the margins, the dorsal side being thick and of a remarkable spongioid texture, composed of numerous very long narrow cells, which radiate towards the periphery, all covered by a reticulated membrane. A slender central column is found in the axis, which splits to the base into two parts that again subdivide, forming four equal, erect, rigid, aristiform supports, which are suddenly reflected at the summit into as many rigid funicular chords, whence the achenia are suspended at a point near their base. It is requisite that the fruit should dry in the open air to exhibit this structure completely. Upon the branch, after the fall of the leaves, the panicle remains, the pericarp dries and falls off, the carpels separate and are seen hanging from their spreading funicular supports; and when at length the achenia drop off, the divided column remains, supported by the persistent unequally ruptured calyx. In the ventral angle of each achenium is an indehiscent, somewhat osseous cell, of half its length, of an oblong shape; and upon one of its sides there is a longitudinal narrow channel, filled with soft matter and nutrient vessels which penetrate into the cell below its apex, and to which the single terete seed is attached in a manner similar to that described in *Rhabdia*. The lateral large open foramen leading into a pseudo-cell, a characteristic feature in *Bourreria*, is altogether wanting in *Crematomia*—a circumstance that affords a ready distinction between the two genera, which otherwise much resemble one another. This structure of the flower, ovary, and fruit renders *Crematomia* a valid genus of the *Ehretiaceæ*. The achenia, with their pericarpial covering, are well depicted in Richard's drawing of a Cuban plant.

All the known species of *Bourreria* are confined within the limit of the West-India Islands; several belonging to *Crematomia* have a similar origin; but one-half of its known species extend into the Columbian portion of the continent and into Mexico.

Crematomia, gen. nov.—*Calyx* tubulosus, ad medium in dente 5 acutos divisibilis, dentibus intus pilosulis, marginibus dense tomentosis, æstivatione valvatis, primum firme adhærentibus, demum segregatis, aut sæpe in lobis 2–3 inæqualibus constans, persistens. *Corolla* tubulosa, carnosula, *tubo* quam calyx longiore, fauce paulo ampliore, *limbo* 5-partito, laciniis orbicularibus vel ovalibus, imo brevissime unguiculatis et rotundatim cordato-auriculatis, patentibus, æstivatione quincuncialiter imbricatis. *Stamina* 5 (rarius 6), laciniis alterna, tubo inserta; *filamenta* imo latiora, hic dense pilosa aut sparse pilosula, superne gradatim filiformia, exserta; *antheræ* 2-lobæ, lobis oblongis, fusco-coriaceis, a medio segregatis, superne collateraliter adnatis, in sinu oscillatorie affixis, lateraliter rima longitudinali alba utrinque dehiscentibus: *pollen* granosum, globosum, granis pulveri farinoso niveo immersis. *Ovarium* conico-oblongum, *disco* brevi suffultum, striatum, glabrum, semiseptis 2 oppositis, parietalibus, utrinque bilamellatim reflexis, marginibus *ovulum* amplectentibus, hinc pseudo-4-loculare et 4-ovulatum. *Stylus* simplex, exsertus, apice fere ad medium 2-fissus, ramis rectiusculis, *stigmate* subpeltato singulatim munitis.

Drupa majuscula, globosa, calyce persistente suffulta: *pericarpium* crasse coriaceum, utrinque nitens, maturitate deciduum; *mesocarpium* parcum, subcarnosum: *cremocarpium* persistens, sub-4-gonum, in achenia 4 primum bigemina, demum omnino solubile; *achenia* ventre angulata, extus subplana aut paulo convexa, lateribus subalata, *endocarpio* dorsali amplo, spongioso-reticulato, e cellulis plurimis vacuis elongatis radiatim centrifugis conflato, angulo ventrali 1-locularia, 1-sperma, loculis oblongis, subosseis, indehiscentibus, latere unico summum versus foramine parvo (intra canalem angustum vasiferum e basi adscendentem) perforatis: *columella* centralis, principio ad basin bipartita, mox iterum fissa in carpophora 4 rigida tenuia erecta ad summum adscendentia; hæc subito reflexa, chordas filiformes liberas ad achenia infra medium affixas simulant, et hoc modo achenia libera in aere suspensa sunt: *semen* teres, loculum implens, e foramine suspensum, structura eadem ac id *Bourreriæ*.
Arbores *et* arbusculæ *in America tropica et in Antillis indigenæ:* folia *alterna, oblonga, petiolata:* paniculæ *corymbosæ, terminales, sæpius laxe ramosæ;* flores *albi, mediocres, interdum majores:* drupæ *majusculæ, sæpius rubræ.*

1. *Crematomia Cumanensis*, nob.;—Rhamnus Cumanensis, *Loefl. Itin.* 182;—Ehretia exsucca, *Linn. Sp.* 275; *Willd. Sp.* i. 1078; *DC. Prodr.* ix. 508;—Ehretia cymosa, *Willd.* (*non Poir. nec Thonn.*) *in R. & Sch.* iv. 805; *DC. l. c.* 511;—arborescens, ramis teretibus, fusco-cinerascentibus, glabris, lenticellatis; foliis obovatis, acutis, imo cuneato-attenuatis, coriaceis, supra minute scabridulo-pilosulis, subtus pallidioribus, opace brunneis, glabris, minute rugulosis, marginibus paulo revolutis; petiolo tenui, sulcato, limbo 12–14-plo breviore: corymbis terminalibus, pedunculatis, dichotome multiramosis, compresso-angularibus, glabris; floribus brevissime pedicellatis, bracteolatis; calyce coriaceo, glabro, inæqualiter 2–3-fido; corolla infundibuliformi, tubo calyce duplo longiore, lobis suborbicularibus, imo auriculato-cordatis, patentibus, filamentis paulo supra basin insertis, imo dilatatis et villosulis, mox filiformibus, ciliatis, longe exsertis; antheris linearibus, imo fissis, in sinu oscillatoriis; stylo tenuissimo, longe exserto, pro quarta parte bifido; drupa 4-gone globosa, 4-pyrena, pyrenis dorso spongiosis.—In Venezuela: *v. s. in herb. Mus. Brit.*, Cumana (Moritz, 383).

A tree twenty feet high, called by the natives Guatacaré; its leaves are 3–3½ inches long, 1½ inch broad, on a petiole 3 lines long: the panicle is 4 inches long and broad; the calyx is 4 lines long, glabrous, striated, the tube of the corolla 9 lines long, the lobes of the border 4 lines in diameter; the stamens exserted 4 lines beyond the mouth; the anthers $1\frac{1}{2}$ line long; the style as long as the stamens.

2. *Crematomia grandiflora*, nob.;—Ehretia grandiflora, *Poir. Dict. Suppl.* ii. 3; *R. & Sch. Syst.* iv. 529; *DC. Prodr.* ix. 510;—ramulis patentibus, teretibus, substrictis; foliis ovatis, apice obtusis, imo attenuatis, inæquilateris, nervosis, utrinque glabris, subtus reticulatis, breviter petiolatis: paniculis corymbosis, terminalibus; calyce 5-dentato, subpubescente, cinereo; corollæ magnæ tubo calyci æquilongo, lobis longioribus, ovatis, patentibus, rubellis; antheris oblongis, oscillatoriis; stylo apice bifido.—In Antillis, ins. S. Domingo (*non vidi*).

This species appears to differ from *C. Guatimalensis* (*Bourreria grandiflora*, Griseb.) in its smaller, more oval leaves, and a corolla with larger reddish lobes. The leaves are about 2 inches long, $1\frac{1}{2}$ inch broad.

3. *Crematomia Guatimalensis*, nob.;—Beurreria grandiflora, *Bertol. Fl. Guat.* 10 (*non Griseb.*);—Ehretia Guatimalensis, *DC. Prodr.* ix. 507;—ramulis apice subpubescentibus; foliis ellipticis vel elliptico-oblongis, utrinque acutis, basi angustioribus, utrinque subglabris vel e tuberculis minutis obsolete scabridulis, planis, nervis tenuibus, immersis, supra opacis, subtus pallidioribus; petiolo subtenui, canaliculato, glabro, limbo 6-plo breviore: panicula corymbosa terminali, dichotome ramosa, ramis angulato-compressis, pubescentibus, bracteolis foliolosis, ovato-lanceolatis; calyce e laciniis cohærentibus irregulariter 2–3-fido, coriaceo, extus glabro, intus subsericeo; corollæ albæ tubo infundibuliformi, calyce triplo longiore, fauce ampla, limbi lobis suborbiculari-ovatis, imo cordato-auriculatis, patentibus; filamentis paulo supra basin tubi insertis, imo dilatatis et villosis, exsertis; antheris fusco-coriaceis, mucronatis, rima nivea utrinque dehiscentibus, oscillatoriis; stylo stamina æquante, apice bifido.—In Guatemala et Venezuela: *v. s. in herb. Mus. Brit.*, La Guayra prope Las Cadugras (Moritz, 907).

As the above characters, drawn from the Venezuelan plant, accord, with few exceptions, with the description given by Bertoloni of his species from Guatemala, I have referred it there. It differs from the preceding species, with which Dr. Grisebach confounds it (Cat. Pl. Cub. p. 204) in the much larger tube of the corolla, which is white (not reddish). The *Beurreria grandiflora* of that botanist, from Cuba (Wright, 3122), without any description, I believe to be a very different plant, though I have not seen it.

The axils are $\frac{3}{4}$–$1\frac{1}{4}$ inch apart; the leaves are $3\frac{1}{2}$ inches long, $1\frac{3}{4}$ inch broad, on a petiole 7 lines long: the panicle is diffusely branched, has spathulately linear deciduous bracts, 2–5 lines long, all pubescent; the pedicels are 1 line long; the calyx is 4 lines long; the tube of the corolla 1 inch long, the lobes of the border $\frac{1}{2}$ inch long.

4. *Crematomia Guildingiana*, nob.;—ramis teretibus, subglabris, superne parce puberulis, cum axillis ramulorum ultimorum valde approximatis; foliis elliptico-oblongis, apice sensim acutis, imo acutioribus, utrinque glabris, opacis, supra fusco-viridibus, nervis subimmersis, subtus pallidioribus, nervis prominulis, marginibus vix revolutis; petiolo sulcato, obsolete puberulo, limbo 8-plo breviore: panicula corymbosa, terminali, dichotome expansa, ramis subcompressis, subglabris; pedicellis brevibus; calyce coriaceo, 5-dentato, aut inæqualiter subtrilobo, extus adpresse puberulo; corollæ tubo infundibuliformi, calyce plusquam duplo longiore, lobis obtuse ovatis, imo breviter cordato-auriculatis, expansis; filamentis supra basin tubi insertis, imo dilatatis et villosis, mox puberulis, sursum filiformibus, paulo exsertis; antheris sublinearibus, rugulosis, mucronatis, imo divergentibus, oscillatoriis; stylo exserto, tenuissimo, apice pro quarta parte bifido; ovario disco insito; drupa carnosa, acheniis 4 demum segregatis, e carpophoris suspensis, dorso spongiosis.—In Antillis: *v. s. in herb. Hook.*, in flore et fructu, ins. S. Vincenti (Guilding, cum icone e plant. viv.).

The details shown in the analytical drawing of the Rev. W. Guilding, in regard to the peculiar mode of suspension of the achenia, are amply confirmed by the specimen which accompanies it; but he does not appear to have seen the pericarpial covering of the fruits, which had fallen away at the period when he gathered the plant: this deficiency, however, is supplied by the Cuban specimens of *Crematomia calophylla*, and by Richard's drawing of the same. It is now easy to understand the rough and incomplete sketch by Jacquin of the fruit of his *Beurreria exsucca*, which it was impossible to comprehend before, in the absence of any specimen.

The branchlets are stout, 3 lines in thickness, with axils $\frac{1}{2}$–$\frac{3}{4}$ inch apart; the leaves are $2\frac{1}{2}$–3 inches long, $1\frac{1}{4}$–$1\frac{3}{4}$ inch broad, on a petiole 4 lines long. The corymb is $2\frac{1}{2}$–3 inches long; the calyx 3 lines long; the tube of the corolla 8 lines long, the lobes 5 lines long; the filaments 8 lines long; the ovary and style 12 lines, the segments of the latter $2\frac{1}{4}$ lines;

the achenia are 7 lines long, $5\frac{1}{2}$ lines broad, narrowing upwards and somewhat cordately inflected at the base; the cell and its contained seed are 3 lines long.

5. *Crematomia Jacquiniana*, nob.;—Beurreria exsucca, *Jacq. Amer.* 45, tab. 173. fig. 17; *Lam. Dict.* i. 527;—Ehretia exsucca, *Linn. Sp.* 275; *DC. Prodr.* ix. 508;—arborescens, ramis interdum subscandentibus; foliis ovatis, acutis, glaberrimis, petiolatis: corymbis racemosis, subterminalibus; floribus pedicellatis, albis, suaveolentibus; calyce urceolato, irregulariter trifido, extus glabro, laciniis intus villosis; corollæ tubo calyce triplo longiore, lobis suborbicularibus, imo auriculato-cordatis, cum tubo crassiusculis, patentibus; filamentis infra medium insertis, longe exsertis; antheris acutis, oscillatoriis; stylo apice bifido, exserto; fructu (delapso pericarpio?) sec. Jacq. viridi, 4-gono, apice obtuse angustato, 4-sulcato, ad angulos partibili, demum in achenia 4 libera in arbore persistentia soluto.—In Nova Granada ad Carthagenam: *v. s. in herb. Mus. Brit.* (flos tantum, ab ipso Jacq. communicatus).

This species, which is clearly identified by the flower sent by Jacquin, differs from the others I have seen, in its more fleshy texture and different proportions. It differs from all in its subscandent habit and the country of its origin; it agrees with *Ehretia grandiflora*, Poir., in the size of its leaves, but differs in its white (not reddish) flowers, which have a much longer tube and shorter lobes.

It is a tree fifteen feet high; its leaves are 2 inches long; the calyx is $2\frac{1}{2}$ lines long, the tube of the corolla 6 lines long, 1 line broad at its base, 5 lines in diameter in the mouth; the lobes are 4 lines in diameter, much overlapping one another by their auricular bases; the stamens extend $2\frac{1}{2}$ lines, the style 3 lines beyond the mouth.

6. *Crematomia venosa*, nob.;—ramulis teretibus, subvirgatis, striatis, glabris; foliis ovatis, apice rotundatis, mucronatis aut emarginatis, imo obtusis, subinæquilateris, in petiolo breviter subito decurrentibus, undique glaberrimis, supra viridibus, costa sulcata, nervis divergentibus rubellis arcuatim nexis, prominule reticulatis, subtus pallidioribus, nervis rubescentibus et prominulis, planis, marginibus paulo repando-sinuleatis; petiolo crassiusculo, sulcato, glabro, limbo 4–8-plo breviore: panicula terminali, laxe ramosa, ramis dichotomis, divergentibus, compressis, glabris; bracteis valde deciduis; floribus fere sessilibus; calyce extus obsolete puberulo, 5-dentato, dentibus acutis, intus cano-subsericeis;

corollæ tubo calyce longiore, lobis ovalibus, imo auriculatis; filamentis medio tubi insertis, parce scabridule pilosulis, exsertis; antheris coriaceis, fuscis, rugosis, submucronatis, oscillatoriis; stylo pro tertia parte bifido.—In Antillis: *v. s. in herb. Hook.*, Jamaica (Dr. Alex. Prior).

The branches are 1 or 2 lines in thickness, their axils are $\frac{1}{2}$–$\frac{3}{4}$ inch apart; the leaves are $3\frac{1}{4}$–$3\frac{3}{4}$ inches long, 2 inches broad, on a petiole 5–10 lines long. The terminal, very spreading panicle is 5 inches long (including the peduncle of $1\frac{3}{4}$ inches) and equal in breadth: the flowers are in bud, the calyx being 3 lines long.

7. *Crematomia calophylla*, nob.;—Ehretia calophylla, *Rich. in La Sagra, Fl. Cub.* ii. 112, tab. 61; *Walp. Ann.* v. 541;—Bourreria reticulata, *Griseb. Cat. Pl. Cub.* 210;—ramulis angulato-compressis, glabris; foliis oblongis, apice rotundatis, imo obtuse attenuatis et paulo inæquilateris, rigidis, subcoriaceis, utrinque glaberrimis, supra læte viridibus, lucidis, aut interdum maculis albis crebris pustulatis (nullo modo scabris), costa rubella, nervis valde divaricatis reticulatis, subtus pallidioribus, flavide glaucis, costa crassa nervisque valde prominentibus, marginibus paulo revolutis; petiolo subvalido, sulcato, rigido, glabro, limbo 3–5-plo breviore: panicula terminali, valde expansa, dichotome ramosa, glaberrima, ramis longis, validis, striato-compressis; calyce crasso-coriaceo, glabro aut obsolete piloso, acute 5-dentato, dentibus margine tomentosis, imo bractea lineari æquilonga decidua donato; corollæ tubo calycem æquante, intra pubescente, lobis oblongis, rotundatis, imo brevissime auriculatis, tubo paulo longioribus; filamentis imo dilatatis et pubescentibus, sub fauce insertis, cum costis totidem pilosulis continuis, exsertis; antheris mucronatis, lobis oblongis, superne adnatis, ad medium divaricatis, in sinu oscillatoriis; stylo hos attingente, ad medium bifido; drupa majuscula, globosa; pericarpio coriaceo, utrinque nitido, pulpa paucissima; acheniis 4 dorso spongiosis, columella centrali affixis.—In Antillis: *v. s. in herb. Hook.*, Cuba (specim. typ. a La Sagra commun.); Cuba (Wright, 3124); *in herb. Mus. Brit.*, Cuba (Wright, 3124, sub nom. *B. reticulata*).

I can perceive no essential difference between La Sagra's typical specimen and Wright's plant, which Dr. Grisebach made a separate species, both (especially the Museum specimen) agreeing admirably with Richard's drawing. It is described as a small tree, the branches being furnished with large shining leaves, approximated towards their extremities: the leaves are 3–5 inches long, $1\frac{1}{2}$–$2\frac{1}{2}$ inches broad, on a stiff petiole 1–$1\frac{3}{4}$ inch long. The panicle is longer and stouter in fruit, when it is $6\frac{1}{2}$ inches long and broad, with long, thick, divaricating branches, the peduncle being $2\frac{1}{2}$ inches long; the articulated pedicels are $\frac{1}{2}$ line long; the calyx 3 lines long, the tube of the corolla 2 lines, its lobes $3\frac{1}{2}$ lines long; the filaments are subpuberulous; the drupe is 9 lines long, 8 lines in diameter, supported on the stellated coriaceous calyx; the achenia correspond in structure with the generic character.

8. *Crematomia coriacea*, nob.;—ramulis angulato-striatis, glabris, rubescentibus; foliis ovatis, apice rotundis et mucronulatis, imo rotundis et breviter auriculato-cordatis, coriaceis, undique glaberrimis, supra subpallidis, in costa nervisque valde divaricatis sulcatis, aut profundius valleculatis, venis grossis minute reticulatis, marginibus subrevolutis, subtus concoloribus, nitidiusculis, costa nervisque transversim venosis valde prominentibus; petiolo crasso, semitereti, supra sulcato, ruguloso, limbo 10-plo breviore: panicula laxe corymbosa, terminali, dichotome ramosa, ramis longiusculis, compressis, nitentibus, rubellis, glabris. —In Antillis: *v. s. in herb. Hook.*, Cuba (La Sagra).

This is very different from *C. calophylla*, to which it was referred by De Franqueville, who obtained the specimen from La Sagra. It is fructiferous, from which all the drupes have fallen. The species is remarkable for its oval, thick, coriaceous leaves, which are cordate at base, with two imbricated auricular lobes, and are deeply channelled along the midrib and unusually spreading nervures. The branchlets are thick, with axils $\frac{1}{2}$–1 inch apart; its leaves are $2\frac{1}{2}$–$3\frac{1}{4}$ inches long, $1\frac{1}{2}$–$2\frac{1}{2}$ inches broad, on a very stout petiole 3–4 lines long; the spreading panicle is $3\frac{1}{2}$ inches long.

9. *Crematomia attenuata*, nob.; — Bourreria Domingensis, *Griseb. in Flor. Brit. W. Ind.* 482; — Bourreria calophylla, *Griseb. Cat. Pl. Cub.* 209; *Pl. Wright. Cub.* 528;—Bourreria tomentosa, *Griseb.* (*non Don*) *Cat. Pl. Cub.* 209;—ramulis glaucis, rugulosis, glabris; foliis late ovatis aut ovato-oblongis, apice rotundatis vel paulo obtusis, subacutis et mucronulatis, a medio ad imum cuneatim angustatis, supra glaberrimis aut costam sulcatam subpuberulis, læte viridibus, nitentibus, reticulatis, nervis tenuibus, subtus pallide glaucis vel dealbatis, glandulis minutissimis nitentibus sæpe munitis, costa puberula, marginibus subrevolutis; petiolo superne sulcato, glabro, limbo

5–7-plo breviore: panicula terminali, dichotome ramosa, cinereo-tomentosa, folio paulo breviore, bracteis minutis, valde deciduis; calyce 5-dentato, cano-sericeo; corollæ tubo calyce dimidio longiore; staminibus paulo supra medium tubi insertis, exsertis; stylo pro tertia parte bifido; drupa globosa, calyce stellato suffulta, cerasi mole, pyrenis 4 generis.—In Antillis: *v. s. in herb. Hook.*, Jamaica, Albion Pen (Dr. Alex. Prior); Cuba (Wright, 3120, in flore); ibid. (Wright, 3124 *a*, in fructu).

Dr. Grisebach has referred the first-mentioned specimen to *Bourreria Domingensis*, the second to *B. tomentosa*, and the third to *B. calophylla*, all which species differ extremely from the species under consideration, which is well marked by the characters above given. The leaves in the Jamaica specimen are a little broader and more rounded at the apex; but they are all in like manner much cuneated at the base. The drupe is smaller than in *Crematomia calophylla*; but its achenia prove that it belongs to the same genus, and not to *Bourreria*, certainly not to either of the above-mentioned species. Its leaves are 2½–4 inches long, 1¼–2¾ inches broad, on a petiole 4–7 lines long.

10. *Crematomia elongata*, nob.;—ramulis compresso-teretibus, subnitidis, junioribus subtomentosis; foliis lanceolato-oblongis, apice sensim obtuse angustatis, imo cuneatis aut obtusiuscule attenuatis, supra e tuberculis parvis demum albidis adpresse scabrido-pilosis, nervis tenuibus immersis, subtus pallidioribus, glauco- vel ferrugineo-tomentellis, nervis paulo prominentibus, marginibus revolutis; petiolo tenui, canaliculato, recto, puberulo, limbo 6-plo breviore: panicula terminali, dichotome ramosa, cinereo-tomentosa, folio vix longiore; calyce 5-dentato, velutine puberulo, dentibus intus sericeis; corollæ tubo calyce paulo longiore, lobis suborbiculatis, imo cordato-auriculatis; staminibus medio tubi insertis, antheris oscillatoriis, exsertis; stylo pro tertia parte bifido, stigmatibus peltato-clavatis.—In Antillis: *v. s. in herb. Hook.*, Jamaica (Bancroft); ibid. (Macfadyen).

A species distinguishable by its very elongated leaves, which are 3–4½ inches long, 1¼–1¾ inch broad, on a petiole 6–9 lines long.

11. *Crematomia formosa*, nob.;—Ehretia formosa, *DC. Prodr.* ix. 510;—ramulis teretibus, striatis, glabris, axillis approximatis; foliis divaricatis, ellipticis, apice subacutis, imo acutiuscule vel obtuse attenuatis, submembranaceis, supra opacis, subnitidis, glabris vel in nervis tenuibus immersis

tantum puberulis, subtus pallidioribus, cinereo-glaucis, sparse puberulis; petiolo tenuissimo, striato, superne puberulo, limbo 4–5-plo breviore: paniculis corymbosis, terminalibus, ramulis tenuibus, compressis, pallidis, glabris; floribus speciosis; calyce turbinato, 5-dentato, extus brevissime tomentoso, intus cano-sericeo; corollæ carnosulæ tubo calyci æquilongo, lobis patentibus, rotundis, imo cordato-auriculatis, tubo duplo longioribus; filamentis subulatis, pilosulis, imo villosis, supra basin tubi insertis; antheris divaricatis, oscillatoriis, longiuscule exsertis; stylo ultra tertiam partem bifido, stigmatibus peltato-clavatis.—In Mexico: *v. s. in herb. Hook.*, Tehuantepec, prov. Oaxaca (Andrieux, 201); Sierra Pedro Nolasco (Jungensen, 710).

A tree thirty feet high, with branchlets $1\frac{1}{2}$ line thick, and axils 3 lines apart; leaves $2\frac{1}{2}$–$3\frac{1}{2}$ inches long, $1\frac{1}{2}$–2 inches broad, on a slender divaricating petiole 5–10 lines long; the panicle is $2\frac{1}{4}$ inches long, with stiff spreading branches: calyx 3 lines long; tube of corolla the same length, its lobes 6 lines long.

12. *Crematomia revoluta*, nob.;—Bourreria revoluta, *H.B.K.* iii. 67;—Ehretia revoluta, *DC. Prodr.* ix. 507;—ramulis subteneris, teretibus, glabris; foliis oblongo-ovatis, apice rotundatis aut valde obtusis, imo cuneatis, crasso-coriaceis, supra profunde viridibus, lucidis, rude reticulatis, in costa rubescente sulcatis, undique glaberrimis, subtus pallidioribus, subrugulosis, nervis venisque reticulatis paulo prominentibus, marginibus revolutis; petiolo glabro, canaliculato, limbo 8-plo breviore: panicula racemosa, terminali, pauciflora; calyce carnosulo, 5-dentato, extus adpresse pilosulo; corollæ tubo calyce paulo longiore, lobis ovatis, imo auriculatis, dimidio brevioribus; staminibus medio tubi insertis, imo tuboque illinc pilosis, paulo exsertis; stylo pro tertia parte bifido; drupa globosa, rubra, pyrenis 4 bigeminis.—In Antillis (hacienda de Regla, Cuba): *v. s. in herb. Hook.*, S. Domingo (Schomburgk).

A species easily distinguished from all others: its axils are about $\frac{1}{2}$ inch apart; the leaves are $1\frac{1}{2}$–2 inches long, $\frac{7}{8}$–1 inch broad, on a slender petiole $2\frac{1}{2}$ lines long. The terminal panicle does not exceed an inch in length; the calyx is 3 lines long; the cylindrical tube of the corolla 4 lines, the lobes of the border $2\frac{1}{2}$ lines long; the subglobose drupe is 7 lines in diameter.

13. *Crematomia molliuscula*, nob.;—ramulis tenuibus, e foliis delapsis nodulosis, compressis, cinereo-tomentellis; foliis

ellipticis, utrinque sensim subacutis, apice sæpe obtusioribus, supra opacis, e tuberculis minutis scabride pilosulis, nervis tenuissimis immersis, obscure reticulatis, subtus pallidioribus, tomentellis, in costa nervisque vix prominulis canopubescentibus; petiolo tenui, superne sulcatulo, cano-tomentoso, limbo 8-plo breviore: panicula terminali, corymbosa, folio breviore, tomentosa, dichotome ramosa, pauciflora, ramulis bracteis parvis sublanceolatis donatis; calyce fere sessili, 5-dentato, submembranaceo, extus cano-sericeo, intus puberulo; corollæ tubo subinfundibuliformi, calyce paulo longiore, lobis ovalibus, imo breviter auriculatis, tubo paulo brevioribus, patentibus; filamentis imo pilosiusculis, medio tubi insertis; antheris mucronatis, imo cordatis, longe exsertis; stylo ad tertiam partem bifido.—In Antillis: *v. s. in herb. Hook.*, Jamaica (Macnab); ibid. (Macfadyen).

A species differing from *C. velutina* in its larger, more fusiform leaves which are minutely scabridulo-pilose above, in the longer tube of its corolla, in the insertion of the filaments, and mucronate anthers. The axils are 3–4 lines apart; the leaves are 2½–4½ inches long, 1⅝–2¼ inches broad, on a petiole 4–7 lines long; the panicle is 1½–2 inches long; the calyx is 2½ lines long, with rather long acute teeth; the tube of the corolla 3 lines, its lobes 2½ lines long.

14. *Crematomia velutina*, nob.;—Ehretia velutina, *DC. Prodr.* ix. 508;—ramulis teretibus, substriatis, cinereo-tomentosis; foliis ovato-oblongis, obtusis, submucronulatis, imo subacutis, sæpe canaliculatim recurvis, supra opacis, velutino-pilosulis, in costa nervisque cano-pilosis, subtus paulo pallidioribus, cinereo-tomentosis; petiolo tenui, cano-tomentoso, limbo 7-plo breviore: panicula corymbosa, terminali, brevi, pauciflora, tomentosa; calyce submembranaceo, cano-pubescente, 5-dentato, dentibus submucronatis, intus velutinis; corollæ tubo calyce paulo longiore, infra medium ad insertionem staminum pilosulo, lobis subrotundis, imo auriculato-cordatis; filamentis imo pubescentibus; antheris coriaceis, rugosis, basi divergentibus, exsertis; stylo fere ad medium bifido.—In Antillis: *v. s. in herb. Hook.*, Jamaica, Port Henderson (Lane).

Its leaves are 1½–1¾ inch long, 9–10 lines broad, on a petiole 2½–3 lines long: the panicle is 2 inches long; the calyx is 3 lines long, the tube of the corolla 4 lines, the lobes 3 lines long; the very immature drupe is 3 lines in diameter.

15. *Crematomia spathulata*, nob.;—ramulis subtenuibus, teretibus, cinereis, junioribus adpresse pilosulis; foliis longe

spathulato-oblongis vel lanceolato-oblongis, obtusis, supra obscure viridibus, scabrido-asperatis, e tuberculis albis rigide pilosis, subtus pallidis vel brunnescentibus, pilis simplicibus rigidis adpressis vestitis, fere enerviis, marginibus revolutis; petiolo cano-pubescente, limbo 12-plo breviore: racemis folio brevioribus, aut terminalibus vel e ramulis novellis brevissimis folio unico munitis ortis, 4–6-floris; floribus brevissime pedicellatis; calyce fere ad medium 5–6-dentato, dentibus mucronulatis, utrinque cano-velutino; corollæ tubo calyce paulo longiore, lobis 5–6, rotundis, imbricatim expansis; staminibus 5–6, medio tubi insertis; antheris longe exsertis, mucronulatis; stylo ultra quartam partem bifido.—In Mexico: *v. s. in herb. Mus. Brit.* (ex herb. Pavon sub nom. *Ehretia exsucca*).

The specimens bearing Pavon's name, in his own hand, are inscribed in pencil, by D. Don, *Cortesia spathulata*; but it certainly does not belong to that genus. Its branchlets are slender, with axils 3–5 lines apart; the leaves are 1–1$\frac{3}{4}$ inch long, 3–7 lines broad, on a petiole 1–1$\frac{1}{2}$ line long; racemes little more than $\frac{1}{2}$ inch long, pedicels $\frac{1}{2}$–1 line long; calyx 3 lines long; tube of corolla 5 lines, wider in the mouth, lobes of border 3 lines long; anthers exserted 2$\frac{1}{2}$ lines beyond the mouth of the tube.

16. *Crematomia Kunthiana*, nob.;—Bourreria exsucca, *H.B.K.* iii. 67 (*non Linn. nec Jacq.*);—ramis teretibus, glabris, incanis, junioribus pubescentibus; foliis obovatis, obtusis, rotundatis, coriaceis, reticulato-venosis, sæpius subglabris, utrinque præsertim in nervis strigoso-pubescentibus; petiolo canaliculato, pubescente aut glabro, cum margine ciliato, limbo 10-plo breviore: paniculis terminalibus, corymbosis, pedunculatis, dichotome ramosis, pubescentibus; floribus sessilibus; calyce irregulariter 2–3-fido, subpubescente, laciniis acutis; corollæ tubo cylindraceo, calyce longiore, lobis 5, rotundatis, patentibus; staminibus 5, tubo insertis, corollæ æquilongis, imo villosis; stylo bifido, stigmatibus capitatis; fructu 4-gone globoso, depresse rostrato, in achenia 4 spongiosa demum soluto.—In Venezuela, prope Cumana (*non vidi*).

This is indigenous with *C. Cumanensis*, and is also called Guatacaré by the natives; but it differs from it in its rounder leaves, not cuneate at base, of only half their size, on a shorter pubescent petiole, in its pubescent inflorescence with sessile flowers, its tomentose calyx, its corolla with a shorter and more cylindrical tube. Its leaves are 1$\frac{1}{2}$ inch long, on a petiole 1–2 lines long. It is a tree 20 feet high.

17. *Crematomia Andrieuxii*, nob.;—Ehretia Andrieuxii, *DC. Prodr.* ix. 510;—ramulis teretibus, flexuosis, rugosis, cinereo-tomentosis; foliis ovatis, imo rotundiusculis, apice obtusis aut obtusissimis, naviculari-recurvis, marginibus plicato-undulatis, utrinque canescenti-pubescentibus, nervis parallelis, divergentibus; petiolo cano-velutino, limbo 8-plo breviore: panicula subcorymbosa, terminali, breviuscula, dichotome ramosa, cano-velutina; floribus majusculis, capitato-aggregatis, brevissime pedicellatis; calyce breviter campanulato, 5-dentato, utrinque velutino; corollæ tubo calycem vix excedente, late infundibuliformi, lobis rotundis, imo late cordato-auriculatis, patentibus, tubo duplo longioribus; filamentis imo villosis, sub fauce insertis, exsertis; stylo pro tertia parte bifido.—In Mexico: *v. s. in herb. Hook.*, Puebla (Andrieux, 200).

A very distinct species, apparently of low growth, with very rough, flexuose, tomentous branchlets, with axils 3 lines apart; leaves 1–1¼ inch long, ½–¾ inch broad, on a patent or reflected petiole 1½–2 lines long: panicle 1¼ inch long, with crowded flowers; calyx 2 lines long and broad; tube of corolla 2 lines long, lobes 4 lines long.

18. *Crematomia fasciculata*, nob.;—Ehretia fasciculata, *H.B.K.* iii. 66; *DC. Prodr.* ix. 508;—Lutrostylis inermis, *Don, Dict.* iv. 391;—ramosissima, ramulis teretibus, albescentibus, glabris; foliis in summo ramulorum brevissimorum 3 vel 4, pseudo-fasciculatim approximatis, obovato-oblongis, obtusis, basi acutis, subcoriaceis, nervosis, reticulatis, utrinque glabris, margine ciliatis, supra læte viridibus, subtus pallidioribus; petiolo canaliculato, tenuissimo, ciliato, limbo 5–6-plo breviore: paniculis corymbosis, terminalibus, brevissimis, dichotome ramosis, ramis angulatis, pubescentibus; calyce 5-fido, dentibus acute ovatis, margine tomentosis; ovario depresse globoso, sub-4-gono, glabro; stylo fere ad basin diviso, laciniis erectis, stigmatibus subcapitatis; drupa globosa, piperis mole, pyrenis 4, monospermis.—Prope Cumana (*non vidi*).

The above characters, from Kunth's description, conform with this genus, only that the style is more deeply divided than usual: the specimen from which they were taken, however, was stated to be incomplete, and apparently without flowers and with immature fruit. We find a parallel of the almost fasciculate leaves in *C. Guildingiana* and in some species of *Bourreria*. The leaves are 2 inches long, on a petiole 4–5 lines in length; the panicle is 1 inch long; the placentation of the ovary after the fall of the corolla conforms to the character of the genus.

19. *Crematomia* (?) *huanita*;—Morelosia huanita, *Ll. et Lex. Nov. Veg. Desc.* 1; *Don*, *Dict.* iv. 392;—ramulis tortuosis, ultimis deformatis, angulatis; foliis in extremitate ramulorum ovatis, nitidis, integerrimis, longe petiolatis: paniculis corymbosis, terminalibus; floribus plurimis, sessilibus, articulatis et caducis, odoratissimis; calyce coriaceo, ventricose tubuloso, 5-fido; corollæ tubo calyce subbreviore, lobis rotundis, æstivatione inter se cucullatim imbricatis, demum patentissimis; filamentis medio tubi insertis, subulatis, imo tomentosis; antheris exsertis, sagittatis, polline albido; ovario conico, striato; stylo apice 2-fido, cum stigmatibus clavatis; drupa globosa, sub-4-gona, subcarnosa, coriacea, nitida, styli vestigio apiculata, imo laciniis calycinis circumdata; nuce oblonga, 4-sulcata, loculis 4 monospermis (an in 4 demum solubili?).—In Mexico, ad Urupuam, prov. Mechoacan (Valladolid) (*non vidi*).

The *Morelosia* of La Llave and Lexarza has always been a genus of doubtful position: by its authors it was considered to be near *Cordiaceæ* on the one hand, and near *Ebenaceæ* on the other. Endlicher placed it after *Symplocos*, stating that its ovary was inferior and adnate to the calyx—an error arising from an ambiguous expression in its original character. Prof. De Candolle showed (Prodr. x. 177) that it could not belong to *Borragineæ*, *Ebenaceæ*, or *Styraceæ*. The characters given of it are sufficiently clear, showing that its ovary is superior and enclosed in a *tubular perigynous corolla*, and that its fruit is supported by the ruptured *segments of the calyx*. The error above-mentioned has arisen from the expression of the author, "calyx adherens," meaning *persistent* or attached to the base of the drupe. Its bifid style, combined with its other characters, shows that it belongs to *Ehretiaceæ*, and either to *Bourreria* or *Crematomia*, probably the latter, on account of its Mexican origin, the short tube of the corolla, the large imbricated lobes of its border, and the stamens tomentose at base: it is a species near *C. formosa*, from which it appears to differ little. The character of the fruit was probably drawn from the drupe in an immature state, when the achenia were agglutinated together.

It is described as a tree of middle size, with a scabrid, rough trunk, its leaves being 3–4 inches long, upon elongated petioles.

BIBLIOGRAPHICAL NOTICE.

Thesaurus Siluricus. The Flora and Fauna of the Silurian Period. By J. J. Bigsby, M.D., F.G.S., &c. 4to, pp. i–liv & pp. 1–214. London: Van Voorst, 1868.

Dean Conybeare's apothegm, "The boldest and happiest generalizations must depend on details," is the author's motto; and his book is full of details, with a short Introduction showing what facts and inferences may be derived therefrom, and how they are to be worked out. It is a praiseworthy and elaborate attempt to collect and arrange all that is known of the creatures that existed in the far-back period termed "Silurian" by geologists, and to treat of them as a fauna and a flora, with their regions, provinces, and habitats, their incomings and migrations, their persistency or evanescence, and their relationship as predecessors, if not as ancestors, to such as live and flourish at the present day.

The body of the work consists of a systematic catalogue of the known Silurian fossils, arranged in natural-history order, as far as existing circumstances permit, together with the authorities for genus and species (the former with dates), and indications of the formations in which the species occurs, and the country in which it is found. The great natural groups adopted are Plantæ (p. 1), Amorphozoa (p. 3), Actinozoa (p. 6), Crinoidea (p. 18), Cystidea (p. 24), Asteridea (p. 27), Annelida (p. 29), Trilobita (p. 33), Phyllopoda and Ostracoda (p. 72 §), Polyzoa (p. 78), Brachiopoda (p. 88), Monomyaria (p. 126), Dimyaria (p. 131), Pteropoda and Heteropoda (p. 143), Gasteropoda (p. 150), Cephalopoda (p. 170), and Pisces (p. 192). An Appendix of Addenda, Errata, List of Authors, and Index of Genera completes the work, which, however, has been supplemented with an additional fly-leaf of *corrigenda*, chiefly relating to double insertions, both old names and synonyms having been catalogued in many instances; but the correction of these and of numerous other mistakes of copying, misplacement, and omission really makes but a small percentage of difference in the estimated totality of known Silurian life; and the author's figures may be taken for fairly approximate statistics whereon to found the biological inferences and philosophical conclusions which in part he produces, and in large part he wishes others to work out.

Dr. Bigsby supplies in the introductory "Facts and Observations" some highly suggestive essays, pregnant with useful truths. 1st. On the influence of Locality on the nature and amount of life, p. xxxiv, he observes that, as "every tolerably large space of sea-bottom has its own conditions and its own fauna," and as "the physical state of land and sea was and is as local as the population," every considerable Silurian region contains much that is peculiar, *generic* alliances being the main links between the creatures of different Silurian areas. "The maximum of life is usually local, meaning by that expression the largest combination of abundance, variety, and rank. It may show itself in any country, in any part of an epoch, or of a stage, in the middle or at the end of either, being governed principally by the nature of the sediment." "Striking examples of localization in time and place" are pointed out, as "the rich Primordial beds of Western Newfoundland and of Quebec, the crowded Pleta beds of Esthonia and Russia, the Trenton Limestone of the State of New York, the Bohemian beds E. e. 1, 2, some of the Welsh beds near the same horizon as those of Prague, the Lower Helderberg rocks of New York;" and, on the other hand, isolated localities and extensive areas nearly barren of life among the widespread Silurian strata are indicated. He notes that out of 9030 species of marine creatures registered as belonging to the Silurian period, 4628 only are set down as met with in one locality of a certain radius. Some species have inhabited many areas, as indicated by their finding-places, from two to twenty-five; such are the remaining 4402. "Such a very great number of species (4628) being each restricted to a single locality is an important fact. They are so many *specific centres*." . . . "It indicates that when species are common to two sets of beds, more or less apart, the connexion between the latter is closer than has hitherto been thought, and, further, that the absence of identical species in two beds does not forbid considerable relationship." . . . "Multiple creation is implied, going on everywhere, and affecting every form of life. The grand mystery of creation has been in operation, all through the epoch, in thousands of places." By a table showing the number of Silurian species, belonging to each of the orders, and known only at one place, we are shown "that in each order the tendency of the species inhabiting only one place is to *one-half* of the whole number," though some fall short in the average and some are in excess. Other interesting facts, as food for speculation, are also offered on this point. 2nd. *First appearances* (p. xxxvii). From observations resting wholly on natural-history facts derived from the 'Thesaurus' and similar sources, the author regards the first appearance of a creature in its lowest traceable place in the succession of strata as being indicative of its time and place of creation. This is liable to be mistaken sometimes, but nearly sure to be ultimately corrected; and he finds that, as a fact, it may be reasoned from with tolerable safety. 3rd. *The duration of species* (p. xxxviii). "This is an important part of vital statistics, which, running up the whole scale of existences, reaches and deeply interests man himself." Much has been written on this subject. Dr. Bigsby points to M. Barrande's late researches as really showing that "a species only exists in Bohemia during a part of a stage-subdivision, and that the organic separation of part from part is very sharp, leaving but a brief interval for the exercise of natural selection." 4th. *Extinction* and its causes (p. xxxix). 5th. *Migration* and conditions favourable or inimical to distribution (p. xli). 6th. *Recurrence*, or vertical range (p. xliv). 7th. *Divergence* (p. xlviii), or change of residence from ground to ground. Under all these headings, the mutual dependence of species, the influence of sea-bed, climate, depth, feeding-grounds, and other physical conditions are important topics kept in view; and the author looks at the relationship of creatures to conditions from a teleological point of view. The evolutionist, however, will find little to interfere with the feasibility of his scheme, except the indistinctness of the earliest and of many of the intermediate circumstances of the life-history of a species. The naturalist, whatever views he may adopt, will here find much that is worth noting, and not attainable without such patient and work-loving research as has produced the 'Thesaurus Siluricus' and its Introduction. Other matters for consideration are suggested at p. li, such as a comparison of Silurian and Recent Sea-beds, the Bathometry of ancient and modern molluscan life, the possible synchronism (or, rather, homotaxis) of strata, the foreshadowing of coming faunal groups, and so on.

With reference more especially to the first six lines of consideration above noted, the author has treated of some great groups of Silurian animals, namely, the Gasteropoda, Trilobita, Cephalopoda, Brachiopoda, and Echinodermata (pp. vii–xx), showing, in his concise and almost quaint, apothegmatic style, the results of a rigid examination of the multitudinous entries in the 'Thesaurus,' and in numerous tables of condensed information their localization, distribution, habitats, appearances, recurrency, and other conditions and peculiarities. At p. xx he treats of the flora and fauna of the so-called "Primordial" stage of Silurian life; at pp. xxiii–xxxii he gives a very valuable series of observations on the Silurian fossils of Bohemia, which, by their local abundance and the scientific care with which they have been discriminatingly collected and described, are of as great a value as the perfect dredgings of any sea-area; and, indeed, they are more complete. Their relationships both among themselves and to other Silurian groups can now be easily mastered; and geologists will thank both Dr. Bigsby, for his analytical work, and the eminent Barrande, for the liberal communication of facts the harvest of years of labour, and of ripe opinions due to careful judgment and extensive knowledge. The long special lists of M. Barrande's latest additions to Bohemian palæontology, given on several pages in the 'Addenda' to the 'Thesaurus,' are proofs of the anxious care to complete a good work, and of the ready aid given in furtherance thereof.

The universality of the Silurian system of rocks (p. xxxiii) is the only other subject that the author has allowed himself to treat of, and that briefly. "More than fifty great terrestrial spaces, scattered over the whole earth, are occupied with some portion of the Silurian succession of rocks, with their proper stratigraphical habitudes, connexions, &c." Well may Dr. Bigsby wish to see the life-conditions of this great old ocean-territory brought before the mind, as a grand picture of creative power, skill, and goodness! He has commenced the sketch of this scene of restored existences; he has stretched the canvas, prepared the palette, and sketched in the outlines of the work; he has copied his lines and taken his tints from many other studies and palettes besides his own, in good faith, with perfect confidence in the ready cooperation of geologist and naturalist, and in strong hope that the finished work will be a labour of love to many, as his 'Thesaurus' has been to him; and whether reflecting, however dimly, the processes of evolution, or the results of direct creation, this hoped-for reproduction of Silurian life in all its bearings, in both an analytic and a synthetic form, will be a work worth any man's labour, adding to useful knowledge, and enlarging our conceptions of the ways and means of Nature and of the grandeur and perfection of her Creator.

MISCELLANEOUS.

Birds in the Philadelphia Museum. By Dr. J. E. Gray.

The collection of stuffed birds formed by Mr. Wilson, and presented to the Museum of the Academy of Natural Sciences of Philadelphia, is a very large one. Dr. Harvey, the algologist, in his letters just published in his 'Life,' which give the most lifelike and interesting account of the country, and especially the great centres, and of the scientific and literary men of the United States that I have read, observes, Dr. Leidy "accompanied me over the museum, the collection of birds in which is said to be the first in the world. Agassiz and the Prince Canino, both good authorities, say there is no such single cabinet in Europe" (p. 195).

Having purchased the collection that formed the basis of the Museum in Philadelphia, for Mr. Wilson, I may give an account of how it was procured, more especially as it will show at what a moderate rate a large and beautiful collection may be obtained, and the manner in which such things are managed in France.

Mr. Wilson called on me as a stranger, saying that he wished to make a collection of birds, and that he had received an offer from a dealer who had mentioned my name, and he wished to know if I considered the price fair, and if the vendor was likely to carry out his engagements. The price proposed was a progressive one—three shillings per specimen for the first two hundred skins, four shillings for the next two hundred, the price increasing with each succeeding hundred, making the rarer birds very high. After some conversation, and finding that he wanted it for the Academy of Natural Sciences of Philadelphia, of which I am a member, I said, if he wanted to form a museum, why did he not try to purchase a collection, as there were several in the market? I mentioned two or three, among the others Prince Masséna's collection in Paris. I said that it had been long for sale, and that I believed it could be purchased for a very moderate price—probably four francs (about 3*s.* 6*d.*) each specimen, which is the price that birds cost to be stuffed only. He said he had inquired about that collection, but it was not to be obtained for twenty times that sum, and indeed he doubted if it was to be purchased at all. A printed catalogue of the collection having been circulated, it was easily known what the amount would be at the price I named. I said that I intended to go to Paris in a very short time, and that, if he liked it, I would see what could be done.

In a few days he called again, and asked me if I really was willing to undertake the commission, and if I believed I could obtain it at the sum I had named. I said I thought I might, and would try; on which he sent me an order on Messrs. Green, the bankers in Paris, for double the amount I should require, according to the printed catalogue, and said, if necessary, I might use the whole sum. On my arrival in Paris, I put up at Meurice's, and at once sent a messenger with a note to the Prince Masséna, saying that I was willing to purchase the collection of birds at the rate of four francs per specimen, and that I was prepared to pay for it in ready money. While sitting at dinner at the *table d'hôte*, an aide-de-camp came in, all green and gold, with a cocked hat and a large white feather, to inquire for me, with a message from the Prince to inquire what I intended by ready money, and, when I explained, to inquire if I was ready to pay the sum that evening. I said no, that I had only just arrived in Paris, and had not delivered my letter of credit to the banker, but I would be ready to pay as soon as the bank opened the next morning. He said the bank opened early, and would I come to the prince at seven o'clock? to which I assented. I immediately sent my letter of credit to Messrs. Green, and mentioned the sum that I should draw for early the next morning. I kept my appointment; the prince met me, declared the collection agreed with the catalogue, on which I gave his highness a cheque on Messrs. Green; and he gave me a receipt and handed me the keys of the cases, and I sealed them up, the affair being settled in a few minutes.

Having finished my work sooner than I expected, and it still being early, I went to call on my dear old friend Prof. De Blainville, and had breakfast with him. He asked what had brought me to Paris. I said, among other things, to purchase the Prince Masséna's Collection of Birds, which I had done; on which he became much excited, and said that the French Government had intended to purchase it, and that he must take measures to prevent its leaving France. I said I was not aware that the Government wanted it, for I knew it had been for several years in the market, and it was now too late, as I had paid for the collection, which was now in my possession; and I showed him the keys of the cases and the receipt for the money. At length my good and kind friend became pacified. I then sent to an English dealer residing at Dieppe to come and pack the collection for exportation to the United States, as Mr. Wilson wished me to do if I succeeded in getting it.

It soon became buzzed about Paris that I had bought the collection; and I had applications from several dealers to pack it, and remonstrances from others for having made the bargain myself, and not through them: they said that if I had employed them, I could have got it for the same price, and they have obtained a good profit out of it!

Mr. Wilson was much pleased with the purchase, and afterwards purchased the cases, in which the birds were retained, and the specimens of the parrots that were not contained in the catalogue. On my return from Paris, Mr. Wilson sent me a very complimentary letter containing a cheque for £50, which I returned to him, observing that there were duplicate specimens of certain birds in the collection that we had not in the British Museum, and that I should be pleased if he would let the Museum have them, which he most readily acceded to.

The collection was a very large and good one, but it has one fault common to most French collections; that is to say, the bird-stuffers constantly pull off the feathers, and replace them, with gum, so as to give the body a smooth appearance, and they are not always careful to put the feathers into the parts from which they were extracted. Until I saw the operation in the French laboratories I could not understand why some figures of birds in French works, and some descriptions of species taken from specimens in French museums, are said, as in Wagler's 'Systema Avium,' not to be quite true to nature.

Genera of Gorgoniadæ. By Professor Verrill.

Professor Verrill, in a paper on the Corals and Polypes of the west coast of America, in the first volume of the 'Transactions of the Connecticut Academy,' p. 385, proposes to divide the family *Gorgoniadæ* into genera according to the spicules, thus:—

1. *Gorgonia,* with spindles in the cœnenchyma and an external layer of peculiar small club-shaped spicules, producing a smooth surface. Type *G. verrucosa.* Professor Verrill says this genus is very nearly allied to *Eunicea.*
2. *Pterogorgia.* The spicules in the cœnenchyma small, with double spindles, and also crescent- or bracket-shaped; they are nearly smooth on the convex side. Type *P. acerosa.*
3. *Eugorgia,* with longer and shorter double spindles and numerous double wheels; surface decidedly granulous with naked spicules. Type *E. ampla.*
4. *Litigorgia,* having only the two forms of double spindles; surface somewhat granulous, but less so than in the last. Type *L. Floræ.*

He proposes to divide the genera into groups according to the branching of the coral, which M. Valenciennes used as a generic character.

Lamarck's Collection of Shells. By Dr. J. E. Gray.

Lamarck, in his work on Invertebrated Animals, described some of the species of shells from specimens in his own cabinet, and others from examples in the Museum of the Jardin des Plantes. This naturalist, who had a most wonderful faculty of perceiving natural groups and their relation to each other, and certainly was one of the most industrious of the votaries of natural science (for he not only published on zoology and botany, but on other branches of science), in his old age became blind, and so reduced in circumstances that when I saw him he was living in a very small room, with scarcely any furniture, on the stair leading to the library of the museum, chiefly supported by the labours of his daughters, who were employed to place the plants in paper for the herbarium. I am glad to say that I never knew any man with even the slightest pretence to being a scientific student living in such a miserable state in this country; and to me it was a great distress to see two members of the Institute so illustrious as Lamarck and J. C. Savigny, who had done such good work while they had eyes to see, living, when they became blind and feeble by age, in such poverty and distress. To these names I might add a third conchologist, De Montfort; but his labours were small compared to the others', and his state of poverty more abject. The botanists of the Institute are not more fortunate or more cared for. I recollect with sorrow my visit to Louis Claude Richard, the author of the invaluable 'Analyse du Fruit,' and to M. du Petit-Thouars, a botanist who had done good work, and bears a name so celebrated in the naval annals of France. Our scientific men are rarely pensioners of the state, like the members of the Institute; but still they never come to such poverty, or die a lingering death from want of food and warmth, and at the same time are free to express any opinion, scientific, religious, or political, that they may conscientiously hold or wish to inculcate.

The Baron Benjamin Delessert purchased Lamarck's private collection of shells. When I went to Paris to study the types of the species which Lamarck had described, that I might name the shells in the British Museum with certainty, and also in hopes that I might have time to prepare for the press the work on the species of shells on which I had long been working, M. Delessert, who knew me years before as a botanical student, received me with his usual kindness, and offered me every facility to study the shells in the Lamarckian collection and make notes on them. I found in this collection species that had greatly puzzled me when, on a previous visit to Paris, I examined the shells as I could see them through the glass cases in the Jardin des Plantes; for there I observed that several of the specimens that were marked with the names of the new and unfigured species in Lamarck's 'Histoire' were well-known species, properly named in other parts of the collection; and I was more surprised when I found, on comparing them with Lamarck's short descriptions, that they could hardly be the specimens from which he had taken his characters. The difficulty was set at rest when I consulted M. Delessert's collection; for I then found that the shells in Delessert's collection that bore these names were either very distinct species or well-marked varieties, and there could be no doubt that they were the proper types of the Lamarckian species.

M. Delessert, in 1842, soon after obtaining the Lamarckian collection, published a large folio work, with very accurate plates, entitled "Recueil des Coquilles décrites par Lamarck dans son 'Histoire Naturelle des Animaux sans Vertèbres' et non encore figurées," which enabled conchologists to determine with accuracy many Lamarckian species. M. Kiener, who was the curator of the conchological portion of M. Delessert's collection, published, under the Baron's sanction and by his pecuniary assistance, the beautiful work entitled

"Illustrations Conchyliologiques, ou Descriptions et Figures de toutes les Coquilles connues." After Kiener's death, this work was continued by M. Chenu, who succeeded him, and it has reached its 84th Part; but I fear there is very little hope now of its being continued further.

M. Chenu (from the same collection, and I believe by the liberal assistance of its possessor) brought out his most useful 'Manuel de Conchyliologie et de Paléontologie'—"Conchyliologie" in two large volumes, illustrated with nearly 5000 woodcut figures, which is certainly the cheapest work on science ever published.

M. Delessert has certainly done all in his power to illustrate the conchological labours of Lamarck and to forward the science.

On the Constitution and Development of the Ovarian Egg of the Sacculinæ. By J. Gerbe.

In the ovule of a considerable number of species belonging to various classes of animals, there is, besides the vesicle known to physiologists as the *germinal vesicle* or *Purkinjean vesicle*, a second vesicle, generally of smaller size, which occupies a position more or less approximate to the former. Wittich, Siebold, and V. Carus have indicated it in the ovules of *Aranea domestica*; Balbiani has discovered it in those of the Myriopoda, of the Crustacea of the genus *Oniscus*, of frogs, of a considerable number of spiders, &c.; and, finally, Coste figured it as early as 1847 in the primitive ovule of the bird, immediately above the vesicle which forms the centre of the cicatricula.

What is the function of this second vesicle? Are we to regard it, with Balbiani, as the true formative centre of the germ? or is it not destined to fulfil some other function?

This question may be completely solved by the study of the ovule of those singular parasites the *Sacculinæ* (*Sacculina*, Cavolini, =*Peltogaster*, Rathke), which are found adhering to the tail in certain Crustacea, especially *Cancer mœnas*.

In these parasites the reproductive organ, which alone forms five-sixths of the mass of the animal, contains ovules of all ages, the various evolutionary phases of which may be traced from their origin to maturity. Taken from about the central part of the organ, these ovules, which are only from 0·06 to 0·08 millim. in diameter, present a form so different from that generally exhibited by those of other animals, that it would be difficult to recognize their true character, if we did not see them pass from this to a more advanced stage, which leaves no doubt on the subject. They are then formed:—1, of two independent, transparent vesicles, of nearly equal volume, and touching each other almost by a single point of their circumference; 2, of a general envelope (vitelline membrane), which is very delicate and constricted about the point where the two vesicles are in apposition; 3, of a small quantity of colourless substance, excessively finely granulated, which separates the two vesicles from the enveloping membrane. The ovule, instead of being globular, is therefore here bilobed and, as it were, composed of two ovules placed side by side and similar in form and organization.

To this first phase others soon succeed which reveal to us the function which these two vesicles are destined to fulfil. Each of these vesicles soon becomes enveloped by fine globules, which make their appearance successively. But whilst round one of them the globules remain very small, retain nearly the same volume throughout, and seem to have a limited multiplication, round the other vesicle they present themselves of very different sizes, gradually increase, and become more and more abundant as the ovule approaches maturity.

That lobe of the ovum in which this increase in the number and volume of the primitive elements takes place necessarily undergoes proportionate modifications; it enlarges for the reception of the materials which increase in it, just as the vitelline membrane of the bird's egg enlarges in proportion as the vitellus is formed, and it finally acquires such a predominance that the other lobe, the development of which has remained in a manner stationary, only forms at one of the poles of the ovule a little prominence like that which is produced in the ovum of osseous fishes in consequence of the condensation of the vitellus.

Such is the appearance presented by the mature ovule of the *Sacculinæ*. As to its organization, it only differs from the very small ovules by the intervention in unequal proportions of two distinct elements. The predominant element, formed by a mass of large and small globules, in the midst of which one of the primitive vesicles always shows itself, is, there is no doubt, the analogue of the yelk of the bird's egg—that is to say, the material destined for the nourishment of the future embryo; whilst the restricted disk, situated on the periphery of the ovum and composed of very small granules grouped round the other primitive vesicle, evidently represents the cicatricula of birds—that is to say, the essential and fundamental portion of the ovum, of which the materials are directly employed in the formation of the new creature.

The study of the ovule of the *Sacculinæ*, therefore, gives us the signification of the two vesicles which are contained in the ova of certain species; we may even say that in this case the demonstration is complete, for we may follow the phenomenon in all its phases. One of these vesicles is the formative centre of the germinative element, and must retain the name of *germinal vesicle* under which it is already known; the other is merely the formative centre of the nutritive element.—*Comptes Rendus*, February 22, 1869, tome lxviii. pp. 460–462.

Euplectella.

Dr. C. Claus, the Professor of Zoology and Director of the Zoological and Zootomical Institute of Marburg, has published an essay on *Euplectella aspergillum* in quarto, with a beautiful photographic illustration representing two varieties of this sponge, and three copperplates of the spicules of which it is formed. Dr. Claus states that the spicules are composed of numerous concentric coats; and in one figure he represents the fracture as produced in the centre, showing about six thick layers, each shorter than the preceding; but all the other breaks are represented short, straight or oblique, like a broken glass rod. The short reflexed hooks on the surfaces of the elongated spicules at the root of the sponge are formed by folds of the siliceous lamina.

He describes the network as formed of more or less elongated spicules united by a siliceous cement, which, like the spicules, is deposited in laminæ.

Dr. Claus's plates show that the spicules of this sponge are formed of concentric laminæ as are the spicules of *Hyalonema*—which, I believe, has not before been observed; and at the same time he shows that the spines on the surface of the spicules are formed in a very different manner from the ring of spines on the spicules of that genus.—J. E. Gray.

Sea-Pools in the Friendly Islands. By Dr. Harvey.

"I walked out on the coral-reef opposite the landing-place [at Tongataboo]. It fringes the whole north side of the island, in some places extending a mile or more from the beach. A great part of the surface was worn and dead, but in the pools the coral was alive. Near the margin of the reefs these pools were numerous and deep, and in them many beautiful corals were growing luxuriantly. They were various—some branching or leafy, others knobby or massive, some bushy, some tree-like, or saucer-shaped or huge disks, some sessile, others on stems. The colours varied from white to brown, purple, green, yellow, flesh-colour, and dull red; and many reflected rainbow-tints changing with the angle, particularly at the tips of the branches. The water was clear as air; and through it multitudes of little sapphire fishes (Coloto) darted among the coral-branches. Seaweeds were very few, and almost all of the green order, among which were *Halimedea* and *Bryopsis*. Starfishes of the long-armed class, *Ophiura* and *Ophiocoma*, were abundant; and a large brown feather-star was frequent under stones. Great, black, ugly sea-cucumbers (*Holothuriæ* or Trepang) were crawling everywhere; I caught at one, which immediately threw out multitudes of long, blue, shiny, slimy threads, that coiled round my fingers: I dropped the brute, but had some difficulty in getting my hand free; it did not sting me, however. I picked up a *Cidaris* and an *Echinus* (Urchin), and saw another species of the latter, which I did not venture to touch, remembering how I had been stung by one (I think the same species) at Key West. It has long, slender, and very brittle spines, covered with highly poisonous slime. Near the edge of the reef Nullipores abound, in places left bare at low water. I noticed that some of the living corals were bare also; but probably they did not long remain so, for it was a low spring tide.

"A huge and beautiful species of *Alcyonium* (a soft coral called 'dead-man's toes') grew where it was left exposed at low water.

In this state its substance shrank up under the sun, and became of a pale brown or sponge-colour; but when its *animals* were expanded under water, this lobed fleshy mass was thickly spangled with golden stars, and looked very lovely. Several naked Mollusca, of gay colours and beautiful forms, glided among the corals; but I could only do them homage and release them again.

"There were, besides, countless soft creatures allied to sea-anemones—in fact quite an *anemonic* paradise. I found but few shells, and these for the most part rough and common."—*Mem. of Dr. Harvey*, p. 298.

North-Atlantic Dredging-expedition.

The Royal Society has applied to the Admiralty for the use of a steamer in order to continue the investigations so ably commenced by Dr. Carpenter and Prof. Wyville Thomson; and the 'Porcupine' has been placed at their disposal. The expedition will take place about the middle of May; and the deep water, from 1100 to 1300 fathoms, near the Rockall Bank will be first explored, and afterwards the sea-bottom lying off the outer Hebrides and the Shetland Isles. Mr. Gwyn Jeffreys will take charge of the expedition for the first period of a month or six weeks, Prof. Wyville Thomson for the second period, and Dr. Carpenter for the last.

Land-Leeches of Ceylon. By Dr. Harvey.

"We ascended a steep mountain-pass through dense jungle (near Paragulla in Ceylon), where were plenty of land-leeches; and as I stopped to pick some off my gaiters I said, 'Well they are not much trouble after all,' when, looking at my wrist, there was a great leech sucking his fill; this was the only bite I got. I must admit these leeches are annoying; you cannot stand a moment on the grass without seeing a troop of them coming towards you from every side; fast they come, and are soon up your legs if you are without gaiters; and they are always hungry. The naked legs and feet of our coolies were streaming with blood. They abound everywhere in the grass and dead leaves; nor can you when walking in the garden leave the gravel without being attacked."—*Memoir of Dr. Harvey*, p. 258.

The Loaf Starfish (Culcita).

"At Tonga I met with a very remarkable Starfish, of the pentagonal form (*Culcita*), as large and as thick as a four-pound loaf of bread; but it has greatly shrunk in the drying, and is now quite flat, and only an inch in thickness. Three others I have cut open and skinned, and have their skins and skeletons. In the stomach of each was a fish some inches long. How such a sluggard could persuade a lively and sensible fish to walk into his stomach is to me a mystery."—*Mem. of Dr. Harvey*, p. 308.

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[FOURTH SERIES.]

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XL.—*Observations on the Amphipoda occurring on the Norwegian Coasts.* By Axel Boeck*.

Although the Amphipoda occurring on the Norwegian coast have been the subject of the investigations of several naturalists, and valuable contributions to our knowledge of them are published, it appears that continued investigations may furnish important results, as we are probably far from having anything like a complete knowledge of the forms which occur there.

When Milne-Edwards, in 1840, published the third volume of his 'Histoire Naturelle des Crustacés,' in which the Amphipoda are treated of, only a few Norwegian species were known; but within a few years the number of the described species was considerably increased by the investigations of H. Rathke, Kröyer, Lilljeborg, and others. Quite recently our knowledge has been much increased by the publication of Bruzelius's memoir in the 'Svenska Vetenskaps-Akademiens Handlingar' for 1858. In this he describes, from his own investigations, some new species, and many previously known ones, in all 77 Scandinavian species, most of which occur on the coast of Norway. This number, however, does not include any species of the tribes Hyperidæ and Caprellidæ. To this number must be added some new species which Professor Sars has described in the 'Christiania Videnskabs-Selskabs Forhandlinger' for 1858, others which are mentioned by Danielsen in the list of forms found by him on the coast of Finmark, published in the 'Nyt Magazin for Naturvidenskaberne' for 1858, and some which are described in the 'Throndhiemske Videnskabsselskabs Skrifter' for 1858, from collections made by him at Christiansund and Molde.

* Translated from the 'Forhandlinger ved de Skandinaviske Naturforskeres, Ottende Möde,' 1860, pp. 631–677, by W. S. Dallas, F.L.S. &c.

Recently this family has also been in other countries the object of attention to naturalists. By this means not only has the number of known species and genera been increased, but so much diversity of form has been met with, that the mode of classification established by Milne-Edwards can no longer be regarded as satisfactory. Dana, who has the merit of having treated not only of the forms which he was able to study attentively himself, but also of those which he found described by other authors, has elaborated an entirely new systematic arrangement which evidences a clear conception of the nature of these animals. He has raised Milne-Edwards's families into higher groups (subtribes), and divides these into families and subfamilies. Spence Bate, who also elaborated a new systen, in which, however, he only treats of the English species, has nevertheless, by calling attention to the relation between differences of form and differences in mode of life, contributed to the recognition of those characters to which we must have regard in their natural arrangement. A. Costa's works upon the Amphipoda occurring in the Mediterranean also contain material towards their systematic arrangement.

It will, however, be easily seen that just as the augmented material in conjunction with a greater knowledge of the structure and mode of life of the Amphipoda has enabled these new systems to be brought forward, so may further investigations modify them in turn. The division of the Amphipoda into three primary sections (the *Hyperidæ*, *Gammaridæ*, and *Caprellidæ*) will probably always retain its value; but the characters upon which the subdivisions are founded will hardly remain of the same importance, so that the boundaries of the groups will have to undergo alteration. Thus, for example, Dana and Spence Bate differ as to the limits of the various families and subfamilies, so that the same genera are often found in different subfamilies. They do not entirely agree in the characters upon which they depend for their principle of division. To this must also be added that these observers did not know the northern species of Amphipoda from their own investigation; possibly, also, the languages in which these are in part described prevented the characters adduced being completely understood, so that a few errors have crept in. For the present, therefore, we can hardly arrange our Amphipoda in a system consistently carried out, or in all parts follow one already established. I will therefore, like Bruzelius, in the following preliminary contribution to the natural history of the Norwegian Amphipoda, merely cite the genera one after the other under families, in the manner in which I think they ought to be placed side by side in accordance with their nearer or more distant affinities, but without grouping them in subfamilies; nevertheless, in noticing the genera established as typical of the latter, I will touch upon such points as I believe may serve to elucidate the nearer relationships of the groups.

In the systematic arrangement of the Amphipoda I have not only taken into account the form of the legs and tail, but have also especially sought to obtain systematic characters from other equally important and more occult organs, such as the parts of the mouth and the ovigerous and respiratory lamellæ. Undoubtedly the structure of the buccal organs has long since been employed in systematic arrangement, as the absence or presence of palpi on the maxillæ or mandibles and the number of joints in the maxillipedes have been cited as important characters; but I maintain that the form of the inner lamella on the first pair of maxillæ and its border of hairs furnish specially characteristic marks. Moreover the bordering of teeth and hairs which occurs at the upper end of the œsophagus is of importance. In this preliminary memoir, however, I have not taken notice of this last character (although my investigations already made have quite convinced me of its importance in a systematic point of view), partly because it cannot be described without greater prolixity than this memoir permits, and partly because its investigation is difficult. The form of the ovigerous lamellæ, and their relative size and relations to the respiratory lamellæ, are also very essential; but in this memoir I have noticed only those which are attached to the fourth pair of legs. It must be remarked, however, that these do not always maintain the same size (as some observers have stated), but are smaller when the females do not employ them for the protection of the eggs or young. I may here also call attention to the double armature of teeth which the males of many species possess in contradistinction to the females, the mandibles being furnished on the inner surface with a toothed point, whilst the rows of spines and masticatory tubercles are sometimes doubled. At the same time the outer lamella of the first pair of maxillæ has, besides the strong armature of teeth at the apex, another, corresponding one on the inner surface; their palpus shows a similar construction to that of the second pair of maxillæ. This I have found to be the case in species of the genera *Orchestia*, *Allorchestia*, *Anonyx*, *Ampelisca*, *Haploops*, *Dexamine*, *Gammarus* (*dentatus*, Kr.), *Amphitopsis*, *Acanthonotus*, *Gammaropsis* (*anomalus*, H. R.), and in certain Caprellidæ—for example, in the genus *Ægina*.

As Bruzelius's memoir is a complete monograph of the

Scandinavian species, I will in what follows briefly describe the new ones, and only notice those already described either when they are not cited by him or when there is something to be added with regard to their occurrence. A more complete and exhaustive description, accompanied by illustrative figures, will shortly be published by me in conjunction with M. Danielsen.

The necessary materials for the arrangement of the Norwegian Amphipoda have been partly collected by me at Christiansund, Mandal, and Farsund, and partly obtained from the University Zoological Collection, to which, by the kindness of Prof. Rasch and M. Esmark, I have had free access. In it there are Amphipoda collected on the coasts of Nordland and Finmark by Sars and Esmark, on those of the district of Throndhiem by Professors C. Boeck and Rasch, and from the district of Bergen by Sars.

The animals investigated are thus brought together from the most different parts of the country, by which means we obtain fresh materials for the solution of questions as to their geographical distribution.

Tribe I. HYPERIDÆ, Dana.—I have placed this tribe first, as it is united by a new and remarkable form, *Trischizostoma*, with the family Orchestidæ, and also with the genera *Anonyx* and *Opis* among the Gammaridæ, to which the first place is usually given.

Of this tribe few species occur on the Norwegian coast; and these all belong to the second subfamily, Hyperinæ, which is represented by the genera *Hyperia* (Latr.) and *Lestrigonus* (M.-Edw.). These two genera may be separated from each other by the length of the antennæ; whilst in many species of the genus *Lestrigonus* the seven thoracic segments are distinctly developed, and the first not amalgamated, as stated by Milne-Edwards, from his species *L. fabrei*, to be characteristic of the genus. In the general form of the body the two genera agree, and will perhaps hereafter be combined into one.

Genus 1. *Hyperia*, Latr.—Of this genus the well-known *H. Galba*, Mont. (*Latreillii*, M.-Edw.), occurs pretty generally in large specimens of *Cyanea capillata* along all the west coast, at least to the fjord of Throndhiem, where it was found near Beian by Professors Boeck and Rasch.

A new species, *H. spinipes*, mihi, was taken at the same place. This may be distinguished from the preceding species by the fact that the first two pairs of legs are more strongly formed, the fifth joint or hand is closely set with moderately long straight and strong spines, and the angle of the head between the upper and lower antennæ is much larger and more strongly prominent.

Genus 2. *Lestrigonus.*—This genus is also represented on our coast by two species. The first of these may, I think, be identified with Kröyer's *L. exulans*, although it differs from this in its considerable size and also in having the upper antennæ longer than the head and the first two segments together, and their flagella composed of seventeen short joints. The first joint of the flagellum is, moreover, shorter than in *L. exulans*, and of a different form; but it is possible that Kröyer's specimen was not perfectly developed. These parts vary both in form and size according to age. I have therefore for the present cited it under the above name.

The second species, *L. Boeckii*, resembles the preceding one in size; but the antennæ are very nearly of the same length as the body. The first joint of the peduncle in the upper antennæ is very short, and the flagellum is formed of eighteen very long and thin joints. The third and especially the fourth joints of the inferior antennæ, when compared with those of the preceding species, are much longer, and their extreme end is furnished with more teeth; the fifth joint is about half as long as the fourth. The flagellum is formed of twenty-four long and slender joints. The eyes are very large, and occupy the whole side of the head, becoming contiguous above. The claws of the first two pairs of feet are denticulated on the upper part of the hinder edge. The last three pairs of thoracic legs are not much longer than the preceding.

The first of these species was found near Beian and Söndmör by Professors Rasch and Boeck; the second was found as long ago as 1818, in the Christiania-fjord, by Professor C. Boeck, and also subsequently by him at Beian.

A remarkable transition between this and the next tribe is constituted by a new form, which differs so much from both, especially with regard to the parts of the mouth, that it cannot find a place in either of these, and therefore must be set up as a separate tribe and family.

Tribe II. PROSTOMATÆ, mihi.—This includes only one genus and species, which M. Esmark, who first distinguished its aberrant form, indicated under the generic name of *Trischizostoma*, naming the species, after its discoverer, *T. Raschii*.

This Amphipod, according to Professor Rasch's statement, was taken by him at Havbroen, off the coast of Söndmör, by sinking a dead bird to a depth of about 100 fathoms. To this three specimens, all females, attached themselves. He is not, however, quite certain as to the correctness of his statement, as his notes are lost; but the structure of the animal seems to strengthen it. The largest individual measured 45 millims., and it is therefore one of the largest of the Amphipoda. The body is strongly made, somewhat compressed laterally; the back round, without a keel; the head projects forwards in a long and broad rostrum, which covers the basal parts of the superior antennæ; the eyes are very large, and occupy, as in the *Hyperidæ*, nearly the whole of the sides of the head, and are nearly contiguous above; the superior antennæ are the shortest; the peduncle small and short; the flagellum formed of a somewhat long first joint, clothed with hair on the inner surface, and of from twelve to fourteen other shorter joints; the secondary flagellum likewise consists of a long first joint, and of two much smaller following joints. The inferior antennæ are one-third longer than the superior ones; the first three joints of the peduncle are very short, the two following ones longer and equal in length, the first serrated on its lower surface; the flagellum consists of twenty joints. They therefore agree with the antennæ of the *Hyperidæ* and of the genus *Anonyx*. The parts of the mouth appear as an extended trifid tube, which is formed by the extraordinarily produced labrum and the transformed outer lamellæ of the maxillipedes. Within this tube (from which the generic name is derived) are the acute, much-produced, but weak mandibles and maxillæ, which resemble a kind of prickles. The maxillipedes are furnished with four-jointed and the mandibles with three-jointed palpi. The first pair of feet are converted into strong prehensile organs of peculiar structure; the fifth joint, or hand, is very large, inflated, and attached by its inner side to the preceding joint. The claws are not, as usual, attached to the lower angle, applying themselves against the hinder margin with their points upwards, but attached to the hinder upper angle, with the points downwards—thus agreeing somewhat with Kröyer's genus *Opis*. The second pair of feet is formed as in the genus *Anonyx*; the third and fourth pairs are dissimilar; the first and, especially, the third joint of the fourth pair are strongly dilated into a shield-like form, whilst those of the third pair are narrower; the three following pairs are of the usual structure, and gradually increase in length. The abdomen is very broad, and closely agrees in its form with that of the *Hyperidæ*; but the three posterior pairs of abdominal legs have the peduncles shorter than in the latter. The second pair of epimera are particularly large, triangular, with the base downwards and the obtuse apex upwards, and nearly conceal the first pair.

The animal thus resembles the Hyperidæ in the structure of the head, eyes, antennæ, and abdomen, and partly also in the outer lamella of the maxillipedes, which is operculiform; but here there are palpi, which are wanting in the Hyperidæ. On the whole, the parts of the mouth in this animal are peculiar, and appear as if intended for sucking. In some respects it approaches the Orchestidæ, but has also much in common with the genera *Opis* and *Anonyx* among the Gammaridæ in the structure of its antennæ and feet.

Tribe III. Gammaridæ:—

Family I. **Orchestidæ.**—None of the characters which are proposed for this family belong to it exclusively, or are constant in all its forms. By the long superior antennæ and the well-developed claw on the palpi of the maxillipedes in *Allorchestia*, this family approaches the Gammaridæ, from which, again, it is not clearly separated by the want of mandibular palpi, as these are also wanting, for example, in the genus *Dexamine*. *Acanthonotus* and *Stegocephalus* possess a short maxillary palpus like that of *Allorchestia*. Again, the peculiar form of the abdomen is not exclusively characteristic of this family, as it also occurs in several genera of the family Corophidæ. The two genera of this family which occur on our coasts differ from the other Amphipoda, however, by the series of spines on the mandibles. This is formed by long, thick, but flexible, and strongly ciliated hairs, whilst those of all other Amphipoda examined by me consist of simple denticulated spines, or of spines divided at the apex. In the structure of the inner lamella of the first pair of maxillæ (which is long, narrow, and furnished at the end with two long, ciliated hairs) the family much resembles the genera *Anonyx* and *Opis*, which it also resembles in having the ovigerous lamellæ longer and much narrower than the respiratory lamellæ, and at the same time furnished with long, but not approximated, hairs. In both our genera of this family there is in the males the peculiar double armature of teeth, which is wanting in the females. In *Allorchestia Nilsonii* this is particularly distinct on the mandibles and first pair of maxillæ.

Family 2. **Gammaridæ.**—For this family it is still more difficult to lay down definite limits. Neither Milne-Edwards's statement that his *Crevettines marcheuses*, which nearly coincide with Dana's family Corophidæ, are distinguished from the *Crevettines sauteuses* by their less compressed body and their small epimera, and by the three hinder pairs of abdominal legs being furnished with "lames natatoires," and not formed as a jumping-apparatus, nor Dana's statement that his Corophidæ have "pedes partim lateraliter porrecti," can satisfy us as constant and exclusive characters. A better limitation was obtained by this family when Spence Bate transferred the genus *Amphitoë*, as reduced by Dana, to the Corophidæ; but to characterize this family, with him, as a tribe (Natatoria), and to place the Corophidæ under a tribe (Domicola), cannot be regarded as satisfactory; for several of the latter do not inhabit tubes formed by themselves, whilst some Gammaridæ do so, such as the genus *Haploops* established by Professor Lilljeborg. The best character seems to me to be that set up by Bruzelius, that the abdominal appendages in the Corophidæ are very thick, often beset with spines, and that the branches of the last pair of leaping-feet are most frequently cylindrical. To this may be added, that the inner lamella of the first pair of maxillæ is small, thick, or obsolete, and only furnished with simple, not quadrifid hairs, whilst in the Gammaridæ the abdominal appendages and the branches of the last pair of abdominal feet, as well as the inner plate of the first pair of maxillæ, are lamellar.

Anonyx, Kr.—To this genus, already including a great number of species (which are just as difficult to distinguish from one another as the genus is easy to recognize at the first glance), I can add four new species from our west coast. Besides the usual characters cited for this genus, it may be stated that the inner lamella of the first pair of maxillæ is, as in the Orchestidæ, very long and narrow, and furnished with two strong and long setæ, closely ciliated on the margins. To this, however, *A. tumidus*, Kr., and *A. Kröyeri*, Bruz., are exceptions; and these also differ in many other respects from the rest of the species, and constitute transitions towards the following genera. The respiratory lamellæ are broad, and the ovigerous lamellæ long and narrow, beset with single, scattered, but long setæ.

The new species discovered by me are:—

1. *A. serratus*, mihi.—This species and the following one belong to those in which the lower posterior angle of the third abdominal segment does not form a hook. Its eyes are large and become narrowed upwards. The first joint of the peduncle of the superior antennæ is long, thick, and cylindrical, the other two very small; the flagellum is formed of seven joints, of which the first is as long as the following three together; the secondary flagellum is four-jointed. The third and fourth joints of the inferior antennæ are of equal length. The flagellum is formed, in the female, of eleven joints, in the male of about twenty. The parts of the mouth are much produced and narrow; the mandibles acuminated at the apex, and from that point to the long narrow masticatory tubercle extends a

series of eight short blunt spines. The palpi of the first pair of maxillæ are beset with teeth at the apex; their outer lamella is elongated and acute above. The two lamellæ of the second pair of maxillæ are nearly of equal length, narrow, and bent in a sigmoid form. The outer lamella of the maxillipedes is closely set on the margin with small blunt teeth. The palpi are narrow and long; the third joint is only a little shorter than the second. The fifth joint of the first pair of feet is longer than the fourth, and straightly truncated at the apex. The claws are very strong. The legs of the second pair are very long and narrow, with their last joint short. The last three pairs of abdominal feet are long; the branches of the seventh pair are lanceolate. The telson is oval; the end is emarginate triangularly to the middle; and both of its lobes are furnished on the outer margin with four short, but strong spines. The posterior lower angle of the third abdominal segment is nearly a right angle, and its posterior edge is serrated.

2. *A. pinguis*, mihi.—The first joint of the flagellum of the superior antennæ is nearly as long as the other seven together; the first joint of the secondary flagellum is long, and dentate on the lower surface; the other three joints are short. The first two joints of the inferior antennæ are short, the third long, the next joint longer and thicker than this, and the fifth shorter than the third. The flagellum consists of twenty joints. The form of the first pair of feet is as in the preceding species, but the fourth joint is still shorter. The fourth joint of the second pair of feet is short, but clavately thickened at its lower end. The parts of the mouth are shorter and stronger than in the preceding. The series of spines on the mandible consists only of three teeth; the masticatory tubercle is oval and prominent. The outer lamella of the maxillipedes, which reaches to the third joint of the palpus, is furnished at the apex with two strong, curved, and pointed teeth; the others are unarmed. The last pair of abdominal feet are narrow; their outer branch is much longer than the inner one, and furnished with a spine at the apex. The telson is cleft only in its posterior third. The epimera are very high; the fourth is deeply emarginate on its hinder margin, and the fifth is higher than broad. The lower posterior angle of the third abdominal segment is rounded. The fourth segment has a saddle-like depression in its middle.

The following species have the lower and posterior angle [of the third abdominal segment] produced into a recurved hook.

3. *A. obtusifrons*, mihi.—The first joint of the flagellum of the superior antennæ is as long as the following seven toge-

ther. The first joint of the secondary flagellum is very long, furnished on the lower margin with several spines; the buccal organs are of the usual form. Masticatory tubercle of the mandibles small. Palpus of first pair of maxillæ rather long. The outer lamella of the maxillipedes reaches to the third joint of the palpus, and is furnished on the margin with scattered, coarse teeth. Fifth joint of the first pair of feet shorter than the fourth, and obliquely cut off at the end. Claws short, but strong. The fourth joint of the second pair of legs is elongated, twice as long as the following one. The first joint of the last three pairs of legs is rather long. The branches of the fifth pair of abdominal feet are very unequal, the inner one being much shorter than the outer, and furnished at the apex with a long, conical, and pointed claw. The branches of the last pair are lanceolate, the inner one much shorter than the outer. The inferior posterior angle of the second abdominal segment forms a short point; the third runs out into a recurved hook.

4. *A. Bruzelii*, mihi.—The flagellum of the superior antennæ is formed of twelve joints, of which the first is rather short; the secondary flagellum consists of from five to six joints. The first two joints of the inferior antennæ are short, but broad; the third joint is longer, the fourth much longer and thicker than the preceding one; the fifth shorter than the fourth, but longer than the third. The apex of the mandibles is acuminate, their masticatory tubercles large and prominent. The rows of spines are formed by eight blunt teeth. Palpi long and narrow. The outer lamella of the first pair of maxillæ is elongate triangular, and its inner side is beset with numerous broad, serrated spines. The inner lamella bears two broad, ciliated hairs. The palpi are toothed at the apex. The outer lamella of the maxillipedes is large, with a few obtuse tubercles on the margins; the inner lamella bears a strong tooth and many ciliated hairs. The first pair of feet are very long and narrow; the second joint is somewhat more than half as long as the first; the fourth is shorter than the fifth, which is about the length of the second joint, and obliquely cut off at the end. The claws are small. The first joint of the second pair of feet is extremely long; the fifth is narrow, and not half so long as the preceding one. The branches of the last pair of abdominal feet are lanceolate. The telson is elongated and divided nearly to its base. The inferior posterior angle of the second segment of the abdomen forms a little point, and that of the third a recurved hook.

Ichnopus, Costa.—A. Costa separates this genus from *Lysianassa*, M.-Edw., by the great length of the antennæ and of the first two pairs of legs. As I do not know Milne-Edwards's genus, from which this, perhaps, differs but little, I have referred to Costa's genus a new species which is not uncommon on the shores of Bergen and Throndhiem. It also agrees in many respects with *Anonyx*, from which it cannot be separated by the elongated antennæ, as *A. littoralis* likewise possesses these—or because the first pair of feet have no prehensile hand, as this is also wanting in *A. Vahlii.* The peculiar form of the respiratory lamellæ, however, is what especially distinguishes it; and this is also described by Costa. These are very large and triangular, and furnished in the middle with a longitudinal fold, like the midrib in a leaf, from which closely approximated transverse folds are given off, like the secondary ribs. These folds are very deep, and give the respiratory plates quite a peculiar form. This, however, is not exclusively characteristic of this genus, as I have found the same structure in *Amphitoë* (*Epidesma*) *compressa*, Lilljeb., but only in the last respiratory plate. The second pair of abdominal feet are also of an unusual form: their branches are dissimilar in structure; the inner one, which is the shortest, is very broad in its first half, and then suddenly contracted, so that only the inner border is continued into a curved, acute, and long spine, and from the truncated outer side issues a long thick seta. In other respects the genus resembles *Anonyx*.

I. spinicornis, mihi.—This species attains a length of 30–40 millims. The peduncle of the superior antennæ is short; its first joint, which is much longer than the following two together, is produced below into a strong spine; a similar one occurs on the inner side of this, as also on the second joint. The third joint of the flagellum is short; the other (still shorter) joints amount in the females to 66, in the males to about 100, and in the latter they are furnished with sucking-disks alternately on the two sides. The inferior antennæ are longer than the the superior; the fifth joint is shorter than the fourth, and the flagellum consists of 80–120 joints. The feet of the first pair differ from those of A. Costa's *I. Tauros* in the second joint in our species being very long and the fourth scarcely longer than the fifth. The third joint of the second pair of feet is in our species much longer than the fourth, and the fourth considerably shorter than in the species described by A. Costa. The three hinder thoracic legs successively increase considerably in length. The telson is very long, and cleft to beyond the middle. The inferior posterior angle of the third abdominal segment forms a small upturned hook.

Urothoë, Dana.—Dana established this genus, with which A. Costa's *Egidea* perhaps coincides, upon two species from the Sooloo Sea. I have found a species upon our coast which must be referred to it, although it does not completely agree with the character of the genus as given by Dana. It differs in the following particulars from Dana's description and figure. The superior antennæ are longer than the inferior, which is probably due to the fact that my specimen was a female, and Dana's males. The palpi of the first pair of maxillæ are two-jointed, with the joints of equal length; but Dana figures them as of one joint. This probably depends on imperfect observation. In my species, moreover, the maxillipedes are thicker, and both their lamellæ larger, and the apices of the maxillæ are not furnished with secondary teeth; but in external form and in the other organs it agrees with the species established by Dana. The characters of the genus may perhaps be settled as follows:—

Body elevated. Epimera moderately long, narrow, and ciliated at the end. Peduncle of the superior antennæ elongated, but its first joint short. The flagellum is small, and the secondary flagellum somewhat less than this. Mandibular palpi three-jointed. First pair of maxillæ strong, their palpi two-jointed, with the joints of equal length; the inner lamella elongated, with a few ciliated setæ at the apex. The maxillipedes are either long or of moderate size. The first two pairs of legs furnished with prehensile hands; the last pair of abdominal feet are broad, and their terminal branches beset with ciliated hairs. Telson bifid. The ovigerous lamellæ are long and narrow, and furnished with a few but long hairs.

From these characters we see that the genus must, as Dana supposed, stand in the neighbourhood of *Anonyx* and *Lysianassa*, and therefore belong to his subfamily Lysianassidæ, and not to the Gammaridæ, as Spence Bate and others have thought, on the ground that the peduncle of the superior antennæ is long and the branches of the last pair of abdominal feet broad and ciliated; for even in *Anonyx tumidus* the peduncle is elongated, and several species of *Anonyx* (such as *A. serratus*, mihi) have the branches of the last pair of abdominal feet furnished with a few ciliated hairs on the inner side. The form of the ovigerous lamellæ and of the inner lamella of the first pair of maxillæ, however, is sufficiently characteristic to distinguish it from these.

U. norvegica, mihi, resembles *U. irrostratus*, Dana, in the form of the head, but differs from that species in that the inferior posterior angle of the fourth joint of the first two pairs of feet is acute, and the branches of the last pair of abdominal feet are short. The first two pairs of hands are not narrow, as in *U. elegans*, Spence Bate, but short; and the inner branch of the posterior abdominal feet is much shorter than the outer one.

Bathyporeia, Lindström.—This genus, which was referred to its proper place by its founder, was removed, like the preceding, to the subfamily Gammaridæ by Spence Bate; but the thick peduncle of the superior antennæ and the form of the second pair of feet refer it to the subfamily Lysianassidæ. Moreover I think it must stand here on account of the structure of the maxillipedes, in which it closely resembles *Urothoë*, whilst the palpi, as in that genus, are elongated and have their second joint strongly developed, and also especially because the ovigerous lamellæ, exactly as in *Anonyx*, are long and narrow, with scattered long hairs. The epimera are furnished with cilia, which the preceding genus also possesses, of which *Anonyx* bears indications, and which are more evident in the following genera. By the large inner lamella of the first pair of maxillæ, which is furnished with numerous ciliated hairs, it approaches the genus *Pontoporeia*.

The species occurring with us differs in some particulars from the descriptions and figures of *B. pilosa*; but as this varies much, I believe that it is only a variety of that species.

Pontoporeia, Kr.—This genus of Kröyer's, which he founded upon the Greenland species, *P. femorata*, and which was enriched with three species by Lindström and Bruzelius, may be here further increased by another new one, which occurs in the University Zoological Museum, without indication of the locality where it was found, but is probably from the coast of Bergen.

P. armata, mihi.—This differs from the other species in having the secondary flagella rather long; the first pair of feet are long and strong; and the inner branch of the posterior abdominal feet is nearly rudimentary. It is also distinguished by having the upper posterior angle of the first joint of the fifth pair of feet produced and bent up into a long curved point; the first joint of the sixth pair much longer than [that of] the fifth, and furnished at the same place with a similar but somewhat straighter spine; the first joint of the seventh pair considerably dilated and broader than high; the telson very broad, with a small emargination in its posterior margin; the second and third abdominal segments somewhat carinated, and both projecting at the posterior edge into a short blunt spine.

This genus is the type of the subfamily Pontoporeinæ, Dana, to which belong, according to him, the genera *Phoxus* and *Ampelisca*, which also occur with us. But if we examine the structure of this typical genus, we shall see that it differs but little from the preceding genera, and that it does not possess the characters ascribed to that subfamily. In *Pontoporeia* the head is not dilated into a hood above the superior antennæ. The peduncle of these is thick, although rather elongated, and the flagellum short; the mandibles are distinctly divided at the apex, and somewhat, although obsoletely, toothed. The inner lamella of the first pair of maxillæ is large, and furnished with numerous ciliated hairs; but this is the case, although in a less degree, in *Bathyporeia*, and even in some species of *Anonyx*. The second pair of feet is elongated as in the above-mentioned genera; in *Bathyporeia* there is no claw upon them, whilst *Anonyx* and *Pontoporeia* possess a small claw; in *Urothoë* the claws are as strongly developed upon the second as upon the first pair of feet. The third and fourth pairs of feet in *Pontoporeia* are not furnished with prehensile organs, any more than in some of the preceding; but they are as strong as in these. Lastly, the ovigerous lamellæ are quite of the same structure as in the preceding genera.

Phoxus, Kr.—In this genus the head is developed in front into a hood above the peduncle of the superior antennæ, and these originate in front of the inferior antennæ; but this cannot be of so much importance as to justify the formation of a subfamily as Spence Bate supposes; for *Urothoë rostratus*, Dana, possesses a similar hood, whilst the other species want it; and in some species of the genus *Ampelisca* the superior antennæ originate in front of the lower ones, and in others beside them. In other respects it agrees closely with the preceding genera. The peduncle of the superior antennæ is thick; the apices of the mandibles, which were divided even in the last genus, are here distinctly toothed. The inner lamella of the first pair of maxillæ is only small and furnished with few ciliated setæ; the first two pairs of legs are furnished with prehensile hands; the ovigerous lamellæ are as in the preceding genera.

Œdicerus, Kr.—Kröyer founded this genus upon the species *Œ. saginatus* from Greenland. He indicates as a generic character that the head runs out in front into a long rostrum, which has a knob in its foremost part, as to which Bruzelius and Sars have shown that it consists of the eyes, which have attained this remarkable position. Further generic characters cited are, that the peduncle of the superior antennæ is long, with a scarcely longer flagellum, and without a secondary flagellum; the first two pairs of legs are furnished with strong prehensile hands; the third and fourth pairs are long, with a broad claw; the two next pairs have the first joint but little developed, and the seventh pair are very long. Dana added to this genus a new species, *Œdicerus novizealandiæ*, and thought that some of the characters which Kröyer ascribed to the genus were of little value as generic characters. To these species Bruzelius has added two, and Sars one, to which a sixth species is now added. Thus so many species are now brought together that the proposed generic characters require a fresh investigation. These species may be divided into two distinct sections,—one of which includes the species *saginatus*, Kr., *affinis*, Bruz., *lynceus*, Sars, and *norvegicus*, mihi, the other *novizealandiæ*, Dana, and *obtusus*, Bruz. Dana, finding that his *Œ. novizealandiæ* agreed in some respects with *Œ. saginatus*, Kr., especially in the considerable length of the last pair of thoracic legs, by which it was separated from the genus *Iphimedia* as he conceived it, assumed therefore that it must belong to the genus *Œdicerus*, Kr.; but it, as well as *Œ. obtusus*, Bruz., of which I have had examples from Finmark to examine, differs much from the typical species. Thus:—In these two species the superior antennæ are elongated, whereas in the other they are very short, only a little or scarcely longer than the peduncle of the inferior antennæ. The head does not project in a long and strong rostrum in which the eyes are placed so close together as to look like a single organ, but the rostrum is wanting, and the eyes are, as usual, placed on the sides of the head. The apices of the mandibles are not toothed; and their palpi, which in species of the same genus are of the same structure, differ in the form of the second joint from those of *Œ. saginatus*. The inner lamella of the first pair of maxillæ is large and furnished with several strongly ciliated hairs, whilst in those of *Œ. saginatus* &c. there is only a single seta. There is therefore sufficient ground for separating these two forms from each other, especially as each of them includes several species. I have therefore set up *Œ. obtusus*, Bruz., as the type of a new genus, *Aceros*, mihi, to which I also refer *Œ. novizealandiæ*, Dana. These two species differ from each other in the length of the peduncle of the superior antennæ; for this, in Dana's species, is short, with a long flagellum, and in *Œ. obtusus* long, with the flagellum short. Lastly, with regard to the place of this genus in the system, Dana has placed it in the family Gammaridæ, as he only knew his species with long antennæ; but I think that it must go with the preceding genera, as the form of the ovigerous lamellæ and their relation to the respiratory plates are the same as in these, whereas those of the genera resembling *Gammarus* are of a different form. In the structure of the hands on the first two pairs of legs the genus is related to the subfamily Leucothoinæ.

The species which belong to the genus *Œdicerus* as thus reduced differ greatly in the structure of the feet. In all, indeed, the first two pairs of legs are furnished with large prehensile hands of a peculiar form; but in the various species these are different in some parts: in *Œ. lynceus* the lower posterior angle of the fourth joint is not produced into any process; in *saginatus* and *affinis* this is not half so long as the hand; in *norvegicus* it is so long that it meets the tips of the claws, and the hands are much broader than in the others. The same joint in the second pair of hands possesses in *saginatus* and *lynceus* a not very long process, and the hands are oval; in *affinis* both the processes and the hands are much elongated and narrow; and in *norvegicus* this is the case in a still higher degree, so that they are not much shorter than the preceding joints together, and not much thicker than these. Moreover the lower posterior angle of the hands projects into a finger, and the processes project even further than this. The third and fourth pairs of feet are entirely destitute of claws in *norvegicus*; in *affinis* the claws are small; in *saginatus* long and broad, as long as the fifth joint; in *lynceus*, finally, they are more strongly produced and narrower. In the two following pairs the same relations occur; but here a small claw is seen in *norvegicus*. The last pair of legs are, as in the other species, much elongated, and the sixth joint, or claw, is very long and conical. It may also be remarked of this species that the eye-processes are very short and broad, so that the head appears to form a hood over the superior antennæ, the flagellum of which is very short. The fourth and fifth joints of the inferior antennæ are of equal length; the second joint of the palpus of the maxillipedes is very broad; the fifth epimera are of the same height as, but much broader than, the fourth.

[To be continued.]

XLI.—*Notes on some Indian and Mascarene Land-Shells.* By William T. Blanford, F.G.S., C.M.Z.S., &c.

1. *On the Lingual Ribbon of* Realia (Omphalotropis).

The resemblance of the shell and operculum in some forms of *Assiminea* to those of *Realia** is so great that, without an acquaintance with the animal, it is extremely difficult to deter-

* As no generic distinction has been shown to exist between *Realia* and *Omphalotropis* (the only difference being that the latter has a less thickened lip, and a keel round the umbilicus), the two cannot be kept distinct, and the genus must bear the older name of *Realia*.

mine to which genus a shell should be referred. The former is almost invariably, I believe, estuarine, living between tide-marks at or near the mouths of rivers, its favourite habitat being the mud of tropical deltas; while *Realia* is a land-shell. *Assiminea* has lately been classed by Dr. Stimpson amongst the Rissoidæ, on account of the characters of its lingual dentition; and, whether this character alone is quite sufficient connexion or not, there can be very little doubt that *Assiminea*, *Truncatella*, *Bithynia*, *Tomichia*, and probably *Acicula*, with some other genera, form a very natural group, very nearly allied to *Rissoa*.

As the only known external characters by which *Assiminea* and *Realia* can be distinguished are the relative position of the eyes and the form of the tentacles, and as the relations of *Realia* to the other operculated land-shells are somewhat obscure, it appeared to me very desirable to examine the lingual ribbon; and as I have been lately furnished, by the kindness of my friend Mr. Geoffroy Nevill, with specimens of *R. rubens*, Quoy and Gaim., and *R. globosa*, Bens., both from the Mauritius, with the animal dried inside, I have extracted the tongues, and ascertained that the teeth are of peculiar form, tænioglossate, of course, but differing considerably from those of any Gasteropod previously examined. The basal denticles on the central teeth, which Dr. Stimpson considers characteristic of the Rissoidæ, are entirely wanting.

In the accompanying sketch the teeth of *Realia rubens* are represented considerably further apart than they occur on the

Lingual teeth of *Realia rubens*, Quoy & Gaim.

lingual ribbon, on which they are so much crowded together that they cannot be clearly made out. The central tooth somewhat resembles that of some Cyclophoridæ in form; it has nine denticulations along the upper margin, that in the middle being larger than the others. The first lateral tooth has eight denticulations; the second, which is somewhat like that of *Paludina*, has six. The outermost lateral tooth exhibits the peculiar character of the divisions between the different denticulations (twenty in number) being carried down for some distance below the upper margin. This character, I believe, has only been observed before in West-Indian forms of Cyclostomidæ. The tongue of *Realia* (*Omphalotropis*) *globosa*, Bens., does not differ in any important character from that of *R. rubens*; but I have not isolated the separate teeth so as to count the denticulations.

The nearest approach to the lingual dentition of *Realia* appears to be made by *Chondropoma candianum*, D'Orb. (conf. Troschel, Gebiss der Schnecken, vol. i. pl. 5. fig. 1), which Troschel regards as forming a link between West-Indian Cyclostomidæ (Licininæ) and the European and African forms (Cyclostominæ). The characters of the central teeth and two inner lateral approach more nearly to those of the latter subfamily, while the outer laterals show the peculiarity which has induced some naturalists to consider the former a link between the Tænioglossa and Rhipidoglossa.

The examination of the teeth, on the whole, tends to confirm the position assigned to *Realia* by Pfeiffer as a subfamily of Cyclostomidæ equivalent to the Licininæ and Cyclostominæ. Of course, *Hydrocena* and the *Assimineæ*, hitherto included, must be removed to other families.

2. *On* Cyclotopsis.

When first describing this genus, in 1864 (Ann. & Mag. Nat. Hist. ser. 3. vol. xiii. p. 447), I pointed out that *Cyclotus conoideus*, Pfr., from the Seychelles and Mauritius, would probably prove to belong to it. Mr. Geoffroy Nevill has recently collected specimens which completely confirm this opinion: both shell and operculum agree perfectly in character with the typical Indian species.

In the 'Zoological Record' for 1864, Dr. von Martens expresses his dissent from my conclusion that this genus belongs to the Cyclostomidæ proper, because its operculum has several whorls. Dr. von Martens must have overlooked my description of the animal (p. 446), in which I pointed out that it possessed the longitudinally cleft foot and peculiar mode of reptation so characteristic of the Cyclostomidæ—a character of much higher importance than the number of whorls in the operculum. Several West-Indian Cyclostomidæ belonging to the genus *Choanopoma* have polyspiral opercula, some of them with four and five whorls—quite as many as are found in *Cyclotopsis*. I pointed out the resemblance of the operculum in the Indian forms to that of *Choanopoma*, when first describing the genus (*l. c.* p. 448).

Dr. Stoliczka has lately carefully examined the anatomy of *Cyclotopsis*, and entirely confirms my view of its affinities. The lingual teeth are very similar to those of typical *Cyclostomata*, and do not resemble those of *Cyclophorus*.

3. *On the Genus* Cremnoconchus (*olim* Cremnobates).

As the name which I gave in 1863 to this very remarkable land-shell appears to have been preoccupied for a genus of fishes*, I propose to substitute for it *Cremnoconchus*†.

Besides the type species *C. syhadrensis*, W. Bl., a shell described by Mr. Layard in the Proc. Zool. Soc. for 1854, p. 94, as *Anculotus carinatus*, proves also to belong to the genus. This shell occurs in a similar habitat to that of the typical species, on a precipice at Mahableshwar, about 4500 feet above the sea.

The shell described by Mr. Layard was immature; in the adult the last whorl is angulate below the suture and at the periphery. The shell is imperforate, ovately conical, with the apex eroded, and 8 millimetres long by 5½ broad.

I possess a variety of *C. carinatus* with canaliculate sutures, from Torna hill, about twenty miles west of Poona. At the same hill I found a third undescribed form, differing from *carinatus* in the absence of any angulation at the periphery.

As neither *C. carinatus* nor the new form is perforated or costulated, these characters must be omitted from the generic description.

Dr. Troschel has described the tongue of *Cremnoconchus* in the 'Archiv für Naturgeschichte' for 1867; but I have been unable to gain access to the paper. I believe the result of the examination has been to confirm the position I had assigned to the genus. It is necessary to state, as I find I have been misunderstood on the subject, that the localities where *Cremnoconchus* occurs are from thirty to fifty miles from the sea.

4. *On the* Alycæinæ *and* Diplommatininæ.

One of the characters pointed out by Von Martens as distinctive of the subgenus *Diancta* (type *Diplommatina constricta*, v. Mart.) is the presence of a constriction. It does not appear to have been noticed that this character is almost universal in the genus *Diplommatina*; but in most species it takes place in the penultimate whorl, and is greatly concealed by the peristome. Examining a series of specimens from the Indian and Burmese region, I find this constriction well marked in the following forms:—

D. diplocheilus, Bens. *D. pachycheilus*, Bens.

* I am indebted to the politeness of M. Crosse, in the 'Journal de Conchyliologie,' and of Dr. von Martens, in the 'Zoological Record,' for pointing this out.

† Etym.: κρημνὸς, a precipice; κόγχος, a shell.

D. Blanfordiana, Bens. *D. labiosa*, W. Bl.
D. pullula, Bens. *D. gibbosa*, W. Bl.
D. semisculpta, W. Bl.

In the latter it is not so strongly marked externally; but, as in several others, there is a distinct internal rib.

In almost every species I can detect a slight constriction, even in the forms from Southern India (*Nicida*). Its being noticed in *Diancta* appears principally due to its occurring at the back of the shell; but it is far from constant in position. In some Indian forms it is on the penultimate whorl behind the lip, in others in the middle of the peristome.

The character of the shell in *Diplommatina* is exactly similar to that in *Alycæus*, and quite different from other Cyclophoridæ. There is a complete absence of the coloured markings so characteristic of *Cyclophorus*, *Cyclotus*, *Pterocyclos*, and their allies; there is, as a rule, no epidermis, or only a very thin one; and the structure of the shell is different, more horny and less calcareous. The sculpture, too, is quite different in general from that of the Cyclophorinæ.

I am therefore disposed to consider that *Diplommatina* and its various subgenera *Palaina*, *Diancta*, *Nicida*, &c., with *Opisthostoma*, ? *Clostophis*, and *Alycæus*, form a very natural subfamily of the Cyclophoridæ distinguished by the peculiar structure of the shell and the presence of a constriction. This subfamily should be called *Alycæinæ*.

I have not examined the lingual ribbon of *Diplommatina*; that of an *Alycæus* from Upper Burma (*A. Vulcani*, W. Bl.) is represented herewith. It is quite of the Cyclophoroid type; but the outermost laterals do not appear to be denticulated.

Lingual teeth of *Alycæus Vulcani.*

XLII.—*Descriptions of new Genera and Species of* Tenebrionidæ *from Australia and Tasmania.* By Francis P. Pascoe, F.L.S. &c.

[Concluded from p. 296.]

Notwithstanding the following additions to the genus *Amarygmus**, there still remains a considerable number of species,

* Dalman, Anal. Entom. p. 60. M. Blessig separates the Australian species of the genus, under the name of *Chalcopterus*, on account of the mandibles of the latter being entire at the end, not bifid. (Hor. Soc. Ent. Ross. fasc. i. p. 103.)

some of which, although they would be called "evidently distinct," are apparently so nearly allied to others already published that they could not be satisfactorily differentiated without a larger suite of specimens than I possess. The variability of some of them (e. g. *A. purpureus*) has probably led to more than one being split up into so-called species. All here described are, I venture to think, either more or less specialized or are distinguished by very strong characters from those to which they may be considered most approximate.

Amarygmus cœlestis.

A. ovalis, niger, nitidus; elytris læte cyaneis, sat leviter seriatim punctatis, interstitiis impunctatis; tarsis tenuiter elongatis.

Hab. Brisbane.

Moderately oval, black, shining; the elytra bright indigo-blue, with slight violet reflections; head flat between the antennary tubers, separated from the clypeus by a deep broad groove; eyes approximate, entirely concealed by the prothorax in repose; antennæ rather slender, the last joint irregularly oblong-obovate; prothorax small, not very broad at the base or apex, the punctures almost obsolete; scutellum small, triangular; elytra moderately convex, seriate-punctate, the punctures rather fine, but well-marked, intervals of the striæ impunctate; body beneath and legs glossy black, with a brownish tinge; abdomen finely striated longitudinally; all the tarsi slender, elongate. Length $5\frac{1}{2}$ lines.

A handsome species, allied to *A. amethystinus*, Fab.*; the latter, however, has a dark-blue prothorax and red femora.

Amarygmus vinosus.

A. ovalis, viridis, nitidus; elytris purpureis in virides mutantibus, sat leviter seriatim punctatis, interstitiis subtiliter punctatis.

Hab. Sydney.

Moderately oval, green, shining, the elytra purple changing to green according to the light; head black, very slightly convex above the clypeus; eyes moderately approximate; antennæ gradually thicker outward, the last joint ovate; prothorax minutely and sparsely punctured, broad at the apex; scutellum small, triangular, black; elytra moderately convex, seriate-punctate, the punctures rather fine, but well marked, the intervals of the rows minutely punctured; body beneath and legs glossy brownish black, the abdomen finely striated longitudinally; anterior and intermediate tarsi shorter than in the last. Length $5\frac{1}{2}$ lines.

* Ent. Syst. ii. p. 40 (*Erotylus*).

In outline resembling the last, but differently coloured, with the prothorax shorter and much broader at the apex, the intervals of the rows on the elytra minutely punctured, &c.

Amarygmus exilis.

A. anguste oblongus, nitidus; prothorace trapezoidali, viridi-metallico; elytris elongatis, aureo-viridibus, in certo situ cupreo-resplendens, leviter seriatim punctatis.

Hab. Lachlan River.

Narrowly oblong, nitid, slightly convex; head green in front, blackish towards the clypeus; eyes remote; antennæ short, stout, ferruginous, the last six joints thicker and longer than the two preceding, the third only a little longer than the fourth; prothorax metallic green, trapezoidal, the sides nearly straight, the base not much broader than the apex; scutellum equilaterally triangular, black; elytra rather long, but much broader than the prothorax at the base, the sides nearly parallel, finely seriate-punctate, bright golden-green with copper reflections; body beneath light chestnut, glossy; legs dark chestnut; tarsi ferruginous. Length $3\frac{1}{4}$ lines.

A much narrower form than any of the preceding, with shorter antennæ.

Amarygmus indigaceus.

A. oblongus, subnitidus; prothorace nigro, angulis anticis acuminatis; elytris cyaneis, distincte seriatim punctatis; antennis tarsisque obscure testaceis.

Hab. Sydney.

Oblong, a little nitid; head black, rather coarsely punctured; eyes somewhat approximate; antennæ dull testaceous, the last four joints shorter and a little thicker than the others; prothorax rather narrow, shining, minutely punctured, the anterior angles produced and pointed; scutellum triangular, black; elytra broadest at the shoulders, very gradually narrower posteriorly, indigo-blue, rather finely seriate-punctate, the intervals of the striæ narrow; body beneath and legs chestnut-brown, slightly glossy; tarsi dull testaceous. Length $3\frac{1}{2}$ lines.

Allied to *A. picicornis* and *A. tarsalis*; the former, *inter alia*, has varying metallic elytra, and the latter a different prothorax and coarsely punctured elytra.

Amarygmus Cupido.

A. oblongo-ovalis, nitidus; prothorace nigro; elytris læte violaceis, certo situ cyaneo-resplendens, leviter seriatim punctatis.

Hab. Queensland.

Oblong-oval, nitid; head black; eyes scarcely approximate; antennæ dark ferruginous, the last five joints thicker and longer than the three preceding, but the third a little longer; prothorax glossy black, rather broad at the base, finely punctured; scutellum equilaterally triangular, black; elytra broadest, with the sides nearly parallel, along the middle third, rich violet, with lightish blue reflections, finely seriate-punctate; body beneath and legs chestnut-brown, glossy; tarsi ferruginous. Length $3\frac{1}{2}$ lines.

This is a beautiful and very distinct species, in size and form resembling the last, but with a nearly perfectly oval outline.

Amarygmus pusillus.

A. ovalis, niger, parum nitidus; elytris fere opacis, striato-punctatis, interstitiis impunctatis; subtus pedibusque castaneis.

Hab. Kiama.

Oval, black, a little nitid; head dull black; eyes not approximate; antennæ brown, gradually thicker from the third joint, the last five especially so; prothorax a little more nitid, well rounded at the sides, very minutely punctured; scutellum triangular, black; elytra nearly opaque, brownish black, strongly striate-punctate, the punctures oblong-linear, the intervals of the striæ broad, flattish, with a slight trace, in certain lights, of transverse linear impressions; body beneath and legs chestnut-brown, slightly glossy. Length $2\frac{3}{4}$ lines.

The sculpture of the elytra seems to approach in its character that of *A. rugosus*, Germ.; but the latter, *inter alia*, has rugose striæ, which is not the case in the species before us. The following has also striated elytra, but with different sculpture.

Amarygmus minutus.

A. suboblongo-ovalis; elytris fuscis, subnitidis, fortiter striato-punctatis, interstitiis punctulatis; subtus pedibusque pallide ferrugineis.

Hab. Sydney.

Slightly oblong-oval; head dark brown; eyes not approximate; antennæ pale ferruginous, the last five joints gradually thicker and very little longer than the three preceding; prothorax chestnut-brown, finely punctured, well rounded at the sides, broad at the base; scutellum triangular, brown; elytra brownish black, rather glossy, strongly striate-punctate, the punctures large, round, the intervals between the striæ finely punctured; body beneath and legs pale ferruginous. Length $2\frac{1}{4}$ lines.

Amarygmus obtusus.

A. oblongo-subovalis, niger, nitidus; elytris fusco-purpureis, haud versicoloribus, fortiter seriatim punctatis; tarsis subtus longe pilosis.

Hab. Queensland.

Oblong-suboval, black, shining, the elytra dark purple-brown without reflections; head slightly concave above the clypeus; eyes approximate; antennæ short, slender, the last four joints with a brownish pubescence, the last shortly ovate; prothorax short, gradually rounded from the base, broad and obtuse anteriorly, minutely punctured; scutellum triangular, black; elytra rather elongate, convex, the sides very slightly rounded, seriate-punctate, the punctures rather coarse, the intervals of the rows almost obsoletely punctured; body beneath and legs brownish black, subnitid; tarsi slender, with long hairs beneath. Length 7 lines.

The form and colour of this very distinct species will render it easily recognizable.

Amarygmus polychromus.

A. late ovalis, niger, nitidus; elytris cyaneis, vel purpureis, vel viridibus, coloribus variis resplendentibus, tenuissime seriatim punctatis; prothorace basi haud lato.

Hab. South Australia.

Broadly oval, black, shining; the elytra blue, purple, or green, with metallic reflections of various colours; head very slightly convex in front; eyes moderately approximate; antennæ rather slender, last joint elongate-ovate; prothorax black, with greenish reflections, not broad at the base, narrow at the apex, minutely and sparsely punctured; scutellum equilaterally triangular; elytra rather strongly convex, very finely seriate-punctate, the intervals of the rows broad and minutely punctured; body beneath, legs, and antennæ jet-black, glossy, abdomen finely punctured. Length 6–7 lines.

A very variable species as to the colour of its elytra, but readily distinguished, except from the next, by the fineness of its seriated punctures, which are scarcely to be discriminated from the interstitial punctures, together with its greater breadth and convexity. *A. Howittii* is a still broader species, with its dark-green colour varying principally from darker to lighter shades.

Amarygmus Howittii.

A. late ovalis, nitidus; prothorace nigro; elytris subtiliter seriatim punctatis, interstitiis subtilissime punctatis, æneo et cupreo versicoloribus.

Hab. Victoria.

Broadly oval, smooth, shining; head glossy black; eyes not approximate; clypeus rather narrow; antennæ black, extending but little beyond the prothorax, thicker outwards, the last four joints shorter than the preceding, opaque, the rest glossy; prothorax small, broad at the base, the apex narrow, the anterior angles not produced, glossy black, finely and rather remotely punctured; scutellum small, triangular, black; elytra rather strongly convex, the sides nearly parallel or but very slightly rounded, very finely seriate-punctate, the punctures very close, the intervals of the rows wide and very minutely punctured, the colour dark greenish, shaded from brassy to copper according to the light; body beneath and legs jet-black and very glossy. Length 7 lines.

Dr. Howitt says of this very distinct species, "common everywhere;" but the two specimens he has sent me are the only ones I have seen. It approaches the following in outline, but is very different in colour and sculpture.

Amarygmus semiticus.

A. late obovatus, subnitidus, flavo-cupreus; elytris subtiliter seriatim punctatis, interstitiis vage et subtilissime punctatis; corpore subtus viridi-nigro.

Hab. Port Denison.

Broadly obovate, slightly nitid, colour above an unvarying yellowish copper; head black; eyes approximate; clypeus rather narrow; antennæ black, thicker outwards, fourth and succeeding joints of nearly equal length, the third not much longer than the fourth; prothorax much narrower at the apex, anterior angles somewhat produced, very minutely punctured; scutellum small, curvilinearly triangular, black; elytra broadest nearly at the base, then rounded, gradually narrower to the apex, finely seriate-punctate, punctures close, the intervals of the rows wide, sparsely and very minutely punctured; body beneath glossy greenish black; legs black. Length 7 lines.

Amarygmus semissis.

A. breviter ovalis, modice convexus, niger, nitidus; antennis art. 4 ultimis tarsisque fulvo-ferrugineis; elytris leviter striato-punctatis.

Hab. Kiama.

Shortly oval, black, nitid, moderately convex; head scarcely concave in front; eyes moderately approximated; antennæ slender, the two basal joints glossy ferruginous, the last four pubescent, tawny ferruginous, opaque; prothorax small, not broad at the base, minutely punctured; scutellum triangular; elytra striate-punctate, the striæ shallow, the punctures rather fine, the interstices of the striæ very minutely and sparsely punctured; body beneath and legs glossy brownish black, tarsi tawny ferruginous. Length 4 lines.

This species is allied to the following, but, *inter alia*, has a broader and less elliptic outline, and is much less convex.

Amarygmus ellipsoides.

A. breviter elliptico-ovalis, sat fortiter convexus, fusco-niger, nitidus; elytris viridi-nigris, leviter striato-punctatis.

Hab. Queensland.

Shortly elliptic oval, rather strongly convex, brownish black, shining; the elytra greenish black, without reflections; head scarcely concave in front, a little depressed along the clypeal groove; eyes not approximate; antennæ glossy ferruginous, long, slender, the last joint narrowly oblong; prothorax small, rather narrow at the apex, very minutely punctured; scutellum triangular; elytra striate-punctate, the striæ shallow, the punctures rather fine, the interstices obsoletely punctured; body beneath and femora glossy brownish black; tarsi slender and, with the tibiæ, ferruginous. Length 4½ lines.

Amarygmus suturalis.

A. breviter ovalis, sat fortiter convexus, aterrimus, nitidus; elytris purpureo-cupreis in fusca mutantibus, sutura viridi, fortiter striato-punctatis.

Hab. Swan River.

Shortly oval, rather strongly convex, deep glossy black; the elytra purplish-copper changing to brown, the suture bright green; head flattish above the clypeus, the latter convex; eyes moderately approximate; antennæ stoutish, especially outwards, the last joint irregularly and broadly ovate; prothorax broad at the apex, rather narrow at the base, minutely punctured; scutellum convex, triangular; elytra striate-punctate, the striæ narrow and rather deep, the punctures small and nearly contiguous, the intervals of the striæ almost impunctate; body beneath and legs glossy black. Length 5 lines.

This and the two above are among the very few striated species of the genus; and of the striated species they are the most convex and elliptical in outline. Besides the difference of colour, *A. suturalis* has the antennæ much stouter and the elytra much more deeply striate than *A. ellipsoides.*

Amarygmus torridus.

A. breviter ovalis, convexus, nitidus; prothorace fulvescenti-cupreo; elytris viridi-metallicis, fortiter seriatim punctatis; corpus subtus femoribusque castaneo-fuscis.

Hab. Cape York.

Shortly oval, convex, shining; head black; clypeus very broad; antennæ reddish brown, slightly thicker outwards, extending to half the length of the body, third joint longest, the rest of nearly equal length; prothorax yellowish copper, closely and finely punctured; scutellum equilaterally triangular, black; elytra about a quarter longer than broad, convex, coarsely seriate-punctate, all the punctures about equidistant from one another; body beneath and femora dark chestnut-brown, slightly nitid; tibiæ and tarsi reddish brown. Length $5\frac{1}{2}$ lines.

In form something like *A. convexus*, but shorter. An isolated species.

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

In the 'Flora' of Sept. 30, 1868, Dr. W. Nylander has some observations on Cephalodia which are worthy of attention.

These organs of Lichens were little known before Dr. Nylander pointed out their importance as furnishing a primary anatomical character in their gonimia. They occur only in thalli which have gonidia.

The kinds hitherto observed are:—

1. *Epigenous* cephalodia, on the upper surface of the thallus, variously protruded and of various forms, according to the genera and species in which they occur. They are the most frequent.

2. *Hypogenous* cephalodia, less frequent, on the under surface of the thallus, known only in *Peltidea venosa* and *Psoroma euphyllum.*

3. *Endogenous* or *Pyrenoid* cephalodia, which are immersed in the thallus and form a pyrenocarpoid protuberance (covered by the thallus) on the lower surface of the thallus. These are found in foliaceous Lichens, as in many *Stictei*, *Nephroma expallidum*, &c.

But lately Dr. Nylander has detected in *Lecanora* (*Psoroma*) *araneosa* (Bab.), from New Zealand, both epigenous and hypogenous cephalodia. On the pale testaceous, foliaceo-lobate thallus, incurved at the margin, occur superficial concolorous cephalodia, which are at first granuliform, then rounded and at the circumference crenulate, subplacodioid, somewhat convex and unequal. On the pale under surface of the thallus, also, are similar cephalodia, but less developed, slightly prominent, and reminding one entirely of those of *Peltidea venosa.*

Similar cephalodia, but much less developed, are observable on both surfaces of the thallus of *Lecanora allorhiza*, Nyl. (collected in New Zealand by Dr. C. Knight), which is similar to but smaller than *L. araneosa*, and has a pale naked thallus, concolorous on the under surface, shortly rhizinoso-villose, with spores ellipsoid and often somewhat scabrous. This lichen grows on bark, and perhaps is only a diminished variety of *L. araneosa*, though differing in various respects.

XLIV.—*Notes on the "Vielle"* (Batrachus gigas, *Gthr.**). By Swinburne Ward, Esq.

This enormous fish has been frequently seen in these waters, but very seldom captured, as it will scarcely ever take a bait. According to the best authorities, it selects some deep hole with a muddy bottom, and never leaves it. One very large one has been occasionally seen, on very clear days, in a hole inside the harbour, at but a short distance from the shore. I heard of its habitat six years ago; and it was seen within the last six weeks by the captain of an American whaler; but it has as yet baffled all my attempts to capture it, refusing persistently the most temptingly arranged hooks. I only once succeeded in hooking one and bringing it nearly to the surface, when the line broke, and the big fish and my hopes vanished simultaneously.

The specimen whose head I sent home was found dead, thrown up on the reef on the north-west side of the harbour, its tail and a portion of the lower part of its body having been bitten off by a shark—a hammer-headed one, in all probability, as I do not think, from my experience of the shark tribe, that any other variety would attack an animal so formidable-looking so far as size is concerned. The tiger-shark is unusually ferocious when hooked or harpooned; but the hammer-head kills for the pleasure of killing alone.

* See Ann. & Mag. Nat. Hist. ser. 4. vol. iii. p. 131.

I was unfortunately absent when this huge fish was thrown upon the reef, and thus could only secure the head and a portion of the bones: the latter were sent to England some considerable time ago.

Experienced fishermen here inform me that men have been attacked by it, but that its movements are very slow, and no authenticated instance has occurred of any catastrophe having been caused by it. One man told me that he was once diving for an anchor in the harbour, and was followed to the surface by one of these monsters.

A very large fish of a similar appearance has been seen by the Aden divers; but I am not aware if any have ever been caught there. I imagine that it would require a very strong shark-line and hook to capture one of them: but I almost give up the idea of doing so; I have fished for them so often, and so constantly failed.

There are two kinds of this "Vielle," which attain to an enormous size:—one, "Vielle Crabe" (the one now at home); and another, "Vielle Babonne," the teeth of which are about half the length of the middle finger, in one row, and something in shape like those of the English pike*. One of the latter, measuring 17 feet in length, was killed at the south point of this island last year, again during my absence; and, unfortunately, I could not even secure his head or any of the bones. The people will not eat them; and it was simply killed and cut away from the hook in the deep water, where the sharks must have quickly disposed of it. If any are caught during my residence here on any part of the island, I have now made arrangements for securing and preserving as much as nature will permit; but it is not easy to preserve a fish 17 feet long and nearly 4 four feet across the shoulders. The length of the one whose head is now in the British Museum was given me as that "of three men," *i. e.* about 16 feet; but this measurement cannot be considered accurate at all.

Seychelles, Feb. 1869.

XLV.—*Notes of a week's Dredging in the West of Ireland.* By George Stewardson Brady, C.M.Z.S., and David Robertson.

[Plates XVIII.–XXII.]

The naturalist who can count only upon a few days as the length of time which he is able to devote to a distant excursion will probably do well to confine his attention chiefly, if not

*[This may prove to be a species of *Lophius*.—A. Gthr.]

entirely, to some limited subject; otherwise the novelty of the creatures which he meets with, perhaps for the first time, will be liable to withdraw his attention from any careful or minute observation until his time is too far spent to allow of the serious study of any particular group. We have ourselves often erred in this way; but last year (1868) we resolved to devote our short furlough strictly to the examination of the Entomostraca and smaller Crustacea of the district which we proposed to visit. The following notes refer, therefore, almost entirely to that class. We do not suppose that the lists here given are by any means exhaustive: the restricted areas apparently occupied by some species make it almost certain that further opportunities of investigation would have revealed the existence of others as interesting as those which were actually observed*; and there can be no doubt that both the marine and freshwater loughs of Western Ireland, especially of the Connemara district, offer yet a most promising, and in some departments an almost untouched field of research to both botanist and zoologist.

Our dredging during this excursion was confined to the coast in the neighbourhood of Westport, Clifden, and Roundstone; but we also found time to make a few gatherings in the freshwater lakes of the district, and, *en route*, to snatch an hour or two of work in Dublin Bay. The terminus of the Mullingar Canal at Dublin, from which we took some gatherings, afforded us a few interesting Ostracoda, amongst which was one species (*Cypridopsis obesa*) hitherto undescribed, though known to us from one or two specimens taken in the river Scheldt, as also from the occurrence of the valves in some posttertiary lacustrine deposits.

A most interesting feature in the fauna of the freshwater lakes of the Connemara district is the intermixture of marine or brackish-water species with those of strictly freshwater character. The small sheets of water to which we chiefly refer lie scattered by scores or even hundreds over the plateau bounded by the mountain of Urrisbeg on the south, the "twelve pins" on the east, Clifden on the north, and the Atlantic on the west. They are but slightly elevated above the present sea-level; and the presence in them of a partially marine fauna would appear to indicate a perhaps not very far distant elevation of this tract of country. In several of these lakes occurred

* Especially when we consider the small area from which the material was taken; the dredge purposely used took hold so quickly that it seldom required to be drawn more than a few feet before it was full. The profusion of life in the sea-bed is strikingly indicated by the fact of so many members of one group being found within such narrow limits.

Loxoconcha elliptica, a species heretofore met with only in estuarine situations or in pools of brackish water near high-water mark. In Ballinahinch Lough, *Porcellidium fimbriatum* was taken in considerable numbers—a capture the more remarkable as the family to which it belongs was not previously known to number amongst its members any freshwater representative. Several Copepoda were also taken; but of these we are not yet in a position to speak with accuracy. In Lough Moher, which lies further north, about five miles south of Westport, a new and very fine species of *Limnicythere* (*L. Sancti-Patricii*) was taken, and in the same place a few stunted specimens of Foraminifera belonging to two species, *Polystomella striato-punctata* and *Nonionina asterizans*. In the case of the *Porcellidium* it is barely possible that the specimens may have got *accidental* admission into the freshwater gathering, as the same species was taken in Birterbuy Bay on the day previous to its supposed capture in Ballinahinch Lough; but the number of specimens found and the fact of no other marine species occurring with it, would seem to negative this conclusion. Moreover the undoubted occurrence of other marine species in neighbouring lakes renders the matter more intelligible.

Setting aside the Ostracoda, to which we have devoted a separate section of this paper, the most interesting results of our dredging are as follows. In Birterbuy Bay a single fragment of a ray of a starfish hitherto unknown in Britain (*Ophianoplus annulosus*, Sars) was discovered; but, although this was recognized in the dredge as belonging to a species with which we were unacquainted, we were unsuccessful in finding any further portions of the animal. This fragment is here figured of the natural size (Pl. XXII. fig. 1). The species was originally described by M. Sars from a single specimen taken at Naples; and as our fragment, though large enough and well-enough preserved to admit of no doubt as to its specific identity, does not form a sufficient basis for a full description, we here transcribe Sars's account (Middelhavets Littoral-Fauna, pp. 79–83).

" Genus OPHIANOPLUS.

" Rimæ genitales interbrachiæ binæ. Fissuræ orales ad partem aboralem papillis duris instructæ: acervus papillarum dentalium sub columnis dentium. Discus omnino nudus et cute molli tectus, absque scutis radialibus. Brachia scutata, absque omni molliore integumento, spinis lateralibus lævibus. Papillæ spiniformes ad poros tentaculares.

"*Ophianoplus annulosus.*

"Disco supra fusco annulis albis; spinis brachiorum 12.

"This Ophiuridan, of which I found a single example at Naples, in a depth of 40–50 fathoms, forms undoubtedly a new genus, allied to *Ophiocoma*, from which it is easily distinguished by its naked, non-granular disk.

"The disk is very stout or convex, though tolerably flat above, the circumference somewhat five-sided, being prominently arched between the rays, the ventral side rather convex. It is without any kind of armature whatever, being invested only by a smooth integument, and without any ray-plates, by which it is separated from Forbes's genus *Ophiopsila*, to which it has some likeness. On the underside are ten genital fissures. The mouth-plates are small, rounded, but little longer than broad; and one of them, the madrepore-plate, is a little larger than the other four, circular, and surrounded by a spongy, elevated, and deeply punctate border. The mouth-fissures are, as in the genus *Amphiura* of Forbes, beset at the outer end (the sides being naked) with six hard papillæ, namely:—four conical and rather flattened, two on each side, of which the two largest are situated on the outer side of the first ventral ray-plate, and answer to the scale-shaped mouth-papillæ of *Amphiura*; the other two are a little smaller and situated directly under the small tooth-processes, of which we shall speak presently; lastly, there are two very small lancet-shaped papillæ placed higher up in the mouth-cavity, the points of which are turned inwards towards the mouth. These last correspond to the lancet-shaped mouth-papillæ of the *Amphiuræ*, with which this mouth-organ of *Ophianoplus* entirely agrees, except that the under surface of the 'tooth-columns' presents a number of rounded tooth-processes, as in *Ophiocoma*, which form three or four irregular rows. The masticatory organs, which are broader than those of *Ophiocoma*, and formed of a kind of bristles, have in that respect some likeness to those of *Ophiopholis scolopendrica* and *Ophiothrix fragilis*, but differ from the first in having numerous tooth-papillæ, and from the last in having mouth-papillæ.

"The rays are five or six times as long as the diameter of the disk, and differ from those of other Ophiuridæ in being thicker near the middle than at the base: they are nearly cylindrical, very convex above and at the sides, but flat below. The dorsal ray-plates are very small, rounded, about as broad as long, with a convex distal margin, the ventral plates a little longer, furcate, with the distal margin hollowed out; the side plates are much elevated, and have a prominent encircling keel, to which the spines are fixed. The number of these reaches twelve; on the first ray-segment there are but two, on the following three, on the next four, and so on, until, on the tenth segment there are ten or eleven, and further on twelve; on the distal half the number decreases gradually towards the point. All these side-spines are smooth, somewhat compressed or flat, narrower at the root than at the obtuse rounded extremity. They are all nearly of a size, except the two or three lowest, which gradually become larger, so that the lowest is the longest, nearly double as long as the uppermost, or about as long as half the breadth of the ray.

"On the lower surface of the ray, immediately within or on the near side of the tentacle-pores (therefore not in a line with the lateral spines) are two foot-papillæ: these are of a quite unusual form, not being squamous, but spinous or cylindrical, with pointed ends; the outermost are very small; the inner, which are four or five times as long, or nearly as long as the lateral spines, but much more slender, have their apices directed forwards and inwards, so that they cross those of the corresponding papillæ of the opposite side.

"Diameter of the disk 11 millimetres, length of rays 60 millims. Colour of the upperside of the disk chestnut-brown, with large white rings, of which some are circular, some elliptical or elongated, and others forming coalescent rings like the figure 8; sides of the disk whitish, with small round chestnut-brown spots; ventral surface whitish. Rays chestnut on the upper surface, with narrow white cross striæ; spines greyish brown.

"This new Ophiuridan approaches, by its smooth disk, to Forbes's genus *Ophiopsila*, but differs essentially in the absence of ray-plates and the presence of smooth papillæ. From *Ophiarthrum*, Peters, which also has a smooth disk, it is separated by its smooth ray-spines, which in that genus are spinulose. From the genera *Ophiomyxa* and *Ophioscolex*, which also have naked disks, it is separated by the absence of a smooth integument on the rays. In respect of mouth-organs, it stands nearest to *Amphiura*, Forbes, from which it differs in its naked disk and spine-shaped foot-papillæ."

Thyone fusus (Müller) and *Synapta inhærens* (Müller) were found to be not uncommon in Birterbuy Bay in 12–14 fathoms; the latter also occurred, in 4 fathoms water, in Clew Bay. In Birterbuy Bay, *Macrorhynchopterus granulosus* (M'Coy) was taken—and in Ardbear Bay*, on a very muddy bottom, several

* Ardbear Bay, the bay on which the town of Clifden stands; so named in the maps of the Ordnance Survey.

annulose bodies, which appeared to be probably the detached tails of *Priapulus caudatus*.

The stalk-eyed Crustacea taken were as follows. No notes, however, were preserved of the Crabs, which were all well-known natives of the district:—

Palæmon (*squilla*?); young. Clew Bay, 1 fathom.
Athanas nitescens, Leach. Ardbear Bay, 4 fathoms.
Hippolyte varians, Leach. Ardbear Bay.
—— *fascigera*, Gosse. On *Laminaria saccharina*, Ardbear Bay, 4 fathoms.
—— *Cranchii*, Leach. Ardbear Bay, 4 fathoms.
Mysis flexuosa (Müller), young. Clew Bay, 1 fathom.

For the following list and remarks on the sessile-eyed species we are indebted to the kindness of the Rev. Alfred Merle Norman, to whom our specimens were submitted for examination:—

Probolium monoculoides (Montagu) = *Montagua monoculoides*, Bate. Ardbear Bay, in rock-pools and in 4 fathoms water.
Anonyx nanoides, Lilljeborg. Ardbear Bay, 4 fathoms. Recorded as British in my Shetland Dredging Report*.
Phoxus Holböllii, Kröyer. Coralline bed, in 4 fathoms, Ardbear Bay. Both male and female found. The former differs from the latter in having very long upper antennæ.
Urothoë marina, Bate. Ardbear Bay, 4 fathoms.
Dexamine spinosa (Montagu). Among Algæ between Ardbear and Mannin Bays; Clew Bay, 1 fathom, among weeds.
—— *tenuicornis*, Rathke. Ardbear Bay, in rock-pools and in 4 fathoms water.
Atylus Swammerdamii (M.-Edwards). Very common among Algæ between Ardbear and Mannin Bays.
—— *bispinosus*, Bate. Ardbear Bay, 4 fathoms.
Aora gracilis, Bate. Ardbear Bay, 4 fathoms.
Microdeuteropus anomalus (Rathke). On coralline bed in Ardbear Bay, 4 fathoms; both sexes. This is the true *M. anomalus*, but not, I think, the same as that described by Bate and Westwood under that name. *M. gryllotalpa* of B. & W. (not of Costa) is described from the young male of this species. (See my Shetland Dredging Report.)
—— *versiculatus*, Bate. A female specimen (the sex figured by B. & W.), in 4 fathoms, Ardbear Bay.

* Norman, "Shetland Final Dredging Report. Part II. On the Crustacea, Tunicata, Polyzoa, Actinozoa, Hydrozoa, and Porifera" [Report of the British Association for 1868 (1869)].

Protomedeia (?) *Whitei*, Bate. In the same locality as the last.

Melita obtusata (Montagu) = *M. proxima*, another form of the male, and *Megamœra Alderi*, the female. In Ardbear Bay (4 fathoms) on *Laminaria saccharina.* Also many specimens of both sexes nestling between the tentacles of *Anthea Cereus*, in Ardbear Bay—a strange and, one would have thought, a dangerous habitat.

Mœra semiserrata (Bate) = *Megamœra semiserrata*, Bate & Westwood, Brit. Sessile-eyed Crust. vol. i. p. 401. Ardbear Bay, 4 fathoms.

Eurystheus erythrophthalmus (Lilljeborg). Ardbear Bay, 4 fathoms.

Gammarus locusta, Linn. Among seaweeds between Ardbear and Mannin Bays.

Amphithoë rubricata (Montagu). Clew Bay, 1 fathom, among weeds.

Podocerus pelagicus (Leach). Rock-pools in Ardbear Bay.

Cerapus abditus, Templeton. Ardbear Bay, in 4 fathoms.

Genus Exunguia*, Norman, n. g.

Antennæ short and strong; flagella rudimentary, upper pair without a secondary appendage. Body wide; coxæ shallow. First gnathopods long, slender, filiform; dactylos obsolete. Second gnathopods subchelate, slender, but yet much stouter than the very delicate first pair. Pereiopods rather short, subequal; propodos longer than carpus. Uropods all two-branched; branches short, simple. Telson squamiform.

This genus seems to be most nearly allied to *Cratippus*, from which it is distinguished by the remarkable character of the first gnathopods.

Exunguia stilipes, Norman, n. sp. Pl. XXII. figs. 7–12.

Head produced into a short rostrum between the upper antennæ. Eyes on a process between the upper and lower antennæ. Antennæ of both pairs subequal, strong, but short, equal in length to first 3–4 segments of body; joints of peduncle subequal to each other in length, but each rather shorter and of less diameter than the preceding, round, smooth, except one or two minute spines on the inner margin; flagella rudimentary, scarcely a third of the length of the last joint of peduncle, composed of three or four excessively short articulations. First gnathopods slender and filiform, basos long and slender, more than equal in length to ischium and metacarpus

* From *ex* and *unguis*, without a nail.

combined; these two joints subequal to each other, and shorter than the carpus, which is equal to the propodos; these last two joints slender and round; no dactylos, its place supplied by a fasciculus of little spines projecting directly forwards; with the exception of this terminal fasciculus of spines, the whole limb is entirely glabrous. Second gnathopods not large, subchelate; carpus and propodos subequal, flattened, posterior margin gently arched and furnished with tufts of spines, palm not defined; dactylos in the form of a slender, sharp, only slightly curved nail, rather more than half the length of the propodos. Pereiopods subequal, short; basos not expanded; propodos longer than carpus, and bent at a right angle to it, with three or four small spines on the front margin; nail small, acute, not a third of the length of the propodos, and bent at a right angle to it, the whole limb thus taking a strikingly hamate character. Segments of the pleon with the infero-posteal margins well rounded. All the uropods two-branched, their branches one-jointed, flattened, lanceolate, wholly devoid of spines or hairs; but under a high power of the microscope, the edges are seen to be serrulate. Telson small, squamiform, simple, entire. Maxillipedes having the palp long, slender, and four-jointed, the third joint having the inner margin clothed with thick down. Length scarcely one-fifth of an inch.

Found by Messrs. G. S. Brady and D. Robertson in a sponge in Birterbuy Bay in 1868. The structure of the last joints of the pereiopods seems peculiarly to fit those limbs for grasping tenaciously the tissues of the sponge in which the animal lives. *Atylus gibbosus*, which also inhabits sponges, has the pereiopods developed on a somewhat similar plan, the propodos being shorter than the carpus, and the nail bent at right angles to it; but in this species the carpus is furnished with a tuft of strong spines, which seem to assist in the act of prehension.

I know of no Amphipod, except the members of the family Hyperiadæ, that has the flagella of both antennæ in a condition so rudimentary as those of *Exunguia.*

Corophium crassicorne, Bruzelius = *C. Bonellii*, B. & W., the female. Both sexes, Ardbear Bay, 4 fathoms. The form described by B. & W. as *C. Bonellii* is unquestionably the female of this present species, as I have stated in my 'Shetland Report;' but it is worth calling attention to the fact that here, again, the two sexes occur in company.

Caprella acanthifera, Leach. Both sexes in Ardbear Bay, 4 fathoms.

Proto pedata (Abildgaard). A single specimen in Ardbear Bay, on *Laminaria saccharina.*

Tanais Dulongii, B. & W. Among weed, Westport Bay.

Jæra albifrons (Montagu). Westport Bay.

Idotea tricuspidata, Desmarest. Young specimens, Ardbear Bay.

—— *emarginata*, Fabricius. The young in extraordinary abundance among Algæ between Ardbear and Mannin Bays.

Dynamene rubra, Leach. Young specimen among weeds, Clew Bay, 1 fathom; and in rock-pools in Ardbear Bay.

CLADOCERA.

The following Crustacea belonging to this order were found in the freshwater loughs in the neighbourhood of Clifden. It is noticeable that where vegetation was abundant, Entomostraca were very plentiful, but usually of the larger and commoner species; while in those lakes which were almost bare of plants the specimens found, though few in number, belonged often to small but rare species.

Daphnia pulex (*Linn.*).
—— Jardinii, *Baird.*
Sida crystallina (*Müller*).
Acantholeberis curvirostris (*Müll.*).
Macrothrix rosea (*Jurine*).
Lathonura rectirostris (*Müller*).
Bosmina longispina, *Leydig.*
Polyphemus pediculus (*Linn.*).
Drepanothrix hamata, *G. O. Sars.*
Eurycercus lamellatus (*Müller*).
Lynceus quadrangularis, *Müller.*
—— harpæ (*Baird*).
Lynceus macrourus, *Müller.*
—— elongatus (*G. O. Sars*).
—— costatus (*G. O. Sars*).
—— guttatus (*G. O. Sars*).
—— truncatus, *Müller.*
—— exiguus, *Lilljeborg.*
—— barbatus, *Brady**.
—— nanus (*Baird*).
—— testudinarius, *Fischer.*
—— sphæricus, *Müller.*
—— globosus (*Baird*).

In addition to these species, *Lynceus falcatus* and *L. rostratus* were found in Lough Moher, near Westport, and in a burn near the same place *Lynceus trigonellus*, *L. uncinatus*, and *Monospilus tenuirostris*. The specimens which we refer to *L. rostratus*† differ somewhat from the same species as it occurs at Belsay, in the county of Northumberland, the only other recorded British habitat, in having a single small spine at the postero-ventral angle of each valve, and in the rather less hairy ventral margin: in other respects they seem to be essentially the same.

* Intellectual Observer, vol. xii. p. 423.

† This and other little-known British species enumerated in the present paper will be found described and figured in 'A Monograph of the British Entomostraca belonging to the Families Bosminidæ, Macrothricidæ, and Lynceidæ,' by the Rev. A. M. Norman, M.A., and George S. Brady, C.M.Z.S. London: Williams & Norgate, 1867.

OSTRACODA.

Lists of Species taken.

Mullingar Canal, Dublin.

Cypris compressa, *Baird.*
—— reptans (*Baird*).
Cypridopsis obesa, *nov. sp.*
Candona candida (*Müller*).
—— compressa (*Koch*).
—— albicans, *Brady.*
Limnicythere inopinata (*Baird*).

River Liffey, at Dublin, North Wall.

Candona compressa (?) (*Koch*).
Bairdia fulva, *Brady.*
Cythere lutea, *Müller.*
—— castanea, *G. O. Sars.*
Cytheridea elongata, *Brady.*
Loxoconcha impressa (*Baird*).
—— elliptica, *Brady.*
Cytherura nigrescens (*Baird*).
—— similis, *G. O. Sars.*
—— cellulosa (*Norman*).
—— cuneata, *Brady.*
Paradoxostoma variabile (*Baird*).

Westport Quay, in a salt-water tidal pond at high-water mark, amongst Zostera.

Cythere lutea, *Müller.*
—— castanea, *G. O. Sars.*
—— villosa, *G. O. Sars.*
—— cicatricosa, *G. O. Sars.*
—— gibbosa, *nov. sp.*
Loxoconcha elliptica, *Brady.*
Xestoleberis aurantia (*Baird*).
Cytherura nigrescens (*Baird*).
—— Robertsoni, *Brady.*
Sclerochilus gracilis, *nov. sp.*

Lough Moher, Mayo.

Cypris ovum, *Jurine.*
Limnicythere Sancti-Patricii, *n. sp.*

Freshwater Loughs near Clifden.

Cypris lævis, *Müller.*
Loxoconcha elliptica, *Brady.*

Respecting the marine species, it should first be noted that all our dredgings being made in comparatively shallow water, many species are absent from the list which would doubtless have appeared had our time admitted of dredging in greater depths. Yet the results obtained are interesting, as indicating some well-marked peculiarities in the fauna of our Atlantic shores. Most remarkable, perhaps, is the almost entire absence of *Cythere lutea*, a species which in all other parts of the British islands is one of the most abundant. *Cythere tuberculata* and *concinna* appear also to be excessively scarce; and the strongly spinous species, such as *C. antiquata* and *Jonesii*, become much less robust, with more fragile shells and fewer and more attenuated spines. *Cytheridea punctillata*, a species very abundant in some of the Scottish lochs, as well as in most glacial clays, is also absent: the same may be said of *Ilyobates bartonensis* and *Cythere dunelmensis.* The common *Cytheropteron latissimum* appears to be displaced by *C. nodosum.* The occurrence of *Loxoconcha elliptica* in the freshwater lakes has already been noticed in our introductory remarks. The species which seem to be most characteristic of the district are perhaps *Cythere Macallana*, *pulchella*, and *cicatricosa*, *Cytheropteron nodosum* and *C. subcircinatum.* All these have indeed been found on other parts of the British coast, but nowhere so abundantly as in these dredgings from the bays of

Galway and Mayo. It is also worthy of note that, while in dredgings made further north (as notably in those of Professors Thomson and Carpenter between Faroe and Shetland) most of the species new to British ostracodists turn out to be identical with such as were previously familiar to us in the Scottish glacial clays, none of the marine species here described as new have yet been observed in the fossil state. Still it is possible that a search in greater depths of water off the Irish coast might lessen this apparent discrepancy.

Name of Species.	Dublin Bay, 3–4 fathoms.	Westport Bay, 4 fathoms.	Clifden Bay, up to 6 fath.	Birterbuy Bay, 10–15 fathoms.	Remarks.
Cypridopsis obesa, *nov. sp.*	*	..	..	..	One example only.
Bairdia inflata (*Norman*).	..	*			
Aglaia complanata, *nov. sp.*	..	*			
Pontocypris trigonella, *G. O. Sars*	*	*	*	*	
—— mytiloides (*Norman*)	..	*	*	*	
Argillœcia angusta (*Brady*) = Pontocypris angusta, *Brady*, Mon. Brit. Ostr.	..	..	*	*	
Cythere lutea, *Müller*	*	..	..	*	Rare on west coast.
—— viridis, *Müller*	*	*	*	*	
—— pellucida, *Baird*	*	*	*	*	
—— castanea, *G. O. Sars*	*	*	*		
—— tenera, *Brady*	*	..	..	*	
—— porcellanea, *Brady*	..	*			
—— Macallana, *nov. sp.*	*	*	*		
—— cicatricosa, *G. O. Sars*	*	*	*	*	
—— villosa, *G. O. Sars*	*	*	*	*	
—— angulata (*G. O. Sars*)	*	*	*	*	
—— pulchella, *Brady*	..	*	*	*	Atlantic type; characteristic.
—— Robertsoni, *Brady*	*	*			
—— cuneiformis, *Brady*	*	*	..	*	
—— albomaculata, *Baird*	*	*	*	*	
—— convexa, *Baird*	*	*	*	*	
—— tuberculata (*G. O. Sars*)	..	*	..	..	Apparently rare on
—— concinna, *Jones*	*	..	..	..	west coast.
—— emaciata, *Brady*	..	*	*	*	Atlantic type.
—— quadridentata, *Baird*	..	*	*	*	
—— Jeffreysii, *Brady*	..	..	..	*	Ditto; rare.
—— semipunctata, *Brady*	..	..	..	*	Ditto; rare.
—— Jonesii, var. ceratoptera, *Bosq.*	..	..	..	*	
—— Whitei (*Baird*)	*	..	..	..	Rare.
—— antiquata (*Baird*)	*	..	..	*	
Limnicythere inopinata (*Baird*)	*	..	..	..	Probably washed down,
Cytheridea cornea, *nov. sp.*	*	..	*		but has also occurred in
—— elongata, *Brady*	*	*	*		other marine dredgings.
—— punctillata, *Brady*	*	..	..	..	Apparently absent from
Eucythere declivis (*Norman*)	..	..	..	*	Atlantic shores.
—— ——, var. prava, *nobis*	..	*	*		

TABLE (*continued*).

Name of Species.	Dublin Bay, 3–4 fathoms.	Westport Bay, 4 fathoms.	Clifden Bay, up to 6 fath.	Birterbury Bay, 10–15 fathoms.	Remarks.
Eucythere Argus (*G. O. Sars*)	*	*			
Loxoconcha impressa (*Baird*)	*	*	*	*	
—— granulata, *G. O. Sars*	..	..	*		
—— guttata (*Norman*)	*	..	*	*	
—— tamarindus (*Jones*)	*	*	*	*	
Xestoleberis aurantia (*Baird*)	*	..	*		
—— depressa, *G. O. Sars*	..	*	*	*	
Bythocythere simplex (*Norman*)	*				
—— constricta, *G. O. Sars*	*				
Cytherura nigrescens (*Baird*)	*	*	*	*	
—— similis, *G. O. Sars*	*	*	*		
—— cuneata, *Brady*	*	*	*		
—— angulata, *Brady*	..	..	..	*	
—— striata, *G. O. Sars*	*	*	*	*	
—— undata, *G. O. Sars*	*	*	*	*	
—— flavescens	..	..	*		
—— cornuta, *Brady*	*	*	*	*	
—— gibba (*Müller*)	*	*	*		
—— Robertsoni	..	..	*		
—— acuticostata, *G. O. Sars*	..	*	*	*	
—— cellulosa (*Norman*)	*	*	*	*	
Cytheropteron nodosum, *Brady*	..	..	*		
—— punctatum, *Brady*	*	..	..	..	Rare.
—— subcircinatum, *G. O. Sars*	..	..	*		
—— rectum, *Brady*	..	*	..	..	Rare.
—— multiforum (*Norman*)	..	*	*	*	
Pseudocythere caudata, *G. O. Sars*	..	*	*	..	Rare.
Sclerochilus contortus (*Norman*)	*	*	..	*	
—— ——, var. abbreviatus	..	..	*		
—— gracilis, *nov. sp.*	*	..	*		
Cytherideis subulata, *Brady*	*	*	*		
Paradoxostoma variabile (*Baird*)	*	*	*	*	
—— abbreviatum, *G. O. Sars*	*	..	..	*	
—— ensiforme, *Brady*	*	..	..	*	
—— flexuosum, *Brady*	..	*	*	*	
—— arcuatum ?, *Brady*	..	..	*		
—— obliquum, *G. O. Sars*	..	*	*		
—— hibernicum, *Brady*	..	*	*	*	
Polycope compressa, *nov. sp.*	..	..	*		

Order OSTRACODA.

Fam. **Cypridæ.**

Genus CYPRIDOPSIS, Brady.

Cypridopsis obesa, nov. sp. Pl. XVIII. figs. 5–7.

Carapace of the *female* excessively tumid; as seen from the side subtriangular, highest in the middle; greatest height equal to nearly two-thirds of the length; extremities rounded; superior margin very boldly arched, inferior straight or slightly sinuated in the middle. Seen from above, broadly ovate, greatest width near the middle, subacuminate in front, broadly rounded behind; width equal to nearly three-fourths of the length. Shell-surface closely and largely punctate, clothed, but not very thickly, with short appressed hairs. Colour yellowish brown. Length $\frac{1}{40}$ inch.

Hab. In the Mullingar Canal, Dublin, and dredged (one example) in Dublin Bay, in 3–4 fathoms water.

The only other localities in which this very distinct and fine species has hitherto been noticed in a recent state are in the rivers Maas and Scheldt in Holland, and in the river Ouse, near Lynn, Norfolk (Ann. & Mag. Nat. Hist. ser. 4. vol. iii. p. 45); it is, however, abundant in the fluviatile clays of Hornsea, in Yorkshire.

The occurrence of this species in several cases in marine or estuarine situations and in company with truly marine species is remarkable.

Genus Aglaia, Brady.

Aglaia complanata, nov. sp. Pl. XX. figs. 4, 5.

Carapace, as seen from the side, oblong, subreniform, highest about the middle; greatest height equal to less than half the length; extremities rounded; superior margin evenly but slightly arched, inferior almost straight. Seen from above, compressed ovate, extremities pointed; greatest width in the middle, and not much exceeding one-fourth of the length. Surface of the valves smooth, bearing a few short scattered hairs; shell thin and fragile. Lucid spots arranged in an irregular rosette. Length $\frac{1}{40}$ inch.

Hab. Westport Bay, 4 fathoms.

The genus *Aglaia* was proposed by one of the present writers, in a French publication ('Les Fonds de la Mer') for the reception of a Mediterranean species very similar to *A. complanata* in general characters, and exhibiting peculiarities of anatomical structure which distinctly separated it from any established genus. We have had no opportunity of examining the animal of *A. complanata*.

Genus Bairdia, M'Coy.

Bairdia fulva, Brady. Pl. XVIII. figs. 1–4.

Bairdia fulva, Brady, Monog. Recent Brit. Ostrac. p. 474, pl. 28. fig. 21.

Carapace compressed; as seen from the side, subreniform, rather higher in front than behind; greatest height near the middle, and equal to fully half the length; extremities rounded: superior margin boldly arched, sloping more abruptly in front than behind; inferior sinuated in the middle. Seen from above, compressed ovate, widest in the middle; extremities equally pointed; width much less than half the length; end view subrhomboidal, widest in the middle. Shell thin and fragile, semitransparent, smooth, thickly covered with very short delicate hairs. Length $\frac{1}{35}$ inch.

Hab. In sand from Scarpa Bay, Orkney (D.O. Drewett, Esq.); and in the river Liffey at North Wall, Dublin.

The locality (Shetland) given in the 'Monograph' was inserted by mistake for Scarpa Bay. The specific name *fulva* does not well apply to the specimens here described, they being almost colourless; but the discrepancy is scarcely important enough to warrant a change of name*.

Fam. **Cytheridæ.**

Genus Cythere, Müller.

Cythere porcellanea, Brady. Pl. XIX. figs. 1–4.

Cythere porcellanea, Brady, Ann. & Mag. Nat. Hist. ser. 4. vol. iii. p. 47, pl. 7. figs. 1–4.

Carapace of the *female*, as seen from the side, flexuous, reniform, highest in the middle, greatest height equal to rather less than half the length; anterior extremity evenly, posterior obliquely rounded: superior margin evenly arched, inferior deeply sinuated in the middle; postero-superior angle well marked. Seen from above, ovate, widest in the middle, pointed in front; width less than the height. Shell-surface smooth and polished, marked often behind the middle with a few scattered indistinct puncta. Colour whitish. Length $\frac{1}{50}$ inch. Carapace of the *male* in shape much like that of the following species, except that the outline, when seen from above, is regularly ovate.

Hab. Westport Bay, 4 fathoms; and on the muddy shore of Budle Bay, Northumberland, near low-water mark (G.S.B.); and Dungeness Bay, and River Ouse at Lynn (Mr. E. C. Davison's dredgings).

The Dutch specimens from which this species was originally described appear to be either young or stunted individuals; and the figures which accompanied the description do not give

* Since this was in the printer's hands, I have seen examples of *B. fulva* in dredgings from the Dutch localities mentioned above; so that this species would seem to come into the category of fluvio-marine species, to which *Cypridopsis obesa* also belongs.—G. S. B.

a correct idea of the adult shell. It has been necessary therefore to figure and describe the species afresh*.

The differences between *C. porcellanea* and *C. Macallana*, though small, are sufficient to require the separation of the two species. The first-named is rather the larger, has much less surface-sculpture, and, as seen from above, is more regularly ovate in outline; it is also paler in colour, and seems to be sublittoral in habitat. Both species are very nearly allied to *C. pellucida* and *C. castanea*, figures of which we have thought it desirable to give in this place, they not having been sufficiently discriminated in the plates illustrating Mr. Brady's 'Monograph.' These species (*C. pellucida* and *castanea*), especially the latter, have the valves almost always marked with one, two, or more transverse furrows; but though the *males* of *C. porcellanea* and *C. Macallana* bear similar impressions, the females are entirely free from them.

Cythere Macallana, nov. sp. Pl. XIX. figs. 5–9.

Carapace of the *female*, seen from the side, subreniform; greatest height situated in front of the middle, and equal to half the length; anterior extremity evenly, posterior obliquely rounded: superior margin well arched, highest over the eyes, in front of which it is slightly excavated, ending posteriorly in an obtuse angle; inferior sinuated in the middle. Seen from above, ovate, widest in the middle, rounded behind, subacuminate in front; width less than the height. Surface of the shell vaguely and distantly punctate, the ventral surface more or less marked with sinuous grooves. Colour yellowish brown. Length $\frac{1}{65}$ inch. The shell of the *male* is longer and narrower, more tapering (as seen laterally) towards the posterior extremity, and has the dorsal margin almost straight; seen from above, the sides are subparallel, and the posterior extremity obtuse; the shell-surface is also usually less sparingly punctate than in the female.

Hab. Dublin, Westport, and Clifden Bays.

Cythere gibbosa, nov. sp. Pl. XXI. figs. 1–3.

Carapace of the *female* tumid; seen from the side, subtriangular or trapezoidal, highest in front of the middle; greatest height equal to more than half the length, extremities obliquely rounded, the anterior being much the broader: superior

* I may add that I have recently had the opportunity of examining a larger series of Ostracoda from the river Scheldt, and have found a number of examples of *C. porcellanea* differing in no respects from those described in the present paper.—G. S. B.

margin obtusely angulated in front of the middle, thence sloping steeply towards each extremity; inferior quite straight. Seen from above, the outline is ovate, widest in the middle; extremities pointed; width equal to half the the length. Shell of the *male* narrower and longer. Shell-surface smooth and polished, bearing a few short, scattered hairs, which are papillose at the base; obscurely punctate on the ventral surface. Colour whitish. Length $\frac{1}{65}$ inch.

Hab. In a large tidal pond at Westport Quay, amongst *Zostera*; and at Budle Bay, Northumberland*.

Cythere pulchella, Brady. Pl. XX. figs. 1–3.

Cythere pulchella, Brady, Monog. Rec. Brit. Ostrac. p. 404; Ann. & Mag. Nat. Hist. ser. 4. vol. ii. p. 32, pl. 5. figs. 18–20.

This species was admitted into the 'Monograph of the British Ostracoda' on the occurrence of a single specimen in shell-sand from Sutherlandshire. We have found it sparingly in most of our gatherings from the Connemara district; but it would appear to reach its finest development in the Arctic seas. (See Ann. & Mag. Nat. Hist. *loc. cit.*)

Hab. Westport, Clifden, and Birterbuy Bays.

Cythere Robertsoni, Brady.

Cythere Robertsoni, Brady, Ann. & Mag. Nat. Hist. ser. 4. vol. ii. p. 33, pl. 4. figs. 5, 8–10.

This species is new to the British fauna, the specimens from which it was originally described having been dredged by Mr. Robertson at Christiania.

Hab. Dublin Bay, 3–4 fathoms; Westport Bay, 4 fathoms.

Cythere cicatricosa, Sars. Pl. XIX. figs. 13, 14.

Cythere cicatricosa, G. O. Sars, Oversigt af Norges marine Ostracoder, p. 33.
—— *badia* (in part), Brady, Monog. Recent Brit. Ostrac. p. 399 (but not figures).
——? *crispata*, Brady, Ann. & Mag. Nat. Hist. ser. 4. vol. ii. p. 221, pl. 14. figs. 14, 15.

Carapace of the *female*, as seen from the side, subreniform or subsigmoid, higher in front than behind; greatest height in front of the middle, and equal to more than half the length; anterior extremity rounded, posterior subtruncate, slightly sinuated above the middle: superior margin gently arched, slightly excavated in front of the eyes, and ending in an obtuse angle behind; inferior deeply sinuated near the

* Budle Bay is a large expanse of shallow water which at low tide recedes so as to leave a muddy flat, through which a small stream finds its way to the sea. The situation is, therefore, essentially similar to that at Westport, where *C. gibbosa* was first found.—G. S. B.

middle. Outline, as seen from above, compressed, oblong, obtusely pointed in front, truncate behind, the sides deeply emarginate near the posterior extremity; widest behind the middle; greatest width not much exceeding one-third of the length. Shell of the *male* longer and narrower. Surface of the valves irregularly sculptured in a flexuous manner. Colour yellowish brown, the raised ornament often deeply tinged with slaty blue or black. Length $\frac{1}{60}$ inch.

In the 'Monograph of the Recent British Ostracoda,' this species was confounded with *Cythere badia*, Norman, to which it bears considerable resemblance. *C. badia*, however, has only a vaguely punctate surface-ornament, without any trace of the conspicuous flexuous rugæ which mark *C. cicatricosa*; the dorsal aspect of the former is also regularly ovate, while that of the present species is distinctly truncate behind. The figures in the 'Monograph' give a correct idea of the true *C. badia*, and, when compared with those given here, will show more clearly than a verbal description the differences between the two species. The form described and figured by Mr. Brady, in the 'Annals and Magazine of Natural History,' under the name of *C. crispata*, does not differ materially from the present, except in its greater size and its more prominent and profuse surface-sculpture. The northern species may perhaps be looked upon as a depauperized form of the Mediterranean *C. crispata*; and this view derives some confirmation from its greater abundance on the western shores of Ireland.

The specific name *cicatricosa* has been used by Reuss and Bosquet to designate a species which we believe to be identical with *Cythere convexa*, Baird; but as Dr. Baird's name is of prior date, the proper course seems to be to reserve the term *cicatricosa* for the species so named by G. O. Sars, which is undoubtedly identical with that under consideration.

It should be mentioned that while *C. badia* seems to be a purely littoral species, *C. cicatricosa* is not met with except by the dredge. The localities given in the 'Monograph' (for *C. badia*) must be taken as belonging to the present species, except those to which the Rev. A. M. Norman's name is attached.

Genus Limnicythere, Brady.

Limnicythere Sancti-Patricii, nov. sp.
Pl. XVIII. figs. 8–11, and Pl. XXI. fig. 4.

Carapace (of the *male*?), as seen from the side, reniform, nearly equal in height throughout, height equal to half the length; extremities well rounded, the anterior slightly the broader; superior margin almost straight, inferior deeply sinuated in the middle. Seen from above, the outline is irregularly rhomboidal, widest somewhat behind the middle; extremities acuminate; greatest width rather less than the height. Seen from the front, the outline is widest at the base, with gradually converging sides and broadly arched apex; ventral margin convex, and prominently keeled in the middle. Surface of the valves sculptured with small, closely-set, polygonal excavations, marked across the middle with a conspicuous broad and deep curved furrow, in front of which is another, of similar character, but smaller; behind the posterior furrow the shell rises towards the ventral surface into a prominent rounded eminence: the ventral surface is furrowed in a longitudinal direction, and also marked more or less with cross striæ. Animal almost exactly like that of *L. inopinata.* Copulative organs of the female (Pl. XXI. fig. 4 *c*) subquadrangular, upper portion (*b*) elongated and ending in a short seta. Abdomen slightly hirsute, produced into two lobes, each with a short terminal seta (*a*).

Hab. Lough Moher, about five miles south of Westport, county Mayo.

All the full-grown specimens which we have examined of this very well-marked species possess the peculiar appendages represented in Pl. XXI., and which for the present we suppose to be the female copulative organs. Whatever they may be, they seem to be homologous with the parts of *L. inopinata* figured in the 'Monograph of Recent British Ostracoda,' pl. 38. fig. 9 *m*; and their presence in this peculiar form will probably constitute a good generic character.

Genus Cytheridea, Bosquet.

Cytheridea (?) *cornea*, nov. sp. Pl. XX. figs. 9, 10.

Carapace, as seen from the side, subovate, highest in the middle; greatest height equal to less than half the length; anterior extremity well rounded, the posterior somewhat flattened; superior margin evenly arched, inferior almost straight. Seen from above, ovate, pointed in front, greatest width behind the middle, equal to the height. Shell thin and fragile, quite smooth, very sparingly punctate. Length $\frac{1}{42}$ inch.

Hab. Dublin Bay, 2–4 fathoms, near the Pigeon-house; Westport Bay, 2–4 fathoms.

Genus Eucythere, Brady.

Eucythere declivis, var. *prava.* Pl. XXI. figs. 12–14.

Some specimens identical in character with those here referred to were figured and briefly noticed by Mr. Brady in the 'Monograph of the Recent British Ostracoda' (pl. 27. figs. 52, 53, p. 430) as being probably a form of *C. declivis*. They differ from the normal form of that species in being furrowed or corrugated toward the hinder extremity, in the greater sinuation of the inferior and the less pronounced arching of the superior margin; the extremities are also bordered with a flange, which is marked by radiating hair-like lines. Seen from above, the shell is rather more acutely pointed and more tapering in front. Length $\frac{1}{44}$ inch.

Hab. Westport and Clifden Bays.

Genus Loxoconcha, G. O. Sars.

Loxoconcha elliptica, Brady.

Loxoconcha elliptica, Brady, Monog. Rec. Brit. Ostrac. p. 435, pl. 27. figs. 38, 39, 45–48, & pl. 40. fig. 3.

The specimens of this species which we found in various freshwater loughs and pools differ from the typical brackish and marine form only in size and style of sculpture, the punctation of the shell being more distinct, but the papillæ very few or absent; the size much less.

Hab. In a pool amongst *Utricularia minor*, south of Clifden, and in Loughs Fadda and Ballinahinch.

Genus Cytherura, G. O. Sars.

Cytherura flavescens, Brady. Pl. XX. figs. 13, 14.

Cytherura flavescens, Brady, Ann. & Mag. Nat. Hist. ser. 4. vol. iii. p. 49, pl. 8. figs. 13, 14.

Carapace, as seen from the side, oblong, subrhomboidal, nearly equal in height throughout; length equal to twice the height; anterior extremity rounded, posterior forming about the middle a short obtuse process; superior margin straight or slightly incurved, inferior distinctly sinuated. Seen from above, oblong ovate, widest in the middle; extremities pointed; width nearly equal to the height. Surface finely punctate and marked by distinct longitudinal ribs with irregular and less distinct cross striæ; central areola dark-coloured, saddle-shaped. Length $\frac{1}{65}$ inch.

Hab. Clifden Bay, above low-water mark; River Ouse at Lynn, and Dungeness Bay, 7 fathoms (Mr. E. C. Davison's dredgings).

Genus Cytheropteron, G. O. Sars.

Cytheropteron rectum, Brady. Pl. XX. figs. 6–8.

Cytheropteron rectum, Brady, Monog. Recent Brit. Ostrac. p. 476.

Of this species, which was not figured in Mr. Brady's 'Monograph,' we now give drawings. It seems to be of very rare occurrence, and we have had no opportunity of seeing the animal.

Hab. Westport Bay, 4 fathoms.

Genus Sclerochilus, G. O. Sars.

Sclerochilus (?) *gracilis*, nov. sp. Pl. XX. figs. 11, 12.

Carapace, as seen from the side, elongate, subtriangular, highest in the middle; height much less than one-half of the length; extremities narrowly rounded: superior margin boldly arched, somewhat flattened in the middle; inferior straight, with a slight median sinuation. Seen from above, compressed ovate, widest in front of the middle, extremities pointed; width equal to one-third of the length. Shell perfectly smooth, milk-white. Length $\frac{1}{48}$ inch.

Hab. At Westport, in company with *Cythere gibbosa.*

Sclerochilus contortus, var. *abbreviatus.* Pl. XX. figs. 15, 16.

This seems to bear much the same relation to the normal form of *S. contortus* as *Paradoxostoma abbreviatum* does to *P. variabile*; but, from the small number of specimens yet observed, we hesitate to describe it as a distinct species, not having been able to investigate the anatomy of the animal.

Hab. Clifden Bay, above low-water mark.

Fam. **Polycopidæ.**

Genus Polycope, G. O. Sars.

Polycope compressa, nov. sp. Pl. XXI. figs. 5–11.

Carapace, as seen from the side, almost circular, the length being but slightly greater than the height. Seen from above, compressed, oblong, widest in front of the middle; width scarcely equalling half the length, rounded in front, obtusely pointed behind. Surface of the shell perfectly smooth; colour yellowish white. The free margins of the valves are minutely denticulate, with about fifteen small sharp teeth. Diameter $\frac{1}{45}$ inch.

Hab. Clifden Bay, in 4 fathoms, on a fine gravelly bottom; also off Eddystone Lighthouse; and in a gathering from the harbour of Messina, about 8 fathoms, for which we are indebted to the kindness of Dr. Dohrn.

The much more compressed character of the valves, the denticulated edges, and absence of surface-sculpture at once distinguish this from the only hitherto described species of the genus, *P. orbicularis.* Several specimens were captured; and their motions, while in a bottle of sea-water, were noticed to be extremely lively.

EXPLANATION OF THE PLATES.

Plate XVIII.

Fig. 1. *Bairdia fulva*, seen from the left side.
Fig. 2. The same, seen from above.
Fig. 3. The same, seen from below.
Fig. 4. The same, seen from the front.
Fig. 5. *Cypridopsis obesa* (female), seen from the left side.
Fig. 6. The same, seen from below. $\times 60$.
Fig. 7. The same, seen from the front.
Fig. 8. *Limnicythere Sancti-Patricii* (female), seen from left side.
Fig. 9. The same, seen from above.
Fig. 10. The same, seen from below.
Fig. 11. The same, seen from the front.

Plate XIX.

Fig. 1. *Cythere porcellanea* (female), seen from the left side.
Fig. 2. The same, seen from below.
Fig. 3. The same (male), seen from the left side.
Fig. 4. The same, seen from below.
Fig. 5. *Cythere Macallana* (female), seen from the left side. $\times 60$.
Fig. 6. The same, seen from above.
Fig. 7. The same, seen from below.
Fig. 8. The same (male), seen from the left side.
Fig. 9. The same, seen from below.
Fig. 10. *Cythere pellucida* (female), seen from the left side.
Fig. 11. The same, seen from below. $\times 40$.
Fig. 12. The same (male), seen from the left side.
Fig. 13. *Cythere cicatricosa*, seen from the left side. $\times 60$.
Fig. 14. The same, seen from above.
Fig. 15. *Cythere castanea* (female), seen from the left side.
Fig. 16. The same, seen from above. $\times 40$.
Fig. 17. The same (male), seen from the left side.
Fig. 18. The same, seen from above.

Plate XX.

Fig. 1. *Cythere pulchella* (male), seen from the left side.
Fig. 2. The same, seen from above.
Fig. 3. The same, seen from the front.
Fig. 4. *Aglaia complanata*, seen from the left side.
Fig. 5. The same, seen from above.
Fig. 6. *Cytheropteron rectum* (male ?), seen from the left side.
Fig. 7. The same, seen from below.
Fig. 8. The same, seen from behind.
Fig. 9. *Cytheridea cornea*, seen from the left side. $\times 60$.
Fig. 10. The same, seen from above.
Fig. 11. *Sclerochilus gracilis*, seen from the left side.
Fig. 12. The same, seen from above.
Fig. 13. *Cytherura flavescens*, seen from the left side.
Fig. 14. The same, seen from below.
Fig. 15. *Sclerochilus contortus*, var. *abbreviatus*, seen from right side.
Fig. 16. The same, seen from above.

Plate XXI.

Fig. 1. *Cythere gibbosa* (female ?), seen from the left side.
Fig. 2. The same, seen from above. × 60.
Fig. 3. The same, seen from the front.
Fig. 4. *Limnicythere Sancti-Patricii*; abdomen of female (?) : *a*, abdomen; *b*, postabdominal ramus (?); *c*, copulative organs (?). × 210.
Fig. 5. *Polycope compressa*, seen from the left side.
Fig. 6. The same, seen from above.
Fig. 7. The same, seen from behind. × 60.
Fig. 8. The same, right valve, from inside, showing hinge-joint and serrulated margin.
Fig. 9. The same, superior antenna.
Fig. 10. The same, inferior antenna. × 210.
Fig. 11. The same, postabdominal ramus.
Fig. 12. *Eucythere declivis*, var. *prava* (female), seen from left side.
Fig. 13. The same, seen from above. × 40.
Fig. 14. The same (male), seen from the left side.

Plate XXII.

Fig. 1. *Ophianoplus annulosus*, fragment of ray, dredged in Birterbuy Bay; natural size.
Fig. 2. The same, disk, seen from above, with one ray; a little larger than natural size.
Fig. 3. The same, base of a ray, with portion of disk, seen from below: *a*, madrepore-plate; *b b*, smaller, and *c c*, larger mouth-papillæ.
Fig. 4. The same, portion of ray, seen from below, denuded of spines.
Fig. 5. The same, from above.
Fig. 6. The same, transverse section of ray near the middle: *a*, outer, *b*, inner foot-papillæ. (Figs. 2–6 after Sars.)
Fig. 7. *Exunguia stilipes*, upper antenna, × 84.
Fig. 8. The same, lower antenna, × 84.
Fig. 9. The same, maxilliped, × 210.
Fig. 10. The same, first gnathopod, × 84.
Fig. 11. The same, second gnathopod, × 84.
Fig. 12. The same, last segments of body, showing telson and uropod, × 84.

XLVI.—*Notes on some recent Mediterranean Species of Brachiopoda.* By Thomas Davidson, F.R.S., F.G.S., &c.

While I was recently at Nice, it was suggested by our distinguished naturalist Mr. J. G. Jeffreys that I should carefully examine the original specimens of the Mediterranean species of Brachiopoda described by Antonio Risso*, in order to clear away some uncertainty still prevailing with reference to the correct identification and specific value of that author's species. Risso's knowledge of the Mollusca, both recent and fossil, was considerably inferior to his amount of information regarding

* Histoire Naturelle des principales Productions de l'Europe Méridionale, et particulièrement de celles des Environs de Nice et des Alpes Maritimes, vol. iv. 1826.

fishes and crustacea; consequently we must not be surprised to find so large an amount of error in the work above specified. During his lifetime few were permitted access to his collection, which at his death was found in great confusion; but since that time it has been put into good order, and is liberally shown at the Villa Risso by his nephew, Sig. J. B. Risso, consul of the Nicaraguan republic. The shells have been cleaned, remounted, and rearranged with much care by Mr. Haas, a local amateur, likewise possessor of a fine series of recent shells. From this examination I have determined that:—

Terebratula emarginata and *T. quadrata*, Risso, are synonyms of *Terebratulina caput-serpentis* (Linnæus, sp.).

Terebratula truncata, Risso, is the *Megerlea* (*Anomia*) *truncata* of Linnæus.

Terebratula cuneata and *T. Soldaniana*, Risso, are both referable to a single species, for which the designation of *Argiope cuneata* (Risso, sp.) must be retained. *Orthis pera* (Mühlfeldt) is another synonym.

Terebratula urna-antiqua, Risso, is undoubtedly a synonym of *Argiope decollata* (Gmelin, sp.).

Terebratula cordata, Risso. In this collection we find a specimen of *Argiope* (*Ter.*) *neapolitana* labelled as the type of Risso's *cordata*, which I am inclined to consider correct. Risso did not figure his species; and his description is insufficient. I therefore question whether we are justified in preferring the term *cordata* to the well-known one of *Argiope* (*Ter.*) *neapolitana*, Scacchi, described in 1833.

Terebratula cardita, Risso. The figured specimen is no longer in the collection; but an example of *T. cordata*, = *A. neapolitana*, is labelled *cardita*. This is, no doubt, a mistake; for the specimen does not resemble the figure, bad as are all Risso's figures. Mr. Jeffreys and myself are of opinion that the incorrect figure of *T. cardita*, upon which Risso's description was probably founded, was a specimen of *Argiope decollata*. Therefore it will be necessary to exclude the term *T. cardita* from the list of Mediterranean Brachiopoda.

Terebratula aculeata, Risso, is no longer to be found in the collection; and as no figure is appended to the otherwise imperfect description, we are left without means of ascertaining what the shell really was; and the name will require to be erased from the list of Mediterranean shells.

Thecidium mediterraneum, Risso, is a good and well-known species.

I regret to add I could make out nothing certain or useful relative to the fossil species described by our author. The collection, it is true, contains a great number of fossil Brachiopoda, which were, no doubt, obtained from the Tertiary, Cretaceous, and Jurassic rocks, which occur plentifully in the neighbourhood of Nice, Italy, &c.; but as no figures accompany his scanty descriptions, and as the labels no longer exist or else are unrecognizable, those so-termed species become valueless for scientific purposes.

During my sojourn at Nice, I endeavoured to ascertain from Sig. Andrea Aradas, Professor at the University of Catania, in Sicily, what his *Terebratula Spada* really was, since it had been insufficiently figured by him in 1847; but not having been favoured with a reply, and not having seen the shell itself, the details here given must be regarded as provisional. This shell in size and shape much resembles certain delicately ribbed varieties of the *Waldheimia flavescens*, Lamarck, = *australis*, Quoy, of which the present known habitat is South Australia. Sig. Aradas mentions having found it only upon one occasion in the Mediterranean*. Its loop is long and similar to that of the species last named; and it is worthy of notice that no species or other specimen of *Waldheimia* has hitherto been dredged from the Mediterranean by any of the many naturalists that have searched that sea, the nearest spot being Vigo Bay, where Mr. R. MacAndrew once dredged two dwarfed specimens of *Waldheimia cranium.* I have since been assured by Sig. Seguenza, of Messina, that Sig. Aradas's specimen of *W. Spada* had been carefully examined by an experienced conchologist, who had pronounced it to belong to *Waldheimia flavescens*, and who does not believe it to be a Mediterranean shell, in which assumption I completely concur.

I now hasten to recognize Prof. O. G. Costa's priority of publication with reference to his genus *Platidia.* The discovery of the shell termed *Orthis anomioides* is due to Scacchi; but that of its internal organization and generic character seems to have been made simultaneously and quite independently by Prof. Costa and myself; and, indeed, it was only recently that, having procured a copy of that gentleman's work, 'Fauna del regno di Napoli,' I found out for the first time I had been anticipated by three months and a few days in the publication of my genus *Morrisia*, which is the same as his *Platidia.* At page 47 of the work above named, pub-

* Nel Mare di Aci-Trezza, near Sicily.

lished on the 6th of January 1852, Prof. Costa enters upon lengthened details in connexion with his genus, of which the *Orthis anomioides*, Scacchi, is stated to be the type; he also, in pl. 3 bis, gives illustrations of its internal details. In the 'Annals & Mag. of Nat. Hist.' for May 1852, will be found my description and figures of the *Morrisia anomioides*; and it is singular that none of the many conchologists and palæontologists who have adopted my genus should have been acquainted with Costa's work, or been aware of his genus and priority.

XLVII.—*Notes on the Animal of the Organ-pipe Coral* (Tubipora musica). By Ed. Perceval Wright, M.D., F.L.S., Professor of Botany and Zoology, Trinity College, Dublin.

[Plate XXIII.]

Here and there, all along many of the fine sandy bays of Mahé and Praslin, will be found, cast up by the tide, masses of various sizes of the bright-red skeleton of the well-known organ-pipe coral; and in some places the finely broken-up fragments are so mixed up with the sand as to impart to it a slight red colour. Finding the skeletons so common, I expected with a little search to discover the living coral *in situ*, and with this object in view I searched many a mile of coral-reef, but without success. Hearing from some of the fishermen that, on a bank famous for such fine fish as *Mesoprion erythrinus*, *Gerres argyreus*, &c., quantities of red coral were often brought up on their hooks, I proceeded to the spot, and found large quantities of the skeletons of *Tubipora musica*, but no trace of the polyps. In October of 1867 I was residing on the eastern side of Praslin; and, taking advantage of the "grandes marées" of that month, I investigated very closely the extensive coral-reefs on the western side of the beautiful little island called Curieuse. My plan was to commence work about two hours before low water. Sending a small pirogue to row beside the outer edge of the reef, which here encircles the land, I used to walk along this edge, attended by Edward, the black captain of my black crew. His duty was to carry glass jars, into which to put my captures, and to help me in my encounters with eels and cuttlefish; while by the aid of the pirogue I could cross over the deep gullies which very frequently occurred in the coral-reef, without the necessity of having to go to the shore so as to get round them. I need scarcely say that even when wading to my waist in the tepid waters, and half a mile from the shore, I could see, when the sea was tranquil, the surface of the reef as distinctly as if it were only covered by an inch or two of water. I had walked over this and other coral-reefs so very often, that I had not on this occasion much hope of discovering anything new. The surface on which I walked was a perfect carpet of a pretty bluish-green *Xenia*, interspersed here and there with patches of a bright scarlet and of a green alga. Sometimes, when a small heap of dead coral was met with and turned over, a large cuttlefish would endeavour, and sometimes successfully, to get over the edge of the reef, and then away. Large specimens of that fine Holothuroid *Mülleria nobilis*, and at intervals a *Culcita*, would be seen and collected. The edges of the gullies actually bristled with the long spines of *Diadema Savignyi*. The pain caused by incautiously touching the spines of the species of this genus is very great—so great that I have had my arm and hand quite benumbed by it for some hours. At one spot, near the very edge of deep water, my foot sank in some soft yet brittle stuff, and, from the sensation, I knew I had crushed some coral-structure that I had not before met with. On examination, this proved to be a bunch of the *Tubipora*, which was growing parasitically on a large rock of Madrepore; and now that I found the habitat of this species, I had no difficulty in finding any quantity of it. Some masses were two feet in diameter; but it more usually occurred in irregular lumps of about twelve inches in circumference and from two to four inches in height. Very frequently it was covered over with tufts of a small green confervoid alga, or of some sessile halichondroid sponge; and under such circumstances the red colour of the polypidom was, of course, not conspicuous. The crowns of tentacles, like so many stars, were of a greenish colour. Some few pieces were found elevated on a stalk, as if the budding of the original individual polyp had advanced for some time in an upward and then in an outward direction. The polyps were very sensitive, and quickly contracted themselves; nor were they, like the polyps of *Xenia*, at all quick to show themselves after they had been once alarmed.

My residence at Mahé after the discovery of the living animals of this coral was too short to admit of my investigating their development; but a very casual examination showed that the tubes were made up of spicules coalesced together, which were found free and distinct on the upper margin of the tube, and that the tentacles were also thickly covered over with minute pale-coloured spicules.

As the differences between the species of the genus *Tubipora* are not appreciable without an examination of the polyps, perhaps there may always be some doubt as to which species is entitled to be called *musica*; but as the Linnean species came from the Indian Ocean, I think I may fairly assume that the Seychelles species is the *Tubipora musica*, Linn., the *Halcyonium rubrum indicum* of Rumphius; and if so, I cannot find that the polyps have hitherto been dissected. In Prof. Kölliker's short notes on "Polymorphism in various Genera of Alcyonaria"*, he mentions having examined a species of *Tubipora* from the Viti archipelago, which had been preserved in spirits. The species is not mentioned, but is probably one of the two species described by Dana as from the Fiji or Viti Islands, both of which differ specifically, as I take it, from the Indian-Ocean species.

The polyp consists of eight pinnate tentacles, each tentacle with from fifteen to seventeen pinnæ on either side; these tentacles are thickly studded with spicules of an oval shape, flat, somewhat longer than broad; they closely resemble the lenticular spicules of Kölliker: they are met with all over the tentacle, down the centre of which there is one compact row, forming as it were a midrib; they are often slightly compressed in the centre, so as to form a figure of eight. In the centre of the tentacles is the mouth, with a slightly raised circular lip. When the polyp is alarmed, the tentacles are first closed together, and then the polyp sinks down quite into the tube; as it becomes more completely retracted, it draws in after it the uppermost portion of the tube itself, inverting this and folding it in, until the open mouth of the tube is thereby completely filled. It is, of course, only the yet spicular, and not the solid portion of the tube that is thus inverted; and the folds thus formed equal in number the tentacles. I have more than once traced these spicular portions up to the very base of the tentacles, where the fusiform spicules end and the characteristic tentacle- and body-spicules commence, these spicules thus forming a series of triangular spaces, the bases of which join on with the hardened edge of the tube, and the apices are situated at the base of each tentacle. The spicules secreted by this portion of the ectodermic layer are of several sorts:—First, the warty fusiform spicule, so commonly met with in the Alcyonidæ; these spicules will be found in all stages of growth and of coalescence: thus at the upper portion of the edge of the tube, where it is non-retractile, the calcareous tissue will be found to consist of a series of them, partially joined together and making a kind of coarse open network (fig. 10), which, on being macerated in caustic potash, does

* Verhandl. d. phys.-med. Gesellschaft in Würzburg, Dec. 28, 1867, and Zoological Record for 1867, p. 661.

not fall to pieces; but the retractile portion, on being subjected to the same treatment, breaks up into a mass of minute individual spicules (fig. 8). The red colouring-matter would appear not to reside in these latter spicules; for those that I have examined are colourless, presenting in this a marked contrast to the spicules of *Melithœa coccinea*, which retain their red or yellowish-red colour after being exposed to the action of the caustic alkali. A second form of spicule is met with in the retractile portions of the tube; it closely resembles that form of spicule described by Kölliker as occurring in *Eunicea fusca* (Taf. 18. fig. 19), which I think might be called "shuttlecock." While all the forms of spicules met with seem to occupy certain definite portions of the ectodermic layer, yet there is an evident gradation between them, from the smooth fusiform spicule to the most irregularly warty forms, which leads naturally to the inference that all these forms are but different stages of growth, by the aggregation of new calcareous material, until the solid tubular structure so long known to us is at last reached.

The mouth, which is circular, is distinctly marked, and leads into the stomachal cavity, which is small; the stomachal cavity is separated by a thin and delicate membrane from the general body-cavity. I have not been able to determine with exactness the number of openings between these two portions. The ovaries are in the general cavity, and are invested by a delicate membrane, which is continued in the form of eight mesenteric slender bands to the body of the tube, as is seen in fig. 6.

In his 'Icones Histologicæ,' Prof. Kölliker, when treating of the hardened connective tissue met with in the Alcyonaria, divides the denser structures into:—

I. Hard structures which are in substance made up of small isolated bodies of a fixed shape (such as the calcareous spicules of Alcyonidæ).

II. Hard structures forming a more or less compact structure. Of these there exist:—

1. Hard calcareous bodies, either isolated or coalesced together, and in combination with a horny or chalky internodal substance, or occurring alone as coalesced calcareous substance. (Axis of Melithæaceæ, Sclerogorgiaceæ, and Corallinæ.)
2. Lamellated structures, which may be formed as secretions, and which, when calcified, leave, after the removal of the salts, an organic remainder preserving the same outline. Here belong:—

a. The horny axis of Gorgonidæ and Antipathidæ, and the horny internodes of *Isis.*

b. The more or less calcified lamellose axis of Gorgonidæ (*Primnoa*, *Plicaurella*, *Isis*, &c.) and Pennatulidæ.

3. Crystalline structure, which seems to increase through a deposit of chalk from a preexisting structure, as, after the removal of all the salts, there is still left a small, almost inappreciable organic residue. Here are placed :—

a. The greater number of those polyps with merely superficial skeletons (*Tubipora*) ; and

b. Structures like the chalky skeletons of the Madrepores.

The structure, however, of the skeleton of *Tubipora*, as will be seen from the above, is certainly not crystalline; and the manner in which it is deposited differs in no essential particular from that described in section II. 1. Fusiform spicules are secreted by the ectodermic layer; these spicules around the base of the tentacles are of a white colour, and in many cases are simply fusiform, not warty; but those at a little distance from the base of the tentacles not only assume a light-red colour, but become crowded over with warty excrescences, and there is then to be found a gradual growing together and consolidation of those around the edge of the tube—that is, where this is formed. In the case of a young bud, there is at first no tube, the spicules having not yet become coalesced; they are here simply placed side by side.

I regret very much that I had no opportunity of watching the development of the egg of *Tubipora*, or even of seeing the formation by budding of the attached zooid forms. From an examination, however, of a large series of specimens, it is, I think, pretty evident that the external tabulæ are formed in the first instance as flattened offshoots from the upper edges of the tubes. Thus in many instances flat plates will be found to project from the upper and still soft portion of the tube; this plate will consist of a fold of ectoderm, into which some of the endodermic layer is tucked : spicules are freely secreted in the outer layer of this fold, which is of a bright-red colour; and in one or two instances a small swelling was seen to arise from the free end of this lateral fold-like prolongation of the tube. I have little doubt that these swellings were the starting-points of fresh polyps. It must not be forgotten that while in some masses of *Tubipora* the skeleton-tubes were all close together, and the polyps all on the same level, in many others the masses vere very much less compact and the polyps were growing in an irregular manner.

The polyp certainly can and does constantly add to the height of its tube; or, in other words, the spicules are being constantly consolidated into the tube, and the tube thus increases in height. In some cases I have been able to trace the mesenteric bands, which attach the lower portion of the body of the polyp to the walls of the skeleton-tube, as far as the second external septum in depth; and it is very evident that as the outer walls of the tube become consolidated, not only does the tube become elongated, but the polyp elevates itself at the same time in the tube.

I am inclined, with Milne-Edwards, to regard the genus *Tubipora* as belonging to the first family of the order Alcyonaria, viz. Alcyonidæ, but would place it as a separate section of the subfamily Alcyoninæ. Thus we should have—

Order ALCYONARIA.

Family 1. **Alcyonidæ.**

Subfamily 1. *Cornularinæ.*

,, 2. *Alcyoninæ*; and, dividing this into *three* sections, as follows:—

Alcyoninæ.

(I.) Naked or soft, as *Alcyonium.*
(II.) Armed with large spicules, as *Nephthya.*
(III.) Tubed; tubes formed of coalesced spicules, as in *Tubipora.*

Some may perhaps consider it advisable to give more weight to the great difference in the calcareous secretions, and place the genus in a subfamily to rank as a third subfamily of the Alcyonidæ, called Tubiporinæ, which would be characterized by having lenticular spicules developed in the tentacles, the fusiform spicules of the outer body-layer forming dense hard tubes united to each other by calcareous septa.

EXPLANATION OF PLATE XXIII.

Fig. 1. Mass of *Tubipora musica,* nat. size.
Fig. 2. The same, to show the buds.
Fig. 3. Polyps, seen from above, three expanded; from the side of the retracted polyp which is seen in the lower part of the figure, between the two expanded polyps, will be found the lateral fold-like prolongation of the tube referred to in the text.
Fig. 4. Polyps in different stages of expansion and retraction: at *e* the lateral fold-like prolongation is seen.
Fig. 5. Mouth, with circular lip and four tentacles studded with spicules.
Fig. 6. A section through tube and polyp, the latter fully retracted.
Fig. 7. Lenticular spicules from the tentacles.

Fig. 8. Fusiform spicules, plain and warty, from ectodermic layer between base of tentacles and edge of hard tube.
Fig. 9. Warty fusiform spicules.
Fig. 10. The same, gradually becoming coalesced and forming a rough irregular network at one spot; in another becoming solidified.

N.B. All the figures on this Plate have been drawn by Mr. Ford from specimens preserved in spirits. It need not be said that they are accurate representations of the structures thus preserved; yet they would undoubtedly have been much more life-like had they been drawn by Mr. Ford from living specimens. Figure 3, however, is not only an accurate but also to my mind a life-like drawing.

XLVIII.—*On the comparative Carpical Structure of the* Ehretiaceæ *and* Cordiaceæ. By JOHN MIERS, F.R.S., F.L.S., &c.

THUS far the carpical structure of the *Ehretiaceæ* has been explained, especially under the typical form of *Ehretia*; and it will tend to a better comprehension of the subject if I offer a few observations upon *Cordia*, because a very distinguished botanist has proposed to amalgamate *Ehretiaceæ* with *Cordiaceæ*. M. Baillon, in an instructive analysis of the ovary of *Cordia* (Adans. iii. 1, pl. 1), points to the analogy existing in the early development of the ovaries of *Cordia* and *Heliotropium*, and, without sufficient consideration of the subject, he pronounces these two genera to be inseparable; and, as the latter has been referred by some to *Ehretiaceæ*, he would unite the *Cordieæ*, *Ehretieæ*, *Heliotropieæ*, and *Borragineæ* into one family (*Cordiaceæ*). He thus divides it into two groups:—

1. *Borragineæ* proper.
2. *Cordiaceæ*, subdivided into
   - A. *Cordieæ*, having an embryo with plicated cotyledons.
   - B. *Heliotropieæ*, with simple cotyledons, without albumen.
   - C. *Tournefortieæ*, with simple cotyledons, with albumen.

But he does not state in which of these he would place the *Ehretiaceæ*.

These were the inferences he drew from his examination of the ovary of *Cordia ferruginea*; and he figured in the drawing above quoted the different stages observed from the period of the earliest development. He depicts the formation of two rudimentary carpels, which, by the inflexion of their margins, form a low dome with a unilocular cavity, in the bottom of which, intermediate between the four cardinal points, he perceived the evolution of four ovules, fixed in the base upon as many placentary ridges, while between them four septiform enlargements emanated from the wall of the cell at those cardinal points, leaving as many shallow fossets in the base of the cell, where the ovules became ensconced; the parietal emanations tapered upwards, gradually closing and joining together so as to form the style and stigma; and while the cells thus produced continue to grow downwards, the anatropous ovules remain attached to their original placentary supports, with their micropyles pointing upwards. At this stage, M. Baillon's description ceases, and he does not relate what occurs in the further development of *Cordia*, or what takes place in *Heliotropium* or *Ehretia*. The differences in these subsequent developments may, however, be summarized in the following manner.

In *Cordia* the four parietal emanations gradually approach each other, to form four equal partitions united in the axis, so that, at the period of flowering, the ovary is completely 4-celled, with a single subanatropous ovule in each cell, attached to the internal angle by a point below its apex or by its middle: the completion of this growth results in a drupaceous fruit, with a 4-celled osseous nut, each cell with a single seed suspended from below the summit, with a descending raphe terminating in the basal chalaza, the radicle of the exalbuminous seed being superior, and the cotyledons singularly plicated lengthwise. In the base and centre of the nut a large hollow is seen filled with placentary tissue, from which four sets of nourishing vessels issue, penetrating through a minute perforation near the summit of each cell, and terminating in the hilar attachment of the seeds. These are the very peculiar transformations that serve to distinguish the *Cordiaceæ* from all other developments of the same alliance.

In *Ehretia*, the ovary at an early stage is developed much after the manner of *Cordia*: the rudiments of four ovules emanate at the same points, and we see four similar intermediate parietal enlargements; but the basal placentary ridges combine to form a compressed elevated line, running from front to back across the axis, which continues to grow upwards, carrying the ovules with it, or, what amounts to the same thing, the principal growth of the whole takes place downwards; and in this manner the placentary columella is produced, which M. Baillon does not seem to have noticed. On the other hand, the parietal enlargements do not meet round the axis, as in *Cordia*, but are thrust aside after a while; the sinister and dexter emanations form semisepta, which, on approaching the columella, become suddenly reflected both ways, in parallel directions, to meet the corresponding parietal growths from the anterior and posterior walls: the consequence is that, at the period of the perfection of the flower, we see two bilocular carpels, each cell having a suspended ovule, while a vacant space runs across the axis anteriorly and posteriorly, filled with a compressed plate, which is the columella that supplies the nourishing vessels for the growth of ovules and seeds. This growth is constant throughout the *Ehretiaceæ*. The subsequent developments of the fruit in the different genera become modified in the manner already described.

In the *Borraginaceæ* there exists in the earlier stages a normally bicarpal development very similar to that of *Cordia*; but during the subsequent growth there is a tendency to a separation of the whole into four carpels, more or less bigeminately combined in pairs; the style remains free in the centre, supported upon a common gynobase, upon which the four carpels are affixed, and from which their ovules and seeds derive their nourishing vessels. This constitutes a subfamily marked by many peculiar characters: it requires, however, a thorough reinvestigation.

In the *Heliotropiaceæ*, the ovary, normally as well as at maturity, is bicarpellary, and the carpels are seated upon a conical gynobase of half their height. The style is usually very short, thick, and suddenly enlarged into a pulvinate or discoid form; and this is terminated by two sessile stigmata, more or less abbreviated. The fruit is generally exsuccous, divisible into four single or into two bilocular nuts; when four nuts are produced, there is a short placentary process that rises from the gynobase, to which the nucules are attached, and which answers the purpose of the columella seen in the *Ehretiaceæ*, in affording nutrition to the seeds; they are not bigeminately connected, as in that family.

Hence it will be seen that the *Cordiaceæ* possess characters which amply distinguish them from the *Ehretiaceæ*, *Heliotropiaceæ*, and *Borraginaceæ*. Nearly all the species of the family have been huddled into the single genus *Cordia*, because no one has taken the trouble to ascertain their true characters, their examination having been singularly neglected. It is remarkable that, among the 175 species of *Cordia* enumerated by De Candolle in his 'Prodromus,' the number of cells existing in the fruit is mentioned in only four cases, and utter silence is maintained throughout the whole in regard to the number of cells in the ovary, even in the generic character; and the point of suspension of the ovules and attachment of the seeds is everywhere ignored. Prof. Fresenius, in working the monograph of the family for Martius's 'Flora Brasiliensis,' contents himself with a few words in stating the ordinal character: in regard to its 4-locular ovary, he merely says there is an anatropous ovule in each cell, appended from the summit (which is not exactly true); and in regard to the seeds, he is silent about the existence of integuments, raphe, or chalaza, and none of his many analytical figures gives any information upon these subjects.

It is to be regretted that a very small amount of reliable information has been recorded concerning the carpical structure of the family. Among the few analyses that have been published, that of Gaertner is the most important: he shows in his work (i. 364, tab. 76. fig. 1) that of *Cordia* (*Sebestena*) *Myxa*, where the seed is suspended a little below the summit, with a raphe descending from that point to the base, its small radicle being superior, and its large fleshy cotyledons deeply plicated. A very different version of this structure, in a plant which he called *Cordia Myxa*, is given in Wight's 'Illustrations,' pl. 169: in the ovary the ovules are there shown to be quite erect, fixed in the basal angle of each cell; in the fruit the point of the attachment of the seed is not indicated, though it is drawn separately in fig. 11, without any mark of raphe or chalaza. This analysis is drawn by an Indian artist, and shows evident marks of inaccuracy; for the embryo, as shown in figs. 11 and 12, has a long pointed radicle, which is inferior (instead of superior). I therefore place more reliance upon the analysis of Gaertner, which is more conformable with my own observations, as will be shown presently. Wight's 'Icones,' also drawn by Indian artists, show the ovules in the same position as that indicated in the 'Illustrations,' in two other species of *Cordia*, in pls. 1379 and 1381, while in three other cases they are attached by their middle, as seen in plates 469, 1378, and 1380, which agrees with what I have generally found in the Brazilian species of *Cordia*. Prof. A. De Candolle, in a note to the genus *Varronia* (Prodr. ix. 468), states that the ovules are there laterally affixed to the internal angle of the cells; and, again, in another note (p. 471) he adds that he found the ovules in *C. gerascanthus* attached as in *Varronia*, and that in *C. Chamissoniana* (a closely allied species) the point of attachment is nearer the base; but my observations upon the same species convince me that the connexion is at the middle, rather above than below it: in *C. discolor* he found the ovules fixed as in *Varronia*. My examination of the unilocular nut of *Cordia glabra* shows that the seed, which tightly fits the cell, is attached by a somewhat broad hilum to a spot a little below the middle of the cell, from which point a line of raphe, imbedded between the two integuments *, descends

* The seed, as stated by Gaertner, has two integuments: the outer one, of very friable texture, quite white, is composed of numerous large cells rather laxly agglutinated together; but it adheres firmly to the inner integument, which is opaque, very finely reticulated, like an extremely

to a small basal chalaza; at the base of the nut, on the same side, a compressed open channel is seen, leading to the small abortive cells, filled with a chord of nourishing vessels which communicate with the hilum of the fertile seed. I have examined the ovaries and fruits of many Brazilian species of *Cordia*, all giving nearly similar results; and we may infer, from the preponderance of all this evidence, with a tolerable degree of confidence, that the ovules in the ovary or the seeds in their nuts are never affixed to the base of the cells, but are always attached nearer their middle, either above or below it, in the internal angle. In addition to this evidence, Roxburgh affirms of *C. serrata* that its ovules are affixed in the axis.

The *Cordia Myxa* of Roxburgh appears to me a very different plant from that figured by Wight, under that name, in his 'Illustrations,' in which the leaves are larger and the fruit is more than double the size. I have examined the fruit of *Cordia oblongifolia*, Thw., which corresponds completely in size, especially in the persistent calyx, with the figure of *C. Myxa* in Wight's 'Illustrations.' Here the drupe is almost globular, with a short conical apex, and is seated in a thick, striated, cupular calyx, with a denticulated margin; the pericarp is extraordinarily thick, composed of numerous coarse woody fibres, after the manner of a cocoa-nut, within which is a fleshy mesocarp that envelops the nut: this nut is scarcely more than half the length and one-third the breadth of the pericarp, and is marked externally with a few deep hollow punctures; it has two fertile cells (the other two being abortive), with a large hollow cavity in the base, which is continued up the axis in a narrow channel which is open at the toothed apex of the nut; here the seed in each cell is attached by its middle, certainly not below it, at the point where the placentary vessels from the central columella enter the cells in communication with the descending raphe. Roxburgh's *Cordia monoica* has a much smaller drupe, which is oblong, only ½ inch long, with a much thinner, fibrous pericarp, and a fleshy mesocarp covering a nut which has only a single seed, attached near its middle. *Cordia Bantamensis*, Bl., a species closely allied to the above, has an oblong apiculated drupe, longer and narrower than in *C. oblongifolia*, seated in its cupular calyx: the nut is 1-celled, with the indications of

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thin waxy albumen; it is polished inside, and marked with several longitudinal nerve-like lines, produced by pressure between the plicatures of the cotyledons: but both these integuments are quite void of any vessels, except those of the raphe, which are enclosed in a sheath imbedded between them.

three abortive cells; the seed is here fixed above the middle of the cell, with a conspicuous descending raphe terminating in the basal chalaza. *Myxa* will make a good genus composed of several species, only a comparatively small portion of the 122 species classed in the section *Myxa* by De Candolle.

Cordia might conveniently be divided into several genera, for which good differential characters now exist. The form and æstivation of the calyx have already served for sectional divisions; but those of the corolla have been little attended to. Prof. De Candolle has noticed that the border of the corolla is campanulate and plicated convolutely in *Varronia*, as in the *Convolvulaceæ*; in *C. decandra*, Hook. & Arn., and *C. angiocarpa*, Rich., the stamens are twice or three times the usual number, and the lobes of the corolla, which are equally numerous, have a contorsively imbricated æstivation: in some species the border is corrugated, but in general the lobes of the border are quincuncially imbricated, in æstivation. It has not been noticed that in all the species forming the section *Gerascanthus* the border is cleft to the base into five equal flat lobes, which in æstivation are folded sinistrorsely, as in *Echites*: this generic name, established by P. Brown, might therefore be restored. The section *Rhabdocalyx* has one lobe of the border external in æstivation, while the other four are convoluted. The characters of the stamens and fruit afford other good indications. Besides the features I have mentioned as distinguishing *Myxa*, may be added that of its polygamous or monœcious flowers. *Cordia*, indeed, stands in much need of a thorough careful examination and redistribution.

There is one point deserving of notice—that, from some unknown cause, it rarely happens in *Cordia* that more than one ovule becomes fertilized; and this occurs equally in the plants of the Old and New World. The drupaceous nut is usually more or less gibbous and one-celled, with the seed attached as above described, in which case the abortive cells are generally seen on the flattened side, above the middle. May this almost constant abortion be owing to a defect in the stigmata, or to the puncture of insects, attracted perhaps by the nectariferous gland? I have seen cases where the flowers on a branch appeared quite perfect, but there was hardly one ovary in the whole that had not been attacked by a minute grub.

On a future occasion I will call attention to a new group of plants (the *Auxemmaceæ*), closely allied to *Cordiaceæ*, distinguished by the great augmentation of the calyx in fruit, by the peculiar æstivation of the corolla, and by its atropous ovules and seeds.

XLIX.—*Wasps and their Habits.* By Frederick Smith, of the British Museum, V.P. Ent. Soc., &c.

The title of this communication is also that of a very able and interesting paper by Mr. Benjamin D. Walsh, published in the 'American Entomologist' for March 1869. This paper contains a vast amount of information relative to the economy of a variety of species of insects, some belonging to the Vespidæ proper, others to the fossorial group, popularly called Sand-Wasps. Several of the histories will be new to English entomologists, others will prove highly interesting and confirmatory of accounts given by previous observers.

I purpose to make a few observations on the different species and their histories, in the order in which they follow in Mr. Walsh's paper.

Sixteen years ago I published a short paper on the economy of *Agenia punctum*, in which I expressed an opinion that none of the sand-wasps are parasitic; and subsequent observation has not led me to adopt a contrary one*. Mr. Walsh is of opinion that one genus, *Ceropales*, consisting of numerous species, is parasitic, and he assumes to have proved his case.

I offer my remarks in no captious spirit, but simply as an expression of opinion upon this subject, as well as upon some others contained in the paper, for the sole purpose of arriving at the true facts of the case, and also for the purpose of doing justice to previous observers, who have in more instances than one preceded Mr. Walsh, who is not acquainted with the works in which they made their discoveries known.

The first opinion from which I dissent is contained in the following quotation:—"Some authors have supposed that certain species of digger wasps open their nests from time to time, to furnish their young larvæ with fresh supplies of appropriate food. Strictly speaking, the digger wasps do not feed their larvæ at all: they collect suitable food in a suitable nest, lay an egg therein, close up the nest, and then leave it for ever." In my work on the Fossorial Hymenoptera I have stated that I have frequently reared *Mellinus arvensis* from the larval state: this insect provisions her nest with Diptera; and I have obtained from burrows, in a hard sand-bank, cells containing the requisite number of flies, usually four, sometimes five, according to the size of the species of flies selected (for the insect selects Muscidæ as well as Syrphidæ); and I have found the egg attached to one of the flies, deposited at the end of the cell. I have also obtained cells containing only two flies; but in such a case the egg was attached to one

* In this remark I do not include the Scoliadæ.

of them; and I have found also an egg attached to a single fly, that being all that was stored up. These insects appear in the autumn, when they can usually store up the required amount of food without interruption; but they must occasionally be hindered in their work by rainy weather; and as the egg hatches usually in five or six days, it must occasionally happen that the store has to be completed at a time when the larva is feeding on the first fly or flies that were deposited. I do not advance this as an instance in which a solitary sand-wasp feeds its larvæ periodically, but as one in which the species deviates from the general rule that obtains: the fossorial tribe of insects usually lay up the requisite store of food before they deposit an egg upon it.

The habits of a species of the genus *Sphex* (being one not found in this country, but comprising some of the largest and handsomest hymenopterous insects) are very interesting. The economy detailed is that of *Sphex ichneumonia*: this insect burrows into gravelly banks and hard pathways, and stores up a single grasshopper to nourish its future offspring: this is an additional instance recorded that shows the great diversity that frequently occurs in the economy of species belonging to the same genus. Mr. Gosse has most graphically described, in his 'Sojourn in Jamaica,' published in 1851, the economy of a large species of *Sphex* that stores up the caterpillar of a moth.

In my published notes on the economy of the genus *Cerceris* I have recorded the fact of my having captured *C. interrupta* storing up the little beetle *Apion rufirostre*; and *C. arenaria* is well known to prey upon various species of Curculionidæ: I have at one time observed *C. labiata* conveying Curculionidæ to its cells, and at another selecting *Haltica tabida*. *C. ornata*, differing more widely in its choice of provision, selects species of the short-tongued bees, *Halictus rubicundus* or *H. cylindricus* being usually its prey.

The same species of Fossor does not, therefore, at all times select the same kind of prey: thus Shuckard records the fact of *Ammophila viatica* storing up spiders; the same habit has been observed by the Rev. A. Matthews. I have several times observed the same species of *Sphex* conveying a Lepidopterous larva, but never detected it with a spider.

Another instance of variation in the selection of food may be adduced: *Tachytes pompiliformis*, a most abundant British insect in most sandy situations, frequently stores up a sandy-coloured Lepidopterous caterpillar, but as frequently may be observed preying upon the pupæ of grasshoppers.

Mr. Walsh gives interesting histories of some genera with whose habits we were not previously acquainted. *Stizus grandis*, we learn, provisions its nest with *Cicada septemdecem*; *Pepsis formosa* preys upon *Mygale Hentzii*, and *Chlorion cœruleum* upon spiders.

A great mystery presents itself to Mr. Walsh: one or two suggestions relative to its solution are thrown out, but no opinion expressed. The insects included in the genus *Pelopœus*, popularly known by the name of "mud-daubers," have the femora and tibiæ almost destitute of spines or bristles; still some species (*P. lunatus* being an instance) have a few on the tibiæ, principally on the underside of the anterior pair: they are not, as Mr. Walsh remarks, so bristly as in the genera *Sphex* and *Ammophila*, both burrowers in the earth; but why should they be so when the bristles are of no manner of use to her, any more than they would be to a true wasp? One school of philosophers, Mr. Walsh observes, "will reply that its legs are bristly because, ages and ages ago, in the dim far-away vista of bygone geological years, the genus took its gradual origin from some species that did really dig holes in the ground, and had bristly legs to do so—and that, in consequence of the disuse of its bristles for generation after generation, through myriads of geological ages, the bristles themselves have gradually become shorter, weaker, and less numerous."

I would draw attention to one or two circumstances. I first observe that *Pelopœus* is just as destitute of spines as we find many other insects that are either known to be external builders, or that construct their mud cells in ready-made burrows or in some convenient hole or fissure adapted to their requirements: such insects belong to the genera *Agenia*, *Pemphredon*, *Pison*, and some others.

But I shall perhaps add still further to the mystery when I refer to the habits of one of the commonest species of our sand-wasps, *Mellinus arvensis*, which is quite as destitute of bristles on the legs as any species of *Pelopœus*, and yet is a true burrowing sand-wasp. There are hosts of insects with spiny legs that never burrow into any kind of substance—Diptera, for instance; many species of blowflies are examples. Spines are of use for other purposes than digging; bees comb and clean themselves with their spiny tibiæ and tarsi, as well as free themselves from the thin pellicle in which they are enveloped in the pupa state. I have witnessed the operation of escaping from the shroud that envelops the pupa of *Ammophila sabulosa*; and here the use of the bristles becomes very apparent.

Mr. Walsh is not aware that what he considers to be his most important discovery was observed by myself and published sixteen years ago. Among the Pompilidæ there is a section that have the anterior tarsi simple (that is, without cilia) and their intermediate and posterior tibiæ without spines: such is the character of the division named *Agenia*; but when we examine a large number of exotic species, we find that, although we call them smooth-legged, some species have a few bristles on their tibiæ—though in such cases they are rudimentary or extremely fine. These insects are mud-daubers, constructing cells after the same fashion as the *Pelopœi.* Mr. Walsh finds their cells usually under the loose bark of trees. The species whose history I published had constructed its cells on the top of a bee-hive that was covered with an old cloth and a pan; from these I bred both sexes of *Agenia punctum.*

Such is the habit of *Agenia*, a builder of mud cells, and we are led by Mr. Walsh to infer that such is the habit of the entire genus, his conclusions being, of course, drawn from the fact of the species being destitute of armature on the legs; such generalizations, however, will be found to have exceptional cases: I have observed one myself.

In the north of England, *Agenia variegata* is not an uncommon species; and in the summer of 1852 I observed several females burrowing in a bank of light earth: I also once took a pair running on a bank at Coomb Wood, in Surrey; and I am inclined to believe this to be the constant habit of that species.

I have noticed the fact that some species of sand-wasps have never been observed to burrow, but avail themselves of some ready-formed burrow or hole suitable to their requirements; as instances of this habit, I may refer to *Trypoxylon fugax*, a Brazilian species that was found to have used empty cells in a nest of a species of wasp (*Polistes*). *Trypoxylon* stores up spiders, as it had done in this instance, and afterwards had closed up the cells with clay.

Mr. Horne has noticed a similar habit in an Indian species of *Trypoxylon*, which took possession of clay cells constructed by a species of the genus *Pison*; this insect attaches its cells to twigs and stems of grass, and, as is the habit of *Trypoxylon*, stores up spiders. Here a question may arise as to whether in this instance the *Trypoxylon* appropriated the store as well as the cell of *Pison*; if such were the case, we should have the anomaly of an insect being at one time a provident creature and at another time a parasite: certainly until such a fact is clearly established, we cannot assume it to be the case; I know of no circumstance that would justify such a conclusion.

Mr. Walsh obtained five mud cells constructed by *Agenia bombycina*, an American species; they were "all alike, and all of them found in company under the bark of the same tree." From these five cells there hatched out, about the end of June 1864, four specimens of *Agenia* and a single male specimen of a species of *Ceropales*, a genus of Pompilidæ: on this evidence Mr. Walsh concludes the habit of parasitism to be proved; but to this I cannot assent.

I have just alluded to *Trypoxylon* being reared from the cells of *Pison*; in that instance the cells were not deserted ones, but fresh and stored with spiders. Now we know that *Trypoxylon* is not a parasite, and we are therefore justified in concluding that the insect found a cell built by *Pison*, in every way adapted to its purposes, and took possession of it. I may remark that the cells of *Pison* and those of *Trypoxylon* are precisely of the same form and mode of construction.

Mr. Horne also bred *Trypoxylon* from a series of cells constructed by a solitary wasp, a new species of the genus *Pterochilus*: these solitary wasps store their cells with caterpillars; therefore in this instance, as *Trypoxylon* stores up spiders, we are led at once to the conclusion that the latter insect took possession of the cells of the former. Such being the case, I cannot see any reason why *Ceropales* may not in the same way have taken possession of the cell of *Agenia* in the instance mentioned by Mr. Walsh.

I have remarked, in my observations on the genus *Ceropales*, in the 'Monograph of the Fossorial Hymenoptera:'—"These insects have been considered parasites on the genus *Pompilus*; their legs almost destitute of spines, and the absence of cilia on the tarsi, I am inclined to consider indicative of a peculiar economy." St. Fargeau considered them to be parasitic insects; and in the same class he placed all the Fossorial Hymenoptera whose legs are destitute of spines: this, however, was, in accordance with his theory, based entirely on structure. Subsequent observation has long ago proved his arrangement to be fallacious. Structure in some classes of animals may prove a pretty correct index to habit, but it fails to be so when applied to insects. There is no family among the whole of those which constitute the fossorial section more eminently fossorial in structure than the Scoliadæ; their legs bristle with spines: yet these insects have long ago been proved by Passerini to be parasites; and when we become acquainted with their habits, we see at once the use of such a structure even in parasitic insects. *Scolia flavifrons* has to burrow down to the cell of *Oryctes nasicornis*; and other species have been observed preying also upon the larva of species of *Oryctes*. Now it is quite obvious that any theory based upon structure would certainly prove fallacious in the case of *Scolia*; and it must be borne in mind that, even in the operations of such well-known burrowing species as *Sphex ichneumonia* and *Ammophila sabulosa*, half the work is really performed by the use of the mandibles; all the pebbles and harder parts of the ground excavated are removed by them, thrust backwards and kicked out of the burrow by the legs. The insects frequently issue while at work, carrying pebbles in their jaws, which they fly off with and drop at a short distance.

I have thought it desirable to pen the above observations for two reasons: in the first place, I claim to have first made known the habits of *Agenia*, in connexion with remarks upon the structural peculiarities of the insects; and, secondly, I have repeatedly published an opinion that none of the Pompilidæ are parasitic insects; and I must repeat my opinion that the evidence adduced by Mr. Walsh in favour of the parasitism of the genus *Ceropales* is by no means conclusive.

BIBLIOGRAPHICAL NOTICES.

Facts and Arguments for Darwin. By Fritz Müller. With Additions by the Author. Translated from the German by W. S. Dallas, F.L.S. 8vo. London: Murray, 1869.

Just four years ago we gave, from the 'Bibliothèque Universelle,' a general notice of the contents of Dr. Fritz Müller's little work 'Für Darwin,' in which that distinguished zoologist put forward certain observations and arguments derived from his study of the Crustacea, which he regards as almost conclusively in favour of the Darwinian hypothesis. Our former account of the contents of this remarkable book went so far into details as to render any further particulars unnecessary; and we need do little more than call our readers' attention to the recent appearance of a translation of the work by Mr. W. S. Dallas, with additions by the author. It is to be hoped that this translation will make the contents of this admirable little treatise more generally known among English naturalists; for it must be confessed that the original, although highly appreciated in Germany, has made but little progress in this country. And it must be remarked that Darwinian proclivities are by no means necessary to enable the reader to benefit by its perusal. A great part of the contents consists of the records of a long series of observations on the natural history and structure of the Crustacea, and especially on the developmental history of these animals. We know of no work from which so satisfactory a general view of the phenomena is to be obtained. Indeed this is no more than might have been expected, since Dr. Fritz Müller has been one of the foremost workers in this field of research; and not only have nearly all the facts here brought forward been observed by himself, but of several of the most curious and important of them he was actually the first discoverer.

The additions made by the author to the new edition do not appear to be numerous. The most important, as indicated by the translator, are:—a note on the metamorphoses and evolution of Insects (at p. 119), in which the author supports the opinion that, of all existing forms, the Orthoptera approach most closely to the primitive Insectean type, regarding the wingless Blattidæ as the most typical in their form; and a hypothetical description at the end of the book (pp. 135–140) of the mode by which we may suppose such forms as the Rhizocephala (*Sacculina, Peltogaster*, &c.) to have been evolved, on Darwinian principles, from some of the sessile Cirripedes.

A History of British Sessile-eyed Crustacea. By C. Spence Bate, F.R.S., F.L.S., and J. O. Westwood, M.A., F.L.S. 8vo. London: Van Voorst, 1861–1868.

We have already on several occasions called attention to the progress of this most valuable work during the long period over which its publication has extended, and it is with much pleasure that we have now to announce its completion. The work, as published, includes twenty-three parts, of which twenty-one are occupied by the sequential descriptions of the genera and species. In the last two parts the authors give us an Appendix containing descriptions of species which have been detected on our shores during the progress of their work through the press, a few supplementary notes on previously described species, and an introductory chapter containing a general analysis of the structural and other phenomena presented by the order.

We now possess a natural history of the British species of the great section of the Edriophthalmatous Crustacea, which, in completeness, in careful elaboration, and the beauty of its illustrations, leaves little or nothing to be desired; and it is to be hoped that the existence of such an admirable guide may lead to a little more attention being paid by our British naturalists to a department of zoology which has hitherto been somewhat neglected. It is true that in some respects these animals do not present such remarkable peculiarities as the members of the other great divisions of their class, the Podophthalmatous and Entomostracous forms, and especially the Cirripedia and Rhizocephala; nor are their characters so striking as those of the higher species of the former order; but many of them are sufficiently interesting in their habits and mode of life to repay the naturalist's study, whilst, from their typical position in the class Crustacea, their investigation must always be essential to the philosophical student of zoology.

MISCELLANEOUS.

Rediscovery of Trocheta subviridis.

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

Gentlemen,—As some difference of opinion has been expressed as to the rediscovery of this Annelide, the following extract from my notebook may be of value:—"Jan. 15 [1869]. The terrestrial leeches Pryor [Mr. M. R. Pryor, of Trinity College] brought me from the borders of Surrey (near Horsham, Sussex) were, according to Johnston, *Trocheta subviridis*." . . . . "Johnston has described (Cat. Brit. Mus. Non-Parasit. Worms, 1865) *Trocheta subviridis* from a specimen found in the Regent's Park, London (now in the British Museum). This specimen appears to have been the first taken in this country; at least so it was stated by Dr. Gray, who brought it before the Zoological Society in 1851 (Ann. & Mag. Nat. Hist. ser. 2. vii. 429)." This is followed by a note on the position of the generative organs; for in the specimen dissected I found the ovarian loop which passes below the ganglionic column occupying a position different from that represented by Moquin-Tandon (Hirudinées, t. iv. 1846).

I am, Gentlemen,

Your obedient Servant,

J. Gedge.

Anatomical Schools, Cambridge.

Lamarck's Collection of Shells.

The celebrated collections of the Baron B. Delessert passed at his death into the hands of his brother, the Baron F. Delessert; at his death the pictures were sold by auction; and he left his zoological collection, including Lamarck's collection of shells and his herbarium, to the Museum of Natural History of Geneva, this having been his native country. His books, forming the most extensive botanical library in France, were given to the library of the Institut Impérial de France in Paris.—J. E. Gray.

On the Zoological Discoveries recently made in Madagascar by M. Alfred Grandidier. By M. Milne-Edwards.

The existing mammalogical fauna of Madagascar is well known to be very different from that of any other part of the world: it is composed solely of types peculiar to that island; and we do not find in it any representative of the large herbivora which give their most striking characters to the zoological population of Africa and Asia. It might be thought that this was always the case; but the discoveries of M. Grandidier will change the opinion of naturalists on this point. It appears from his observations that, at the more or less distant period when Madagascar was inhabited by the gigantic bird which has been denominated *Æpyornis*, this island also possessed large Pachydermata very analogous to one of the most remarkable African species; in fact numerous remains of a peculiar species of the genus *Hippopotamus* have just been discovered there.

It was by digging in a marshy soil at Amboulitsate, on the western side of Madagascar, that M. Grandidier ascertained this important fact. He found the remains of about fifty *Hippopotami,* mixed with bones of *Æpyornis* and other animals of extinct species.

The subfossil *Hippopotamus* of Madagascar, which M. Grandidier has inscribed in our zoological catalogues under the name of *Hippopotamus Lemerlei,* is much smaller than *Hippopotamus amphibius*; and, both as regards its size and in several osteological peculiarities, it appears to me to approach closely to the Liberian *Chœropsis.* The following are the details which M. Grandidier has just sent me with regard to this curious pachyderm:—

"The little *Hippopotamus* of Madagascar is distinguished from its African congener (*H. amphibius*) by its much smaller size, and by the conformation of its orbits, which are less prominent laterally and rise but little above the forehead. The postorbital and jugal apophyses are short, and leave more than one-sixth of the orbital ring open; the jugal is more elongated and less prominent outwards than in the common Hippopotamus. The lacrymal bone is more developed in proportion, and less narrowed towards the orbital margin; the posterior surface of the cranium is concave, in consequence of the projection of the occipital crest, which is short and continuous with a tolerably thick and slightly concave sagittal suture; the angle of the arch which roofs the orbit is acute, and the median part of the cranium forms a pretty regular lozenge; the nasal bones are scarcely dilated at their extremity, and the palatines are very narrow; the vertebral aperture of the atlas is divided by an interior semicircular ring, concentric with the superior arch of this vertebra. The odontoid apophysis of the axis is pointed, and presents an articular facet beneath; the spinous apophysis of the same vertebra is tolerably prominent. The ulna is, as usual, soldered to the radius, from which it is distinguished by a furrow perforated at each end; the two bones are much depressed. The pelvis is but slightly developed"*.

* The following are the measurements given by M. Grandidier of the principal bones of this Hippopotamus:—

	metre.
Length of various heads, several of which belong to adult individuals	0·315–0·40
Length of the upper jaw to the level of the second molars	0·06–0·07
Distance of the postorbital processes of the frontal	0·21
Distance of the tuberosities from which the lower canines spring	0·22
Minimum length of the lower jaw	0·15
Length of a fragment of maxillaries of a very young individual (from the last molar to the canine, which is beginning to appear)	0·115
Total length of the femur	0·23

The remains of *Æpyornis,* which M. Grandidier found mixed with these bones of *Hippopotamus,* consist of a fragment of an egg, a tibia 64 centimetres in length*, several fragments of still greater dimensions, a femur, and several vertebræ. The femur is remarkably robust; its diameter, measured at the narrowest point of the diaphysis, is equal to more than one-fourth of the length of the bone†. It is very probable that a profound study of these specimens will throw much light upon the natural affinities of the gigantic bird from which they are derived—a subject for the investigation of which materials have hitherto been wanting.

The same deposit contained other bones of birds, as well as various parts of the skeleton of a land-tortoise, which M. Grandidier regards as constituting a new species, and which he designates under the name of *Testudo abrupta.* This traveller has also found remains of crocodiles; and he is led to believe that all these animals were contemporaneous with the Dodo of the island of Mauritius.

These discoveries, so interesting as regards both geographical zoology and palæontology, are not the only results obtained by M. Grandidier since his return to Madagascar. He has found three new species of Lemuridæ, to which he has given the names of *Chirogalus Samati, C. gliroïdes,* and *C. adipicaudatus,* and a new species of tortoise (*Testudo desertorum*). Lastly, he has discovered, in sandy beds at Etséré, a magnificent carapace of an *Emys* (*E. gigantea,* A. Grand.), measuring 132 centimetres in length and 139 centimetres in width, besides several parts of the same animal.—*Comptes Rendus,* December 14, 1868, tome lxvii. pp. 1165–1167.

On the Miocene Alcyonaria of Algeria. By A. Pomel.

The author states that the Miocene strata of Algeria contain the remains of examples of the three chief types of Gorgonidæ, *Corallium, Isis,* and *Gorgonia.* Of the former, many fragments occur which are undistinguishable from the *Corallium rubrum* of the neighbouring coast. Allied to this is a new generic type described as *Stolonia saheliensis.* It has a stony, creeping, stoloniform sclerobase; in other words, it is a *Cornularia* with the sclerobase of *Corallium.* The calyces, forming pits with a nearly smooth bottom near the ramifications of the stolons, have left traces of their eight gastric chambers as deep sinuses, separated by ridges indicating the origin of the

* M. Grandidier adds that the two condyles of the bone are not very prominent and are separated by a rather shallow groove, and that the crests of the antero-superior tuberosity are tolerably prominent. Length measured from the antero-superior tuberosity to the outer condyle 64 centimetres; minimum circumference 16 centimetres; length of the inferior extremity 13 centimetres.

† The upper extremity of this femur is partially broken; the air penetrates into it by an orifice situated above the condyles. Length from the head of the bone to the outer condyle 20 centimetres; minimum circumference 27½ centimetres; length of the inferior extremity 19 centimetres.

mesenterioid laminæ. The sclerobase is very delicate, and its surface is marked with striæ like those of red coral.

An Isidine coral is described under the name of *Melitæa oranensis.* The remains are rootlets and calcareous joints, of various form, but presenting the form and structure of those of *Melitæa.* The ramification was dichotomous.

A fragment of a sclerobasic axis of stony texture and formed of concentric layers is referred by the author to the genus *Gorgonella,* under the name of *G.? anomala.*

Of the Pennatulidæ the author notices the following forms :—*Virgularia saheliensis* had a long, cylindrical, straight, and smooth style, showing a radiated structure; *Graphularia barbara* had a style differing from the type of the genus in wanting the longitudinal furrow; *Cœlographula subcompressa* is the type of a new genus having a fistulous style. The style is elongated, straight, nearly smooth, slightly compressed, convex on one surface, a little depressed at the edges of the opposite side, the middle of which has an obsolete ridge.

These species, except the last, are found in the vicinity of Oran, in beds named Sahelian by the author and synchronous with the Tortonian beds of the Italian geologists. *Cœlographula subcompressa* occurs in the Cartennian of Milianah, immediately below the Helvetian with *Ostrea crassissima.*—*Comptes Rendus,* November 9, 1868, p. 963.

Are Unios sensitive to Light? By C. A. White.

Those who have studied the habits of Unios in their native element are of course well aware of their habit of burying themselves in the mud or sand, leaving only the posterior portion projecting, for the purpose of giving ingress and exit to the respiratory currents of water. The sensitiveness of the margins of the incurrent and excurrent orifices to the slightest touch is also well known; but during the past summer, while collecting mollusks in one of the rivers of Central Iowa, I became convinced that these, or adjacent parts, were also keenly sensitive to light.

Unios were found numerously occupying the position referred to, plying their currents industriously through their distended orifices; but whenever my shadow in the bright sunlight came suddenly upon them, they invariably closed their orifices quickly and completely. This was repeated a great many times, and upon the same individuals, to assure myself that it was not caused by any agitation of the water or movement of impurities in it that might produce irritation of the parts. It was evidently the interception of the sun's rays alone that caused them so suddenly to close their orifices; yet it is worthy of remark that they did not quickly close them if sunlight was suddenly admitted to them while respiring in the shade.

The question then arose in my mind as to the possibility that the parts were sensitive alone to the rays of heat from the sun and not to those of light. Above the Unios was from one to two feet in depth of clear running water, rendering everything upon the bottom distinctly visible.

Believing that the sun's radiation coming directly toward any object so far beneath the surface of the water would have its heat-rays mostly, if not entirely, separated from the light-rays, at or near the surface, through the absorption of these and their removal downwards by the current, while nearly all the rays of light would pass on to the object with only slight refraction, I sought a place where rays of heat from sunlight, striking the surface further up the stream, would not reach the Unio to be experimented upon. This was furnished by a dense growth of trees, shading the stream completely for a considerable distance. Then placing a Unio just at the lower margin of the shade, but quite within the bright sunlight, I awaited the opening of the orifices; then, on quickly intercepting the sun's rays that came freely to it, by passing a screen from above downward, and again from below upward; it responded by closing its orifices as quickly as its fellows had done when my shadow passed over them in the broad open space of sunlight.

Upon the supposition that the light- and heat-rays are divided at the surface of the water, as before suggested, the heat-rays must all, or very nearly all, have passed down below the Unio, by the action of the current, while the light-rays alone reached it, and their sudden interception caused it to close its orifices. Thus in this position the Unio was receiving direct rays of light from the sun, but the rays of heat that might have reached it more or less obliquely, by absorption and the action of the current, if in an open space of sunlight, were here cut off by the long shadow of the trees. Therefore no doubt is entertained that the posterior portion of these mollusks is keenly sensitive to light; but exactly what organs are thus sensitive has not been ascertained.—*Silliman's American Journal,* March 1869.

The Sea-Elephant (Morunga proboscidea) *at the Falkland Islands.*
By Dr. J. E. Gray, F.R.S. &c.

In the 'Annals & Mag. Nat. Hist.' for March 1868, p. 215, I stated that the sea-elephant had become extinct in the Falkland Islands. Mr. Sclater, in the 'Proceedings of the Zoological Society' for 1868, p. 189, says that this statement was a mistake; but in his account of the proceedings of Adolphe Alexandre Lecomte, who was sent by the Zoological Society to collect Sea-lions and Penguins for the Collection, he now confirms my first statement, and observes, "Elephant Island, so called from the former abundance of the sea-elephant (*Morunga proboscidea*), was found to be quite deserted by this animal, which is said to be now entirely extinct in the Falklands." (See Proc. Zool. Soc. 1868, p. 527.)

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L.—*Observations on the Amphipoda occurring on the Norwegian Coasts.* By Axel Boeck.

[Concluded from p. 340.]

Ampelisca, Kr.—The peduncle of the superior antennæ, as in the preceding genera, is generally short and thick, but becomes much elongated in those which Spence Bate has called *Tetrommatus* and A. Costa *Araneops*; this however, is also the case in the genus *Aceros*, which consequently forms a transition to this. Dana places this genus among the Pontoporeinæ; and Spence Bate makes it the type of a distinct subfamily, principally on account of the simple eyes, which it possesses in common with Lilljeborg's nearly allied genus *Haploops*. In reality these two form a closely united group, well distinguished from the preceding, and the species of which are very nearly related and difficult to distinguish. They nevertheless agree very closely with the preceding genera in the form of their ovigerous and respiratory lamellæ. A new species belonging to this genus is

A. spinipes, mihi.—This species, which is 30 millims. long, closely resembles *æquicornis*, Bruzelius, but differs from it in having the second joint of the superior antennæ longer in proportion; the fifth joint of the peduncle of the inferior antennæ is only a little shorter than the fourth, and the number of joints in the flagellum is greater. The second joint of the mandibular palpi is extraordinarily thick. The first two pairs of hands are more strongly armed with setæ than in *æquicornis*; the fifth and sixth pairs have the last two joints, which are very long, strongly armed with spines; the second joint of the seventh pair of legs is very long, and the fifth is nearly as long as the preceding three together. The nails are elongate-lanceolate. The two posterior segments of the thorax and the whole of those of the abdomen are keeled. It is not uncommon on our coasts, where it was found by me at Farsund, and by Sars at Bergen.

Leucothoë, Leach.—This genus requires to have its boundaries enlarged for two species added by Kröyer. Lilljeborg pointed out that Kröyer's species, together with one discovered by himself, ought to form a new genus, but did not establish it. Bruzelius followed him in this opinion, but still referred these three species to the above genus. As many species of different forms have now been found, it will be advisable to separate them. I have found a species belonging to the original genus at Farsund, in the branchial cavity of *Ascidia*; it has also been found under the same circumstances at Manger, by Sars. This species differs in many respects from that described by Lilljeborg, which he believes to be Montagu's *Gammarus articulosus*; but I believe that the species found by me must rather be regarded as the latter, as it is both larger and of more frequent occurrence than Lilljeborg's species, for which I will propose the specific name *Lilljeborgii*, after its discoverer.

L. articulosa, Mont., is about 14 millims. in length, and differs from *Lilljeborgii*, which in other respects it closely resembles, in the following particulars:—The process of the fourth joint in the first pair of legs is not toothed at the margins; the fourth epimera are not armed with any tooth; the inferior hinder angle of the third abdominal segment is straight and forms no tooth; the branches of the fifth pair of abdominal legs are of unequal length, the inner one longer than the outer. The telson is very long, narrow, and lanceolate, pointed at the apex, and not rounded off. This species is evidently the same that Abildgaard described in the 'Zoologia Danica' and figured on pl. cxix. under the name of *Gammarus spinicarpus*.

The genus *Leucothoë* is the type of Dana's subfamily Leucothoinæ, in which he indicates especially the elongated palpi of the maxillipedes with the short masticatory plates, and the absence of masticatory tubercles on the mandibles; but the first character occurs, although not in the same degree, also in species of Bruzelius's genus *Paramphitoë*, such as *P. panopla* and *P. pulchella*, Kr., whilst masticatory tubercles occur in many forms which show a near generic relationship to *Leucothoë*. In all the forms belonging to the Leucothoinæ the legs are certainly long and slender, and the first two pairs of hands of a peculiar form; but nevertheless that subfamily cannot be sharply defined.

Stenothoë, Dana.—Costa's genus *Probolium* may certainly merge in Dana's *Stenothoë*; and it now contains, besides the typical species, *S. validus* and *S. polyprion*, Costa, a new Norwegian species which I have called

S. Danai, mihi.—I found a female of this species at Farsund, at a depth of 15 fathoms. It is not quite 5 millims. in length, and differs from the two other species in the form of the first two pairs of hands, of the fourth epimera, and of the abdomen. The third joint of the first pair of legs has its inferior posterior angle much elongated into a thick process, which is as long as the following joint. The hands are shorter than the preceding joint; the fifth joint or hand of the second pair of feet is extremely large and oval, and its posterior margin furnished with many blunt teeth and with two long spines, which reach the apex of the finger. The fourth epimera are much longer than broad, and become narrower behind, but not emarginate for the fifth, as in *S. validus*. The outer branch of the fifth pair of abdominal legs is much shorter than the inner one, and the peduncle of the last pair of abdominal feet is much longer than in *S. validus*.

Eusirus, Kr.—Dana thought that this genus of Kröyer's differed so little from *Gammarus*, that it must be merged in it. Bruzelius certainly accepted it as a genus, but thought that it stood very near to *Gammarus*. I think, however, that these genera have few characters in common, except the secondary flagellum, and this is very small. At the first glance there appears to be a great agreement between this genus and *Leucothoë*. In both the third joint of the peduncle of the superior antennæ is small, and the first two pairs of hands are nearly of the same form. Both have the following pair of legs long, slender, and feeble, whilst in *Gammarus* they are strong; and, finally, the very long abdominal feet and telson, as also the large first epimera, are very characteristic external peculiarities of the two genera. Similar agreements occur in the more concealed parts. The mandibles certainly differ, inasmuch as in *Eusirus* they possess a masticatory tubercle; but the first pair of maxillary palpi have the same form in both, and are divided into two nearly equal large joints. The inner lamella is furnished only with a single hair, contrary to what occurs in *Gammarus*. The masticatory lamellæ of the maxillipedes are small, and the palpi much elongated, but rather strong. To this genus a new species may be added, belonging to our fauna:—

E. longipes, mihi.—The third joint of the superior antennæ is longer than in *E. cuspidatus*; and the flagellum consists in the males of fifty-four joints furnished with sucking-disks, and in the females of forty-two. The fifth joint of the inferior antennæ is shorter than the fourth; in the females it is furnished on the upper surface with about twenty erect setigerous tubercles. The flagellum consists of from thirty-four (females) to forty-two (males) joints. The second joint of the palpi of the maxillipedes is shorter than in *E. cuspidatus*, and wants the teeth which characterize the latter. The hands of the first pair of legs are of the same form as in *E. cuspidatus*, but rather rounder, and not so oval; the three posterior pairs of thoracic legs are very long; the fifth joint is nearly as long as the preceding two together, whilst it is considerably shorter in *cuspidatus*. The outer branch of the fifth pair of abdominal feet is only a little more than half as long as the inner one, and the telson is less cleft than in *cuspidatus*.

Iduna, mihi.—Bruzelius described a *Gammarus brevicornis* from the Norwegian coast in general and from Bohuslehn; and Prof. Sars found a species in Finmark, which he named *Gammarus fissicornis*. Both species must be separated from the genus *Gammarus*, and placed under a new genus nearly allied to *Eusirus*. The secondary flagellum, which in the latter is very short, becomes extremely long in the two species above mentioned, whilst the flagellum itself is short. The inferior antennæ are short and nearly subpediform. The masticatory tubercles of the mandibles are small; and the inner lamella of the first pair of maxillæ, as in *Eusirus*, is oval, and furnished with isolated ciliated setæ. The masticatory lamellæ of the maxillipedes are small, and their palpi are much elongated. The first two pairs of legs are furnished with strong prehensile hands; their fourth joint emits from its inferior posterior angle a strong process, as in *Leucothoë*; the following pair of legs are very thin and long; the last pair of legs are very long; the abdominal feet are long, and the telson deeply cleft. The first epimera are strong, larger than the following ones; they consequently show much agreement with *Eusirus*, and differ greatly from the typical species of *Gammarus*. The two species may be easily distinguished from one another by their different size, and also because the second and third segments in *Iduna fissicornis* are produced behind into a spine, whilst in the other they are smooth.

The ovigerous lamellæ are of somewhat different size in this group. In *Leucothoë* and *Iduna* they are small, and the respiratory lamellæ long and broad; in *Eusirus* the ovigerous lamellæ are broader than in the preceding; and this is still more the case in *Stenothoë*. In *Leucothoë* and *Stenothoë* there is no secondary flagellum on the superior antennæ; in *Eusirus* it is small, and in *Iduna* long. The mandibles are destitute of palpi and masticatory tubercles in *Stenothoë*; in *Leucothoë* they have palpi, but no masticatory tubercles, which are small in *Iduna* and large in *Eusirus*. In *Leucothoë* and *Stenothoë* the two joints of the first pair of maxillary palpi are of equal length; in *Eusirus* this is nearly the case; in *Iduna* the first joint is short. The inner lamella is larger than the other in *Eusirus* and *Iduna*, but in all only furnished with one bristle; in all, the first two pairs of legs are of a peculiar form, in which they resemble *Œdicerus*, but differ among themselves somewhat in form. The remaining legs are long and slender in all. The telson, which is entire in *Stenothoë* and *Leucothoë*, is cleft in *Eusirus* and divided in *Iduna*.

Dexamine, Leach.—This genus agrees in some respects with the preceding. As in it, the palpi of the maxillipedes are very thin, but the fourth joint, which in *Iduna* was long, and even divided into two joints, appears here to be wanting; the masticatory tubercles are very strongly developed; the inner lamella in the first pair of maxillæ has only a single bristle, but the palpus is of one joint; the form of the ovigerous and respiratory lamellæ is as in the preceding; as in this, the third joint of the peduncle of the superior antennæ is short; in the structure of the legs it approaches *Gammarus*. Besides the species *D. tenuicornis*, H. R., I have found a new species:—

D. thea.—The superior antennæ reach to the second segment of the abdomen. The first joint of the peduncle is not produced downwards into a process; the flagellum consists of eighteen very long and slender joints; the inferior antennæ are shorter than the superior; their peduncle is very thin, and its fifth joint is somewhat longer than the fourth; the flagellum is formed by from twelve to fourteen long joints; the eyes are not very large, but oval; the parts of the mouth are rather longer and slenderer than in *D. tenuicornis*; the first joint of the seventh pair of legs is very slender, not dilated as usual, and not broader than the following joint; the last thoracic segment and the first four abdominal segments are produced into a strong spine; the fifth pair of abdominal feet are much shorter than in the other species, and do not extend further back than to the branch of the last pair of abdominal feet.

In the following genera the inner lamella of the first pair of maxillæ is furnished with many ciliated hairs, and the ovigerous lamellæ are very broad.

Epidesura, mihi.—The type of this new genus is Lilljeborg's *Amphithoë compressa*, which, in the breaking up of the genus *Amphithoë*, must stand by itself; it approaches the preceding genus in several characters. The form of the antennæ is as in the preceding; the mandibles, which in *Dexamine* are destitute of palpi, have them here very thin, weak, and three-jointed; the palpi of the first pair of maxillæ are two-jointed, and the inner lamellæ are furnished with six ciliated hairs; the masticatory lamellæ of the maxillipedes are large; the palpi are small and thin, and their fourth joint is a small claw. The ovigerous lamellæ are extremely large, furnished at the edges with approximated long hairs; the respiratory lamellæ of the last thoracic legs are of the same peculiar form that occurs in *Ichnopus*; the last two segments of the abdomen are coalesced, and the telson is cleft; the body is strongly compressed.

Gammarus, Fab.—This genus, which, from including all the Amphipoda, has gradually become reduced until it only comprises those which have a compressed body with large epimera, and long and slender antennæ with a secondary flagellum, has been very justly divided by Lilljeborg into two genera,—1, *Gammarus*, in which the last abdominal foot is furnished with lamellar branches, and, 2, *Gammaropsis*, in which these are conical. The latter also differ from the former in their smaller epimera and thick telson, and in having the inner lamella of the first pair of maxillæ small and furnished with a single bristle, whilst in the others it is large and furnished with numerous setæ. We must also agree with Bruzelius when he transfers these latter to the family Corophiidæ. The genus *Gammarus* thus formed includes three groups of Scandinavian species. The first of these has the thorax furnished with a keel, and the telson entire: this is H. Rathke's genus *Amathia*, and includes the species *Sabini*, Leach, and *angulosus*, H. R. The second group has the telson divided; the branches of the last pair of feet are furnished with spines and ciliated hairs; the hands are small: this includes the typical species *locusta*, Linn., *pulex*, De Geer, and *pœcilurus*, H. R. The last group has the telson divided, the last pair of abdominal feet very long, the inner lamellæ of the first pair of maxillæ smaller than in the preceding and furnished with fewer ciliated hairs, and the second pair of hands generally very large. This group includes the remaining known Scandinavian species.

Closely agreeing with the genus *Gammarus* is a species which I found in the Christiania Fjord, which, however, differs therefrom in wanting the secondary flagellum on the superior antennæ; but as there is a small tubercle in the place usually occupied by the secondary flagellum, and the species otherwise agrees essentially with the typical species, *Gammarus locusta*, I do not think that it ought to be separated from the genus *Gammarus*.

G. Batei, mihi.—Of this species only one specimen, a male, was found, at a little depth in the neighbourhood of Christiania. The eyes are nearly round; the superior antennæ are longer than the inferior; the peduncle short, with its first joint the longest; the flagellum consists of twenty-three joints; the first joint of the inferior antennæ is extremely large, standing out nearly in a spherical form; the second joint is very short and united with the preceding one; the fourth and fifth are of nearly equal length; the flagellum consists of twelve joints; the fifth joint or hand of the first pair of legs is oval, that of the second pair much elongated and narrower; the last three segments of the abdomen are furnished with small spines. The first segment has two small spines upon each side of the median line; the next has a strong spine in the median line, and a longer and thinner one on each side; the last segment has a small spine on each side. The branches of the telson are furnished with three spines at the apex.

Amphithopsis, mihi.—Milne-Edwards placed in the genus *Amphithoë* those species which had the appearance of the genus *Gammarus*, but wanted the secondary flagellum on the superior antennæ. Dana correctly separated the true species of *Amphithoë* from the rest, which he placed under the name of *Iphimedia*, H. R.; but this selection of a name was less fortunate, as *I. obesa* is a form differing from them. Spence Bate referred the genus *Amphithoë* to its right place in the family Corophiidæ, which opinion has also been adopted by Bruzelius. To the Scandinavian species which ought to come under Dana's genus *Iphimedia* Bruzelius has given the generic name of *Paramphithoë*; and in this genus he places all the species which have the body more or less compressed and furnished with large or middle-sized epimera—in which the superior antennæ are small, destitute of secondary flagellum, and have the third joint of the peduncle smaller than the flagellum—in which the eyes are compound, the mandibular palpi three-jointed, and those of the maxillipedes four-jointed—in which the fifth joint of the first two pairs of legs is converted into a prehensile hand—in which the seventh pair of feet are not twice as long as the preceding—and in which the last pair of abdominal legs are two-branched,—that is to say, all the species of the family Gammaridæ which do not belong to the genera *Ampelisca*, *Leucothoë*, *Dexamine*, *Acanthonotus*, *Œdicerus*, &c. It consequently includes a very large number of species. But if these be more closely examined, we shall easily find that they differ very much among themselves in form, and consequently cannot belong to the same genus. Some of them are stout, keeled, angled, and have the body often armed with spines and furnished with a large pointed rostrum. The inner lamellæ of the maxillipedes are small, and their palpi extremely long; the inner lamella of the first pair of maxillæ is small, and furnished with one bristle. Here belong the species *panopla* and *pulchella*, which may be raised into a distinct genus, and this may retain Bruzelius's generic name *Paramphithoë*. Others have an elongated compressed body with moderate epimera and long antennæ; the inner lamella of the first pair of maxillæ is furnished with from four to five long, thick, ciliated bristles; the inner lamella of the second pair of maxillæ has at the apex many simple bristles, but on the inside there are several very strong and ciliated ones; the maxillipedes are large, and their palpi of moderate length; the hands of the first two pairs of legs are nearly of the same size, but small; the fifth joint in the third and fourth pairs of legs is very long, longer than the third joint; the telson is single; the branches of the last pair of abdominal feet long, often unequal; the ovigerous lamellæ are much larger than the respiratory plates, and have their edges closely beset with hairs. Here belong the species *bicuspis*, *elegans*, *læviuscula*, and *tridentata*, besides two new ones; I have placed all these in the genus *Amphithopsis*. The new species are:—

A. glaber, mihi.—The eyes are oval; the peduncle of the superior antennæ much thicker than the flagellum, which consists of twenty-two joints; the peduncle of the inferior antennæ is short, and the fourth joint only a little longer than the third; the first two pairs of legs are of the same size and form; the fifth joint or hand is longer than the fourth, and its inferior edge is obliquely truncated and furnished with a strong spine at the place where the point of the finger meets it; the two following pairs of legs have the fifth joint very long, nearly as long as the preceding two together; the telson is oval; the thorax smooth and without spines.

A. longicaudata, mihi.—In this the maxillary palpi are very long, their third joint very broad at the end, and transversely truncated; the second pair of hands is longer than the first; the fifth joint very long, slender, and nearly of the same length as the preceding; its inferior side is straightly truncated, and the finger very small; the telson is small and oval; the posterior three pairs of abdominal feet are extremely long, their outer branch shorter than the inner, especially in the sixth pair of legs, in which the outer branch is not of half the length or thickness of the inner one; the inferior posterior angle of the third abdominal segment is nearly straight. Of both these species single specimens were found at Farsund. As they were partially injured, the descriptions are somewhat imperfect.

Acanthonotus, Owen.—Owen established this genus for the species *cristata* from Nordiishaven; and it was retained by Milne-Edwards, who distinguished it from the genus *Amphithoë* on the ground that the first two pairs of legs are not furnished with prehensile hands. The body in this genus is stout, elevated, keeled, and spiny, furnished with large high epimera and hemispherically prominent eyes; the head is short, and runs out into a very long, laterally compressed, high rostrum. This separates from each other the superior antennæ, which are elongated and destitute of a secondary flagellum. The first pair of legs is not provided with a prehensile hand; the second has only a weak one. The parts of the mouth are especially peculiar, and differ much from the form which they have in the preceding genera; the mandibles are very long, and bipartite at the apex, but with the inner branch very small; the masticatory tubercles are wanting, and the palpi are three-jointed; the labium is elongated; the first pair of maxillæ are strong; their outer lamella is nearly triangular and oval at the apex, furnished on the inner side with strong serrated spines and hairs; the palpi are very short and weak, shorter than the outer lamella, two-jointed, with the joints of equal length. The inner lamella is large and triangular, but shorter than the outer; its inner side is furnished with a great number (twenty-four) of strong, ciliated hairs. The maxillipedes are short, broad, and strong, their inner lamella very long; the third joint of the palpi and the lower inner angle are produced into a process; the fourth joint is extremely short, almost rudimentary. Two species occur with us:—

1. *A. serra*, Kr., and

2. *A. cristata*, Owen.—The latter has been found by Sars in Finmark; and to his description I will add something upon the form of the buccal organs, which he has not treated of. The inner branch of the apex of the mandible is large and slightly triangular; it occurs also in *serra*, but is very small, and was therefore not detected by Kröyer and Bruzelius. The maxillipedes are much shorter and broader than in *serra*; the fourth joint or claw of their palpi consists here only of a small blunt tubercle. The telson is less stout in proportion than in the other species, and is triangularly emarginate at the apex.

Iphimedia, H. Rathke.—This genus, which Kröyer has named *Microcheles*, shows much agreement with the preceding in its external characters, but differs in certain parts. It has a stout elevated body, furnished with keel and spines, and oval rigid epimera. The rostrum, like that of the preceding genus, separates the superior antennæ; but the buccal organs here acquire a different form, which justifies the separation of this as a distinct genus from the foregoing. The parts of the mouth are on the whole not so strongly elongated as in the preceding. The mandibles are likewise toothed and bipartite at the apex; but here there is a small trace of a masticatory tubercle, which is deficient in the preceding genus, but becomes strongly developed in the following genera. The third joint of the palpi is much abbreviated; the outer lamella of the first pair of maxillæ is of the same form, but shorter and broader than in *Acanthonotus*; the inner lamella is considerably smaller, and furnished with a far smaller number (eight to ten) of hairs, in this resembling that of the next genus. The palpi, which in *Acanthonotus* were thin, shorter than the outer lamella, and had their joints of nearly equal length, become in this and the following genera broader and longer, with the first joint very short; the maxillipedes in *Iphimedia* resemble in form those of *Acanthonotus*, but the fourth joint of the palpi is much more strongly developed; the first pair of feet are much elongated, which is especially due to the length of the second joint; the fifth joint, which is slender, has the inferior hinder angle produced into a process which meets the claw, and thereby forms a small two-fingered hand; the second pair of legs, which in *Acanthonotus* were strong and short, become in this genus much elongated and of the same form as in the genus *Anonyx*; in the next genus both hands become converted into distinct prehensile organs.

Acanthosoma, Owen.—The characters upon which Owen established this genus were so unsatisfactory that Kröyer combined it with the genus *Amphithoë*; and this view has since been always followed. But I think that there are reasons for reviving it. A. Costa's *Epimeria*, of which one species occurs on our coast, may be combined with it. I have already, whilst describing the preceding genus, cited the peculiarities in the structure of this which have led me to adopt it; and the two species *hystrix*, Owen, which is found on the coast of Finmark, and *parasitica*, Sars, from the coast of Bergen and Farsund, which will probably coincide with *A.* (*Epimeria*) *tricristata*, Costa, may be placed under it, although in some particulars they differ from each other.

Family 3. **Corophiidæ**, Dana.—I have already treated of the characters of this family under the Gammaridæ. It includes a great number of forms, which, however, differ comparatively little from each other, and some of which show great agreement with the Gammaridæ, whilst others approach the Caprellidæ.

Podoceropsis, mihi.—In this genus the body is somewhat depressed, the epimera small, the antennæ long and slender, the superior inserted far in front of the inferior, at the apex of the projecting head. Their peduncle is very long, longer than the flagellum, and without a secondary flagellum. The mandibles are large, divided and toothed at the apex, and with long three-jointed palpi. The palpi of the first pair of maxillæ are two-jointed; the inner lamella is small and thick. The maxillipedes are long and slender; the fourth joint of their palpi is divided into two joints, the last of which forms a pointed claw. The fifth joint of the last two pairs of feet forms a prehensile hand, which in the second pair is much larger than in the first, and of unequal size in the two sexes. The three posterior abdominal feet are biramose, their branches conical and without spines. Telson small and thin. Here belongs the single species

P. sophia, mihi.—The thorax is smooth, without keels or points. The head projects in a small pointed horn between the superior antennæ. The eyes are large, nearly oval, with very large facets. The superior antennæ are as long as the head and thorax; their peduncles are much longer than the flagella, which consist of twelve long but thin joints. The second joint of the peduncle is the longest, the third longer than the first. The inferior antennæ are shorter than the superior, but their peduncle reaches as far as that of the latter; the first joint has a large olfactory spine; the fifth joint is longer than the fourth. The fourth joint of the first pair of legs is longer than the hand, which is oval, and the posterior surface of the finger is serrated. The second pair of hands are much larger than the first; the second, third, and fourth joints are short, the last is produced behind and downwards into a short process. The hands in the males are exceedingly large, as long as the first joint, and oval; their posterior edge is furnished with two large blunt teeth. The claws are curved and serrated at the apex. In the females the hands are much smaller and nearly triangular. The first joint of the hindmost three pairs of thoracic legs is elongated, nearly quadrangular, the lower posterior angle projecting. The three hindmost abdominal legs extend to nearly an equal distance backward, and their branches are of equal length. The length was about 5 millims. It was found at Farsund, at a depth of 15 fathoms.

Leptocheirus, Zaddach.—Zaddach established this genus in the year 1844, for the species *L. pilosus*. Species which I think ought to be referred to this genus have since been described under various names: A. Costa's *Microdeutopus gryllotalpa*, Spence Bate's *Lonchomeres gracilis*, and Bruzelius's species of *Autonoë* certainly belong to it. Lilljeborg separated a number of species from the genus *Gammarus* under the name of *Gammaropsis*, of which those which have the hands of the first pair larger than those of the second must belong to the above-named genus; but I think there is no reason for referring them all here, as Bruzelius has done, and I will retain the others under Lilljeborg's generic name. Bruzelius's species *A. punctata* certainly coincides with Spence Bate's *Lonchomeres gracilis*, which I have found at Farsund. The species *grandimana*, established by Bruzelius, which was found by Lilljeborg off the Swedish coast, I have also met with at Farsund.

Amphithoë, Leach.—To this genus, from which all the species have been removed which differ generically from the typical species, *rubricata*, Mont., I can add a new Norwegian species:—

A. grandimana, mihi.—The body is somewhat compressed, the epimera strongly ciliated on the lower margin; the fifth is the largest, oval, with a small emargination for the fifth pair of legs in the upper posterior angle. The eyes are round and black; the superior antennæ are longer than the inferior, with about thirty joints in the flagellum. The palpi of the first pair of maxillæ are extremely long and slender, much longer than the outer lamella. The first pair of feet are of moderate size; the fifth joint or hand is longer than the preceding joint; the claws are strong. The second pair of hands in the females are of about the same size and form as the first pair—in the males, on the contrary, extremely large, longer than the preceding joints together, and oval. The finger is very large, curved, and strong. The first joint in the third and fourth pairs of legs is very strongly dilated, that of the following pair is longer than broad. The animal, which was found at a depth of a few fathoms at Farsund, was 6 millims. in length.

Hela, mihi.—This remarkable new genus is characterized by its long, slender, depressed body, small, nearly rudimentary epimera, and very long legs, of which the first two pairs are furnished with strong prehensile hands, the first larger than the second; the last three pairs always have the first joint not dilated, but narrow and cylindrical like the following joints, and the claws are long and conical. The abdomen is of the usual structure, and none of its segments are amalgamated. The first three pairs of abdominal feet are exceedingly long and thin, the two following pairs biramose, and the last pair extremely thin, branched, with the branches longer than the peduncle. The mandibles have a divided toothed apex, a prominent masticatory tubercle, and a thin three-jointed palpus. The palpi of the first pair of maxillæ are long, thin, and two-jointed; the inner lamella is small, furnished with a few setæ. The maxillipedes are very strong, and their palpi four-jointed. Respiratory sacs occur at the base of the second to the sixth pair of legs. The greater part of the antennæ was wanting in the described specimen.

Hela monstrosa, mihi.—Head broader than long, elongated in front into a small rostrum. On each side of the base of the inferior antennæ there is a spine. The first joint of the inferior antennæ is large and spherical, and emits a strong olfactory spine from its lower surface. The third joint extends as far out as the first joint of the superior antennæ. The fifth joint or hand of the first pair of legs is shorter than the preceding, and triangular, its posterior inferior side furnished with three strong teeth. Finger long, curved, and ciliated on the convex side. The hands of the second pair are smaller than those of the first pair, and without teeth. The third joint in the two following pairs is as long as the first; the fourth and fifth are equal in length. In the following pair the fourth joint is shorter than the fifth, which in the two succeeding pairs increases still more in proportion to the fourth. The animal is more than 30 millims. in length, and was found at a depth of 30 fathoms off Holmestrand.

Tribe IV. CAPRELLIDEA. — Kröyer has made Milne-Edwards's Læmodipoda into a family under the Amphipoda; and later systematists have followed him in this view. Spence Bate thinks that this section does not stand so near the other two as they do to each other; but this is certainly not the case. Kröyer saw perfectly that most of the characters upon which they have been separated from the Gammarinæ cannot be accepted as of that importance; and only the rudimentary abdomen and the want of epimera separate them from that group. But in a new species of the genus *Ægina* the origin of the feet and the respiratory vesicles are covered by some very large, strong, and spinous processes, which greatly resemble small adnate epimera. In the structure of the buccal organs, this tribe agrees much more with the Gammaridea than these with the Hyperidea. Particular species of the families Corophiidæ and Dulichiidæ furnish, in the form of their body, transitions to the tribe Caprellidea.

Proto, Leach.—*Proto pedata* occurs along the whole of our coast, but is not abundant anywhere.

Protella, Dana.—To this genus belongs Kröyer's species *P.* (*Ægina*) *longispina*, taken by Œrsted at Dröbak and by Sars at Manger, sitting upon *Plumularia pinnata*, at a depth of 30 fathoms. Spence Bate cites it also from the English coast.

Ægina, Kröyer.—Kröyer characterizes this genus by the three-jointed palpi of the mandibles, the two-jointed abdomen with two pairs of appendages, of which the first pair are two-jointed, the second one-jointed. Dana refers to the genus some species which differ from the typical *longicornis* in the formation of the abdomen, and he thinks that this is of little systematic importance. But as I have found two new species which agree perfectly with Kröyer's characters of *Ægina*, and also a species which resembles these in having palpi on the mandibles, but in which the abdomen is constructed as in the genus *Caprella*, I think that Dana's species must be transferred from *Ægina* to a new genus, of which this species of mine is the type. To this genus I have given the name of *Æginella*. The new species of the genus *Ægina*, Kr., are:—

Æ. (*Caprella*) *echinata*, Esmark.—This species, which was found by Professors Rasch and Boeck at Beian and Söndmör, is distinguished by its large size and spinose body. The superior antennæ are very long, and reach to the beginning of the sixth segment. The first joint of the peduncle is of about the length of the second thoracic segment, the second joint is about as long as the first, and the third is shorter than this, but longer than the first; all these joints are closely beset with larger and smaller tubercles. The flagellum is somewhat longer than the second joint of the peduncle, and consists of eighteen joints, which gradually become longer and thinner. The inferior antennæ do not reach to the end of the second joint of the peduncle of the superior. In these (as in the other Caprellidea) the first two joints of the peduncle of the inferior antennæ are so closely united that they look like one joint, which I have called the first. The third joint is shorter but thicker than the fourth. The flagellum is two-jointed. On these joints there are some small tubercles; and beneath they are furnished with short and close hairs. The mandibular palpi are rather shorter than in *Æ. longicornis*, Kr. The first pair of maxillæ are strong. I have not found the inner lamella in this any more than in any other species of this subtribe; and as Kröyer neither mentions nor figures any such organ, I cannot but think that it is constantly deficient. The fourth joint or claw in the palpi of the maxillipedes is much longer and stronger than in *Æ. longicornis*. The first pair of legs are small; the fourth joint is produced downwards behind into an obtuse hairy process; and the fifth joint or hand is elongate-ovate, with its hinder margin furnished with small spines, which also occur on all the other joints. The second pair of legs are much larger. The first joint has a groove beset at its margins with tubercles along the anterior side, within which the anterior margin of the hand can lay itself. This is large, oval, longer than the first joint, and beset with tubercles all over; on the hinder margin there are three strong teeth—one that meets the apex of the claw, and two others nearer its point of attachment. The claws are long and beset with tubercles. The three posterior legs, which gradually increase somewhat in length, are elongated, and of the same form as in *Æ. longicornis*, Kr. All the segments of the body are strongly beset with tubercles, among which the following are especially distinguishable:—two directed forward on the upper surface of the head; a pair upon the anterior end of the first segment; two upon the anterior end of the second segment, and a very large one, cleft in the middle, and a double spine at the hinder end of the segment: besides these there is a long strong spine, directed forwards, which covers the origin of the feet of the first pair, and which appears to represent a rudiment of the deficient epimeron. In the following segment likewise similar tubercles cover the origin of the respiratory vesicles and the remaining space. On the following segments tubercles stand in irregular transverse rows, without any distinguishing themselves from the rest, except the lateral tubercles above the origin of the respiratory vesicles and legs. The form of the respiratory vesicles and abdomen is in all respects as in *Æ. longicornis*. The animal is from 35–40 millims. in length.

Æ. lævis, mihi.—The body in this species is smooth and even all over, without tubercles or spines, and resembles in appearance *Æ. longicornis*; it nevertheless differs much from that species. The superior antennæ reach to the sixth thoracic segment; the peduncle is longer than the flagellum, of which the second joint is the longest and the first the shortest. The flagellum consists of eighteen joints. The inferior antennæ reach to the end of the peduncle of the superior antennæ. The buccal organs as in the preceding species. The first pair of legs are short. The first joint and the hand are of equal length; the fourth joint is produced downwards behind into a process clothed with hairs; and the hand is oval, with its posterior margin furnished with many small teeth. The second pair of legs are very long, about as long as the first three segments of the body together. The first joint is long, and furnished on its anterior margin with a longitudinal depression, in which the anterior margin of the hand can lay itself. The hand is about as long as the first joint, elongate oval; its posterior margin is furnished with three teeth, one of which, situated where the finger meets the hand, is very strong, the second smaller, directed somewhat downwards, and the third broad, but less considerable, nearer the end of the joint. The segments of the body are much shorter, and the posterior legs of the same form, but longer, than in *Æ. longicornis*. The abdomen and respiratory vesicles are of the same form as in the latter.

Æginella, mihi.—This genus, which forms a transition between the preceding and following genera, I have already characterized by its want of palpi on the mandibles, and by the abdomen being, as in the genus *Caprella*, formed of two segments, with unjointed appendages. My typical species of this genus, to which Dana's species of *Ægina* likewise certainly belong, is

Æ. spinosa, mihi.—Head small; forehead projecting in a pointed spine. The superior antennæ reach to the fourth segment of the thorax. The first and fourth joints of the peduncle are nearly of equal length; but the second is much longer than these. The flagellum is longer than the peduncle, and consists of twenty joints. The inferior antennæ are about as long as the peduncle of the superior antennæ. The first joint is furnished with a long, thin, olfactory spine. The first segment of the thorax is furnished at its anterior extremity with a long strong spine, directed forwards and somewhat curved; the second segment has two similar spines on its anterior third, standing side by side, and a single one at its posterior extremity. In addition there are two large tubercles at the sides, above the origin of the second pair of legs. The third segment is longer than the second, and equal in length to the fourth. Both these are furnished at their anterior extremity with two geminate tubercles, two similar ones in the middle over the origin of the respiratory vesicles, and a single one at the posterior extremity. The sides are bounded towards the belly by a sharp line, which is furnished with strong spines at the anterior extremity of the segment, then a little further back, and finally just above the respiratory vesicles. The fifth segment is somewhat longer than the fourth, and has a similar armature of tubercles. The last two segments are very short, and furnished with strong tubercles in the middle and over the origin of the legs. The parts of the mouth are long. The first pair of feet are small, and the second pair not very large, but strong and thick. Abdomen as in *Caprella*.

Caprella, Lam.—To this genus I can add three new species, of which the first two belong to the group of species in which the males and females are of very dissimilar form.

C. Esmarkii, mihi.—This species, which is 12 millims. in length, was found at Beian by Rasch and Boeck. The head is small, and the forehead terminates in front in a tubercle. In the males the superior antennæ reach to the third segment of the thorax; the second joint of the peduncle is twice as long as the first, and the third somewhat shorter than this. The flagellum, which consists of twelve joints somewhat thickened outwards, is not so long as the third joint of the peduncle. The inferior antennæ do not reach to the end of the second joint of the superior antennæ. The first joint of their peduncle is short, the second somewhat longer, the third twice as long as this, and the fourth of the same length as the third, but thinner. The flagellum is as long as the last joint of the peduncle. The antennæ are furnished with long hairs along the whole of the lower surface. In the females the superior antennæ are much shorter than in the males, so that the inferior antennæ are longer than their peduncle. The first joint of the peduncle is very short, only half as long as in the male; the second is somewhat longer than the third. The flagellum is much longer than the third joint. In the males the first two segments of the thorax are excessively long, and both of the same length. The second pair of hands, when extended, do not reach to the beginning of the head. In the females, on the contrary, the segments of the thorax are short, the first segment shorter than the second, and the hands extend in front of the head. The first joint in the second pair of feet is exceedingly short, only a little more than one-third the length of the hand, which is oval, and in the males more elongated than in the females. Its posterior margin is furnished with a strongly projecting tubercle at the point which meets the finger, and another and more strongly pyramidal one near the origin of the latter. Immediately above this tubercle there is a very small one. The respiratory vesicles are thickened at the apex. The posterior pairs of feet are short and broad, and increase gradually in length. The length of the largest specimens is 12 millims.

C. laticornis, mihi.—This species was found at the same place as the preceding, but only isolated male specimens. The head in this species has no frontal tubercle. The superior antennæ are exceedingly long and broad. The first joint of the peduncle is much longer than the head; the second joint, which is one-third longer than the first, is three times as broad as the peduncle of the inferior antennæ. The third joint is only half as long and broad as the second. The flagellum, which is as long as the third joint, consists of ten joints. The inferior antennæ, which are strongly clothed with hair on the lower surface, reach to the end of the second joint of the peduncle of the superior antennæ. The first joint of the second pair of feet is long, somewhat shorter than the thoracic segment to which it is attached. The hand is very large, oval, somewhat curved; its posterior margin, as in the preceding species, is furnished with three teeth; but the lowest of these is much stronger than in that species. The finger is curved, and hairy on the posterior surface. The respiratory vesicles are oval. The posterior pairs of feet, which are short and thin, gradually increase in length. The length of the animal is 15 millims.

C. punctata, mihi.—In this species the sexes only differ slightly. The body is closely covered all over with tubercles, and sprinkled with dark spots upon a light ground. The superior antennæ in the male are longer than in the female, and reach further back than the fourth segment of the thorax. The second joint of their peduncle is as long as the head and first thoracic segment together; the third is somewhat shorter, and the first is still shorter than this. The flagellum, which is somewhat shorter than the last two joints together, consists of eighteen long joints. The inferior antennæ reach about to the third joint of the peduncle of the superior antennæ, and their third joint is shorter than the fourth. In the female the peduncle of the superior antennæ is shorter, and the flagellum consists of 14 joints. The inferior antennæ are much longer in proportion to the superior than in the male. Among the numerous tubercles of the body, one, cleft at the apex, projecting from the head, is especially remarkable. On the second segment there is, in the middle line of the back, a thick blunt tubercle immediately above the point of attachment of the second pair of feet, and two smaller ones on each side of this, besides two on the anterior and two on the posterior margin. Many larger and smaller tubercles are scattered between these in irregular transverse series. The third segment bears a large tubercle near the anterior margin, two smaller ones at the sides still nearer the margin, and in the middle of the segment there is a large one with the apex bifid. The fourth segment is furnished with a large bifid tubercle in front, two large ones side by side on the middle of the segment, and a double one at the posterior margin. The following segment bears two large ones, one behind the other, and two smaller ones at the sides. The succeeding segments have two tubercles side by side, near their posterior margins. Above the origin of each pair of legs on these last three segments there is a strong posteriorly directed spine. The length is 12–15 millims. It has been found at Throndhiemsfiord, Söndmör, and Manger by Professors Boeck, Rasch, and Sars.

C. lobata, Müll., and

C. septentrionalis, Kr., are frequent along the whole coast.

C. hystrix, Kr., was found by Kröyer at Christiansund.

LI.—*On the Discovery of a Malar of a large Reptile in the Northumberland Coal-measures.* By T. P. Barkas.

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

Gentlemen,

I desire briefly to direct the attention of your readers to the discovery of a complete malar of a large Carboniferous reptile. It was found by me in shale from Newsham Colliery, Northumberland, and is probably the malar of the Labyrinthodont *Pteroplax cornuta* (which was described in your pages in April 1868) or of some analogous reptile.

The surface-markings on the malar exactly resemble those of ordinary reptilian head-bones, and closely correspond with the description of the markings of reptile bones in the paper referred to. The length of the bone is $8\frac{1}{4}$ inches, its width at the anterior extremity is 3 inches, at the posterior extremity $2\frac{1}{2}$ inches; and a space at the upper part of the bone exhibits one-third of the eye-orbit. The specimen is in an excellent state of preservation. In form the fossil malar very nearly corresponds with the representation of that of a crocodile given in Prof. Owen's 'Comparative Anatomy and Physiology of Vertebrates,' vol. i. p. 145. no. 26; and when compared with the malar of a crocodile in the Museum of Newcastle-upon-Tyne, it indicates the existence of a reptile in Northumberland during the Carboniferous era of a size equal to that of a full-grown crocodile.

I have also obtained from the same district large jaws, teeth, ribs, vertebræ, and other remains of Carboniferous Labyrinthodonts; and I feel confident that if the various collieries in England and Wales, Scotland and Ireland, were diligently searched by competent observers, a large and rapid addition to our Carboniferous fauna would certainly be made. No field of palæontological research has been more neglected, and none would yield better results.

I am, Gentlemen,

Yours obediently,

T. P. Barkas.

Newcastle-on-Tyne, May 14, 1869.

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

To the generous kindness of Dr. Rehm, of Sugenheim, Bavaria, I am indebted for a copy of his recently published first fasciculus of *Cladoniæ* of Bavaria. It contains fifty specimens, well preserved, in beautiful condition, and carefully mounted. They are enumerated below, with the names, &c., on the attached labels. To these I have appended the results of chemical tests, which are precisely similar to those uniformly met with in an examination of thousands of specimens in all sorts of conditions and from all parts of the world, embodied in the herbaria of D. Turner, Borrer, and Hooker at Kew, and of which a detailed account is given in Not. Lich. No. XII. A few references are made to published collections by way of identification, and an occasional note as to possible differences.

In my experience, the best way to apply the chemical tests is with small brushes made of finely spun glass, merely moistening the cortical layer. There is no need of friction, for the reaction is instantaneous.

The student is especially warned against misconception as to chemical tests constituting a *sole specific character*. All that has been ever asserted respecting them is that they afford an *additional and confirmatory specific character*. And in those cases where external characters are similar or approximate, and doubt necessarily exists, their value as such will be abundantly apparent. For proof, reference may be made to the results of an examination of the Acharian specimens in Mr. D. Turner's herbarium, and those in the Borrerian herbarium, at Kew (see Not. Lich. No. XII.).

In these investigations the student will do well to bear constantly in mind the following admirable caution of Dr. Nylander (see Journ. Linn. Soc. ix. p. 365, note):—"The analyses of lichens made by chemists often fail through the neglect of an exact determination of the species, and probably not less often by the mixture of specimens confounded together and incorrectly assigned to one single species. For the chemist no less than for the physiologist it is of the greatest importance to know exactly what is the plant we have under observation —that is, to have well determined the plant which we are studying." In other words, he must not place implicit confidence on the attached labels as indicating undoubted accuracy, or on his own preconceived notions of the particular diagnosis, but by careful observation and comparison thoroughly satisfy himself that the plant under review is really that which the label indicates it to be. Then apply the chemical test, and doubt will be exchanged for certainty.

1. " *Cl. papillaria,* Hoffm., f. *symphicarpa,* Schær."
K+ C—.
2. " *Cl. cariosa,* Flk., f. *macrophylla apoda,* Nyl. Lapp. 176."
K+ C—. =*Cl. cervicornis,* Del. hb.; Coëm. 19.
3. " *Cl. cariosa,* Flk., f. *continua* (Wallr.), Körb. par."
K+ C—. =Irish specimens.
4. " *Cl. cariosa,* Flk."
K+ C—. =Fellm. Lapp. or. 27.
5. " *Cl. cariosa,* Flk."
K+ C—. = M. & N. 850; Mudd, Br. Clad. 5; Coëm. Clad. Belg. 20.
6. " *Cl. fimbriata* (L.), v. *tubæformis* (Ach.)"
K— C—. =Coëm. Clad. Belg. 41.
7. " *Cl. fimbriata* (L.), v. *tubæformis* (Ach.), f. *integra,* Schær."
K— C—. =Coëm. Clad. Belg. 44.
8. " *Cl. fimbriata* (L.), v. *tubæformis* (Ach.), f. *denticulata,* Flk."
K— C—. =Mudd, 15; Coëm. 46.
9. " *Cl. fimbriata* (L.), v. *conista* (Ach.)."
K— C—. =Coëm. 50; Mudd, 13.
10. " *Cl. fimbriata* (L.), v. *chlorophæa,* Flk."
K— C—. =Coëm. 37; Mudd, 8; Spruce, Amaz. 28.
11. " *Cl. fimbriata* (L.), v. *chlorophæa,* Flk., f. *syntheta* et *staphylea,* Ach."
K— C—. =Coëm. 35.
12. " *Cl. fimbriata* (L.), v. *cornuta,* Ach."
K— C—. =Coëm. 66; Schær. 57.
13. " *Cl. fimbriata* (L.), v. *cornuta* (Ach.), f. *tortuosa,* Del."
K— C—. =Coëm. 79.
14. " *Cl. fimbriata* (L.) *cornuto-abortiva.*"
K— C—. =Schær. 56; Coëm. 67.
15. " *Cl. fimbriata* (L), v. *fibula* (Ach.)."
K— C—. =Coëm. 76 & 108.
16. " *Cl. fimbriata* (L.), v. *ochrochlora,* Flk., f. *chordalis.*"
K— C—. =Coëm. 61 & 62.
17. " *Cl. fimbriata* (L), v. *cornuta,* Ach. (ad *ochrochloram* pertinens?)."
K— C—. =Coëm. 65.
18. " *Cl. cenotea* (Ach.), Schær."
K— C—. =Zwackh. 329.
19. " *Cl. delicata,* Flk."
K+ C—. =Nyl. Paris. 24; Hepp, 112.
20. " *Cl. epiphylla* (Ach.), v. *cæspiticia,* Ach."
K— C—. =Mudd, 44; Hepp, 544; Anzi, Clad. Cisalp. 21; Coëm. 105; Leight. 368.
21. " *Cl. squamosa,* Hoffm., v. *ventricosa,* Fr. (f. *frondosa,* Del.? cf. Nyl. Syn. 209)."
Of *frondosa,* Del., Nylander says (*l. c.*):—" Podetia magis foliolosa podetiis plerumque minus evolutis, foliolis contra magis

evolutis multifidis interdum confertis et apotheciis symphycarpis." This description applies well to this specimen, in which there is a decided reaction K+ in the folioles, and would seem to point to its separation from *squamosa*, which has a different reaction, K—.

22. " *Cl. squamosa*, Hoffm., v. *ventricosa*, Fr., *glabriuscula*."
   Here, again, there is the reaction K+ in the folioles of the podetia; and it may probably be also referable to *frondosa*, Del.
23. " *Cl. squamosa*, Hoffm., v. *asperella* (Flk.), Körb."
   K— C—.
24. " *Cl. furcata*, Hoffm., v. *stricta*, Wall. (syn. v. *stenozosia*, Mass. Ital. 196)."
   K+ C+. =Tuck. L. Amer. 33, but with slight reaction. Mass. Ital. 196 has full reaction, K+C+, and is therefore referable to *pungens*.
25. " *Cl. furcata*, Hoffm., v. *racemosa*, Hoffm."
   K+ C+. =Coëm. 183. This specimen has so decided a reaction that I cannot hesitate in referring it as a state of *Cl. pungens*, var. *foliosa*.
26. " *Cl. furcata*, Hoffm., v. *corymbosa* (Ach.)."
   K+ C+. =Coëm. 189. The decided reaction refers this also to *Cl. pungens*.
27. " *Cl. pungens* (Ach.), Fr., f. *foliolosa*."
   K+ C+. The true plant.
28. " *Cl. pungens* (Ach.), Fr., f. *valida*, Rabh. (syn. *Cl. muricata*, v. *Euganea*, Mass. Ital. 191)."
   K+ C+. In my copy of Mass. Ital., No. 191 is a much stronger plant, and different in aspect from this specimen.
29. " *Cl. pungens* (Ach.), Fr."
   K+ C+. =Mudd, 54 & 55; M. & N. 754; Leight. 16.
30. " *Cl. pungens* (Ach.), Fr."
   K+ C+.
31. " *Cl. degenerans*, Flk., f. *pleolepis*, Ach."
   K+ C+. The decided yellow reaction makes this =*lepidota*, Ach.
32. " *Cl. degenerans*, Flk., f. *phyllocephala*, Wallr., Körb."
   K+ C+. The decided yellow reaction refers this also to *lepidota*, Ach.
33. " *Cl. gracilis*, Hoffm., v. *aspera* (Ach.), Flk."
   K+ C+. The reaction and aspect refer this to *Cl. pungens*, var. *foliosa*.
34. " *Cl. gracilis*, Hoffm., v. *elongata* (Ach.)."
   K+ C+. The reaction and the peculiar character of the cortical layer identify this with *Cl. ecmocyna*, Ach.
35. " *Cl. cornucopoides* (L.), Fr., v. *extensa*, Hoffm."
   K f+ C+.
36. " *Cl. bacillaris* (Ach.), f. *clavata-polycephala*."
   K— C—.
37. " *Cl. bacillaris* (Ach.), f. *clavata*, Ach."
   K— C—.

38. " *Cl. bacillaris* (Ach.), f. *phyllocephala.*"
K— C—.
39. " *Cl. bacillaris* (Ach.), f. *coronata* (Ach.)."
K— C—.
40. " *Cl. macilenta,* Hoffm."
K+ C+.
41. " *Cl. rangiferina* (L.), Hoffm."
K+ C—. =Coëm. 140.
42. " *Cl. sylvatica,* Hoffm., v. *tenuis,* Flk. ?"
Kf+ C+. =Coëm. 150; Hepp, 818; Leight. 57.
43. " *Cl. sylvatica* (Hoffm.), v. *tenuis,* Flk."
Kf+ C+.
44. " *Cl. sylvatica* (Hoffm.), v. *tenuis,* Flk."
Kf+ C+.
45. " *Cl. sylvatica* (Hoffm.), v. *tenuis,* Flk."
Kf.+ C+.
46. " *Cl. sylvatica* (Hoffm.) f. *compacta.*"
Kf+ C+.
47. " *Cl. sylvatica* (Hoffm.), f. ramulis extremis subfuscis, elongatis, nutantibus."
Kf+ C+.
48. " *Cl. sylvatica* (Hoffm.), f. ramulis extremis brevibus, distantibus, laxis."
Kf+ C+.
49. " *Cl. sylvatica,* (Hoffm.) f. *erecta.*"
Kf+ C+.
50. " *Cl. sylvatica* (Hoffm.), v. *alpestris* (Ach.)."
Kf+ C+.

LIII.—*Remarks on the Distribution of Animal Life in the Depths of the Sea.* By M. Sars*.

Upon the question, so interesting and important in many respects, how far animal life extends downwards in the sea, and of what kind are the animals which occur in the great depths, the observations of the last few years have, as is well known, furnished us with some valuable information. This, however, is still extremely scanty, and embraces only a very small number of animal forms accidentally brought to light; they are, it would appear, little more than isolated glimpses of the life that stirs in the abysses of the ocean.

In order, if possible, to obtain a more comprehensive knowledge of this subject, investigations have been made near our

* Translated from the 'Videnskabs-Selskabs Forhandlinger' for 1868, pp. 246–275, by the Rev. A. Bethune, M.A., late President of the Tyneside Naturalists' Field-Club; and communicated by the Rev. A. M. Norman.

coast in the last two years, which, however, as the necessary means for reaching greater depths are still wanting, have for the present been limited to depths between 200 and 300 fathoms, only in a few cases reaching 450 fathoms.

The apparatus, such as the sounding-lead and "Bulldog's machines," which have hitherto especially been employed for the investigation of great depths in the sea, are in reality very imperfect, inasmuch as with them one can only bring up a very small portion of what there is at the sea-bottom, and only from that particular and very limited space upon which the instrument may chance to descend. The ordinary large dredge, which has done such good service in smaller depths, can hardly be used at depths above 200 fathoms, except by an extraordinary expenditure of time and money; and yet it is undoubtedly the most serviceable apparatus for the purpose, as it can be dragged over a larger portion of the sea-bottom, and by this means take up a greater number of the animals living upon it. It is of consequence therefore to improve this apparatus so as to fit it for more convenient use at great depths. Such a modified dredge, of smaller dimensions than the common, but yet sufficiently heavy to withstand the force of the often strong sea-currents, and provided with a fine net to contain animals, has been constructed by my son, G. O. Sars, and found to be very convenient in depths of 300 fathoms, and even sufficient at 450 fathoms. With this instrument nearly all the species referred to in the present paper have been obtained.

Since my former paper on this subject, "Remarks on the extent of Animal Life in the depths of the Sea" ('Christianias Videnskabs-Selskabs Fordhandlinger,' 1864), I am in a position to make a very considerable addition to what is there contained, nearly all derived from my son's unwearied researches during his journeys to the Lofodens, and some contributions kindly communicated by my friends Danielssen and Koren. The number of species from the depth mentioned is, with this addition, which amounts to nearly quadruple what was known before, increased to such a degree that it now supplies us with a tolerably clear idea of the whole fauna living there, which seems very far indeed from being yet fully known—though it is worthy of remark that it exhibits representatives of nearly all classes of marine animals, and an unexpected wealth of forms, of which not a few seem to be peculiar to these depths, while the remainder belong to levels more or less high up.

In my former paper 92 species were given as occurring on our coast at a depth of 200 or 300 fathoms. As three of these have been found by later explorers to be mere varieties, and the nomenclature otherwise stands in need of some correction, I have thought that I ought to include all these earlier mentioned species in the following catalogue.

Catalogue of all Living Species hitherto found on the Coast of Norway at from 200 *to* 300 *fathoms, and in part also at* 450 *fathoms.*

Typus I. PROTOZOA.

Classis Rhizopoda.

	fath.
Rhabdammina abyssorum, *Sars*, n. g. et sp.	450
Astrorhiza limicola, *Sandahl*.	450
Saccammina sphærica, *Sars*, n. g. et sp.	450
Glandulina lævigata, *D'Orb*.	450
Nodosaria radicula, *Linné*, *Parker & Jones*	300
Dentalina communis, *D'Orb*.	300
—— guttifera, *D'Orbigny*	300
Vaginulina linearis, *Montagu*	300
Marginulina lituus, *D'Orb*.	300
—— spinosa, *Sars*, n. sp.	300
Cristellaria crepidula, *Fichtel & Moll*	300
—— cultrata, *Montfort*	300
—— rotulata, *Lamarck*	300
Lagena sulcata, *Walker & Jacob*	300
—— caudata, *D'Orbigny*	300
—— distoma, *Parker & Jones*	300
Polymorphina lactea, *Walker & Jacob*	300
—— compressa, *D'Orbigny*	300
—— tubulosa, *D'Orbigny*	300
Uvigerina pygmæa, *D'Orbigny*	450
—— angulosa, *Williamson*	300
Globigerina bulloides, *D'Orb*.	300
Truncatulina lobatula, *Walker & Jacob*	200
—— refulgens, *Montagu, Carpenter*	300
Anomalina coronata, *Parker & Jones*	300
Rotalia Soldani, *D'Orbigny*	300
Pulvinulina punctulata, *D'Orb*.	300
—— Karsteni, *Reuss*	300
—— Menardi, *D'Orbigny*	300
Discorbina obtusa, *d'Orbigny*	300
—— rosacea, *D'Orbigny*	300
Polystomella striatopunctata, *Fichtel & Moll*	300
Nonionina depressula, *Walker & Jacob*	300

	fath.
Nonionina umbilicatula, *Mont*.	300
—— scapha, *Fichtel & Moll*	300
Pullenia sphæroides, *D'Orb*.	450
Sphæroidina bulloides, *D'Orb*.	450
Operculina ammonioides, *Gronovius*	450
Cassidulina lævigata, *D'Orb*.	450
Bulimina marginata, *D'Orb*.	450
—— aculeata, *D'Orbigny*	450
—— ovata, *D'Orbigny*	300
—— pyrula, *D'Orbigny*	450
Virgulina Schreibersii, *Czjeck*.	300
—— squamosa, *D'Orbigny*	300
Textularia agglutinans, *D'Orb*.	450
—— carinata, *D'Orbigny*	300
Verneuilina polystropha, *Reuss*	300
Bigenerina eruca, *Sars*, n. sp.	300
Valvulina conica, *Parker & Jones*	450
—— fusca (Rotalina), *Williamson*	450
Trochammina irregularis, *Parker & Jones*	450
Cornuspira foliacea, *Philippi*	300
—— marginata, *Sars*, n. sp.	450
Quinqueloculina seminulum, *Linné, Parker & Jones*	450
—— agglutinans, *D Orbigny*	450
Spiroloculina planulata, *Lamarck*	300
Triloculina oblonga, *Montagu*.	300
—— cryptella, *D'Orbigny*	300
—— tricarinata, *D'Orbigny*	300
Biloculina ringens, *Lamarck*	450
—— elongata, *D'Orbigny*	450
—— depressa, *D'Orbigny*	300
Lituola cenomana, *D'Orbigny*	300
—— canariensis, *D'Orbigny*	300
—— subglobosa, *Sars*, n. sp.	450
—— globerigeriniformis, *Parker & Jones*	450
—— scorpiurus, *Montfort*	450
	=68.

fath.

Classis Spongiæ (Porifera).

Cliona abyssorum, *Sars*, n. sp. 300
Halichondria, sp. 300
Hyalonema boreale, *Lovén* .. 200 (sec. Lovén).
Cladorhiza abyssicola, *Sars*, n. g. et sp. 300
Trichostemma hæmisphæricum, *Sars*, n. g. et sp. 300

=5.

Typus II. CŒLENTERATA.

Classis Anthozoa (Polypi).

Paragorgia arborea (Alcyonium), *Linné* 300
—— grandiflora, *Sars* 200
Primnoa lepadifera (Gorgonia), *Linné* 300
Mopsea borealis, *Sars*, n. sp. .. 300
Funiculina finmarchica (Virgularia), *Sars* 300
—— Christii (Virgularia), *Koren & Danielsson* 200
—— Forbesii, *Verrill* (Pavonaria quadrangularis, *Forbes*) . 200 (sec. Koren).
Pennatula borealis, *Sars* 200
Kophobelemnon stelliferum (Pennatula), *O. F. Müller* .. 300
Lophelia prolifera (Madrepora), *Linné* 300
Amphelia ramea (Madrepora), *O. F. Müller* 300
Ulocyathus arcticus, *Sars* 300
Fungiacyathus fragilis, *Sars*, n. g. et sp. 300
Zoanthus incrustatus (Mammillifera), *Düben & Koren* .. 250
Capnea sanguinea, *Forbes* 300
Peachia Boeckii (Siphonactinia), *Danielssen & Koren* . 200
Actinopsis flava, *Danielssen & Koren* 250
Tealia digitata (Actinia), *O. F. Müller*, *Gosse* 300
Actinia, sp. 300
Bolocera Tuediæ (Anthea), *Johnston* 300

=20.

Classis Hydrozoa.

Campanularia verticillata (Sertularia), *Linné*, *Johnston* .. 300
Lafoëina tenuis, *Sars*, n. g. et sp. 300

=2.

Typus III. ECHINODERMATA.

Classis Crinoida.

Rhizocrinus lofotensis, *Sars*, n. g. et sp. 300
Antedon Sarsii (Alecto), *Düben & Koren* 300

=2.

Classis Asterida.

Astrophyton Linckii, *Müller & Troschel* 250
—— Lamarckii, *Müller & Troschel* 250
Asteronyx Lovenii, *Müller & Troschel* 240
Ophioscolex glacialis, *Müller & Troschel* 300
—— purpurea, *Düben & Koren* 300
Ophiacantha spinulosa, *Müller & Troschel* 300
Ophiopholis aculeata (Asterias), *O. F. Müller* 300
Ophiactis clavigera, *Ljungman* .... 200–300 (sec. Ljungman).
Amphiura, n. sp.? 300
—— norvegica, *Ljungman* .. 450
—— tenuispina, *Ljungman* .. 300
Ophiura abyssicola, *Forbes* .. 300
—— carnea, *Sars* 300
—— Sarsii, *Lütken* 300
Ctenodiscus crispatus (Asterias), *Retzius* 200
Brisinga endecacnemos, *Asbjörnsen* 200
Archaster tenuispinus (Astropecten), *Düben & Koren* .. 300
—— arcticus (Astropecten), *Sars* 300

fath.

Archaster andromeda (Astropecten), *Müller & Troschel* .. 250
Goniaster granularis (Asterias), *O. F. Müller* 300
Cribrella sanguinolenta (Asterias), *O. F. Müller* 300

=21.

Classis Echinida.

Cidaris papillata, *Leske* 200
Echinus norvegicus, *Düben & Koren* 450
(sec. Danielssen).
Echinus elegans, *Düben & Koren* 250
(sec. Danielssen).
Echinocyamus angulosus, *Leske* 300

fath.

Echinocardium ovatum (Spatangus), *Leske* 300

=5.

Classis Holothurida.

Echinocucumis typica, *Sars* .. 450
Psolus squamatus (Cuvieria), *Koren* 253
(sec. Danielssen).
Holothuria tremula, *Gunnerus* 250
—— intestinalis, *Ascanius & Rathke* 300
Stichopus natans, *Sars*, n. sp.. 300
Molpadia borealis, *Sars* 200
Oligotrochus vitreus, *Sars*, n. g. et sp. 300
Synapta tenera, *Norman* (S. Buskii, *M'Intosh* ?) 300

=8.

Typus IV. VERMES.

Classis Gephyrea.

Chætoderma nitidulum, *Lovén* 300
Phascolosoma olivaceum, *Sars*, n. sp. 300
—— pusillum, *Sars*, n. sp. .. 300
—— margaritaceum (Sipunculus), *Sars* 300
—— lævissimum, *Sars*, n. sp . 230
Sipunculus, n. sp. 250
(sec. Danielssen).

=6.

Classis Annelida.

Spirorbis borealis, *Daudin*, *Mörch* 300
—— Fabricii, *Mörch* 300
—— lucidus, *Montagu* 300
Ditrypa libera (Serpula), *Sars* 300
Placostegus tridentatus (Serpula), *J. C. Fabricius* 300
Protula borealis, *Sars*, n. sp... 300
Filograna implexa, *Berkeley* .. 300
Chone infundibulum, *Kröyer* (C. Kröyerii, *Sars*) 250
Euchone, sp. 300
Terebella artifex, *Sars* 300
Pectinaria hyperborea (Cistenides), *Malmgren* 300
Terebellides Stroemii, *Sars* .. 300
Maldane biceps (Clymene), *Sars* 200
—— ? pellucida, *Sars*, n. sp.. . 300

Clymene prætermissa (Praxilla), *Malmgren* 300
Ereutho Smitti, *Malmgren* .. 300
Nerine cirrata, *Sars* 300
Chætozone setosa, *Malmgren* . 300
Amage auricula, *Malmgren* .. 250
Sabellides borealis, *Sars* 300
—— sexcirrata, *Sars* (Samytha, *Malmgren*) 300
—— cristata, *Sars* (Melinna, *Malmgren*) 200
Eumenia ? erucæformis, *Sars*, n. sp. 300
Ephesia gracilis, *H. Rathke* .. 300
Scalibregma inflatum, *H. Rathke* 300
Chloræma pellucidum, *Sars*, n. sp. 200
Trophonia pallida, *Sars*, n. sp. (*an* T. glauca, *Malmgren* ?) . 300
—— pilosa, *Sars*, n. sp. 300
—— flabellata, *Sars*, n. sp. .. 300
Ammotrypane aulogaster, *H. Rathke* 300
Pygophelia singularis, *Sars*, n. g. et sp. 300
Glycera capitata, *Œrsted* 300
Chætopterus norvegicus, *Sars* . 300
Spiochætopterus typicus, *Sars* 300
Nephthys incisa, *Malmgren* .. 300
—— longisetosa, *Œrsted* 300
Castalia, sp. 300
Syllis, sp. 300

	fath.
Umbellisyllis fasciata, *Sars*, n. g. et sp.	300
Lumbrinereis fragilis (Lumbricus), *O. F. Müller*	300
Eunice norvegica (Nereis), *O. F. Müller*	300
Onuphis conchylega, *Sars*	300
—— quadricuspis, *Sars*, n. sp.	300
Sigalion stelliferum (Nereis), *O. F. Müller* (S. tetragonum, *Œrsted*)	300
Polynoë cirrosa (Nychia), *Malmgren* (P. scabriuscula, *Sars*)	300
Polynoë nodosa, *Sars* (Eunoa, *Malmgren*)	250
—— (Eunoa) abyssicola, *Sars*, n. sp.	300
—— Sarsii (Antinoë), *Kinberg*	300
Lætmonice filicornis, *Kinberg*	300
Paramphinome pulchella, *Sars*, n. g. et sp.	300
Euphrosyne cirrata, *Sars*	300
	=51.

Typus V. MOLLUSCA.

Classis Polyzoa (Bryozoa).

Crisia denticulata, *Lamarck*, *Smitt*	300
—— cornuta (Sertularia), *Linné*, *Smitt*	200
Diastopora repens (Tubulipora), *Wood*	300
—— hyalina (Berenicea), *Fleming*	300
—— simplex, *Busk*	200–300 (sec. Smitt).
—— patina (Tubulipora), *Lamarck*	300
Tubulipora atlantica (Idmonea), *Forbes*	300
—— serpens (Tubipora), *Linné*	200
—— (Phalangella) palmata *Wood*	200–300 (sec. Smitt).
—— (Proboscina) incrassata, *D'Orbigny*	200–300 (sec. Smitt).
Pustulipora producta, *Sars*, n. sp.	300
Hornera lichenoides (Millepora), *Linné*	300
—— violacea, *Sars*	200
Discoporella verrucaria, forma hispida, *Fleming*	300
Defrancia lucernaria, *Sars*	200
Cellularia ternata, *Solander*, forma ternata et gracilis, *Smitt*	300
—— scabra, *Van Beneden*	300
Bicellaria Alderi, *Busk* (B. unispinosa, *Sars*)	200
Bugula avicularia (Sertularia), *Linné*, forma fastigiata	300
Bugula Smitti (Kinetoskias), *Danielssen*	300
Flustra securifrons (Eschara), *Pallas*, *Smitt*	200
—— abyssicola, *Sars*, n. sp.	300
Cellaria fistulosa, *Linné* (Salicornaria farciminoides, *Jnst.*)	250
Membranipora Flemingii, *Busk*, forma trifolium	300
—— pilosa (Flustra), *Linné*, forma catenularia	200–300 (sec. Smitt).
Porina (Lepralia) ciliata, *Pallas*, forma dura	300
Anarthropora monodon (Lepralia), *Busk*	200–300 (sec. Smitt).
—— gracilis (Quadricellaria), *Sars* (Onchopora borealis, *Busk*)	300 (sec. Smitt, to 600).
Escharella Legentilii (Flustra), *Audouin*	200–300 (sec. Smitt).
—— linearis (Lepralia), *Hassall*	300
Mollia vulgaris (Eschara), *Moll.*, forma ansata	200–300 (sec. Smitt).
Porella lævis (Eschara), *Flem.*	200
Discopora coccinea (Cellepora), *Abildgaard*, forma ventricosa et ovalis	300
Retepora cellulosa (Millepora), *Linné*, forma *Beaniana*	300
Halilophus mirabilis, *Sars*, n. g. et sp.	300
	=35

fath.

Classis Tunicata.

Ascidia obliqua, *Alder* 300
Cynthia Lovenii, *Koren & Danielssen*, MS. 300
—— cinerea, *Sars*, n. sp. 300
—— limacina, *Forbes* 220

=4

Classis Brachiopoda.

Crania anomala (Patella), *O. F. Müller*................ 250
Terebratula (Terebratulina) caput serpentis (Anomia), *Linné* 300
—— (Waldheimia) cranium, *O. F. Müller* 300
—— (——) septata, *Philippi* (T. septigera, *Lovén*) 300

=4

Classis Conchifera (Lamellibranchiata).

Anomia ephippium, *Linné*, var. squamula et aculeata...... 300
Pecten septemradiatus, *O. F. Müller* 300
—— abyssorum, *Lovén*, MS... 300
—— vitreus, *Chemnitz* 300
—— mammillatus, *Sars*, n. sp. 450
—— similis, *Laskey* 300
Lima excavata (Ostrea), *J. C. Fabricius* 300
—— elliptica, *Jeffreys* (L. subauriculata, *Forbes & Hanley*) 300
—— Sarsii (Limea), *Lovén* .. 300
Limopsis minuta (Pectunculus), *Philippi* 450
Arca pectunculoides, *Scacchi* (A. raridentata, *Wood*), forma minor................ 300
————, *Scacchi*, forma major (Arca glacialis, *Torell*).. 300

fath.

Arca nodulosa, *O. F. Müller*.. 250
Yoldia pygmæa (Nucula), *Münster* 300
—— lucida, *Lovén*.......... 300
—— nana, *Sars* 300
—— obtusa *, *Sars*, nov. sp... 300
Nucula pumila, *Asbjörnsen*, MS. 450
—— tenuis (Arca), *Montagu*.. 300
Crenella decussata (Mytilus), *Montagu* 300
Mytilus phaseolinus (Modiola), *Philippi* 300
Cardium minimum, *Philippi* (C. suecicum, *Reeve*) 300
Astarte sulcata (Pectunculus), *Da Costa, Jeffreys* 300
————, var. scotica (Venus), *Maton & Racket* 250
Kelliella abyssicola, *Sars*, n. g. et sp. 450
Montacuta substriata (Ligula), *Montagu* 250
Axinus flexuosus (Tellina), *Montagu* 450
—— pusillus, *Sars*, n. sp. 450
—— ferruginosus (Kellia), *Forbes* 300
Poromya granulata, *Nyst* (Embla Korenii, *Lovén*) 300
Scrobicularia alba (Mactra), *Wood* 300
—— nitida (Mya), *O. F. Müller* 300
Lyonsiella abyssicola, *Sars*, n. g. et sp. 450
Saxicava rugosa (Mytilus), *Linné*, var. arctica 300
Panopea plicata (Mytilus), *Montagu* (Saxicava fragilis, *Nyst*) 300
Neæra rostrata (Mya), *Spengler* 300
—— obesa, *Lovén* 450
—— abbreviata, *Forbes*...... 300 (sec. Koren).
—— lamellosa, *Sars*, n. sp. .. 300

=37

* *Yoldia obtusa.* This I formerly named *Y. abyssicola*; but it is very distinguishable from the form described under the same name by Torell, which is nothing more than the common northern variety (*Nucula gibbosa*, Smith) of *Y. pygmæa*, Münster. To avoid confusion, I have therefore called my new species *Y. obtusa.* It is nearest to *Leda obesa*, Stimpson, but is more than twice as large. The back of the shell is both longer and higher, and it has many hinge-teeth (dent. ant. 11–15, post. 18–27), while *Y. obtusa* has dent. ant. 10, post. 12 (Stimpson).

fath.

Classis Cephalophora.

Solenopus nitidulus, *Sars*, n. g. et sp. 300
Chiton Hanleyi, *Bean* 300
Chiton cancellatus, *Sowerby* (C. alveolus, *Sars, Lovén*) .. 300
Siphonodentalium lofotense, *Sars* 300
—— affine, *Sars* 300
—— quinquangulare (Dentalium), *Forbes* (S. pentagonum, *Sars*) 450
—— subfusiforme, *Sars* 450
Dentalium abyssorum, *Sars* .. 300
—— agile, *Sars*, n. sp. 300
Cylichna alba (Bulla), *Brown* 300
—— umbilicata (Bulla), *Montagu* 300
—— conulus, *Forbes & Hanley* 300
Utriculus expansus, *Jeffreys* .. 300
Utriculopsis vitrea, *Sars*, n. g. et sp. 300
Philine scabra (Bulla), *O. F. Müller* 300
—— granulosa, *Sars*, n. sp. .. 300
—— quadrata (Bullæa), *Wood* 300
Scaphander librarius, *Lovén* .. 300
Puncturella noachina (Patella), *Linné* 250
Natica affinis, *Gmelin* (N. clausa, *Sowerby*) 300
—— Montagui, *Forbes* 250
—— grönlandica, *Beck* 250
Rissoa abyssicola, *Forbes* 300
—— reticulata (Turbo), *Montagu* 300
—— Jeffreysii, *Waller* 300
—— soluta, *Philippi* ?, var. lævis, *Sars* 300
Scissurella crispata, *Fleming* .. 300
Trochus cinereus, *Couthouy* ?, varietas 300
Adeorbis subcarinatus (Helix), *Montagu* 300
Cyclostrema nitens (Delphinula), *Philippi* 450
Tylodina Duebenii .... 200 (sec. Lovén).
Colobocephalus costellatus, n. g. et sp. 230
Admete viridula (Tritonium), *O. Fabricius* 300
Cerithium metula, *Lovén* 300
Cerithiopsis costulata (Turritella), *Möller, Jeffreys* 300
Aporrhais Macandrei, *Jeffreys* 250 (sec. Danielssen).
Fusus propinquus, *Alder* 250
Trophon barvicensis (Fusus), *Johnston* 300
Aclis Walleri, *Jeffreys* 300
Eulima distorta, *Deshayes* 300
—— intermedia, *Cantraine, Jeffreys* 300
—— bilineata, *Alder* 300
—— stenostoma, *Jeffreys* 300
Odostomia acicula (Melania), *Philippi* 300
——, sp. 300
—— insculpta, *Montagu, Forbes & Hanley* 300
Pleurotoma cancellata (Fusus), *Mighels & Adams* 300
—— tenuicostata, *Sars*, n. sp. 300
—— Mörchii (Trophon), *Malm* 300
—— violacea, *Migh. & Adams* ? 250
—— nivalis, *Lovén* 300
—— carinata, *Philippi* 300
—— teres, *Forbes* (P. borealis, *Philippi*) 250

=53

Typus VI. ARTHROPODA.

Classis Arachnida.

Nymphon longitarse, *Kröyer* ? 300

=1

Classis Crustacea.

Sylon (*Kröyer*) Hippolytes, *Sars*, n. sp. .... 250 (sec. Danielssen).
Verruca Stroemia (Lepas), *O. F. Müller* 300
Scalpellum vulgare, *Leach* (Lepas scalpellum, *O. F. Müller*) 300
—— Stroemii, *Sars* 300
Longipedia, sp. 250
Harpacticus ?, sp. 250
Cytherella abyssorum, *G. O. Sars* 450
Polycope orbicularis, *G. O. Sars* ? 250
Conchœcia elegans, *G. O. Sars* 300
—— borealis, *G. O. Sars* 300

fath.

Philomedes Lilljeborgii, *G. O. Sars* 250
Asterope abyssicola, *G. O. Sars*, n. sp. 250
Cypridina norvegica, *Baird* .. 300
Ilyobates prætexta, *G. O. Sars* 250
Cytheropteron alatum, *G. O. Sars* 250
—— subcircinatum, *G. O. Sars* 250
—— hamatum, *G. O. Sars*, n.sp. 300
Cythereis echinata, *G. O. Sars* 300
—— mucronata, *G. O. Sars* .. 300
—— abyssicola, *G. O. Sars* .. 300
Argillœcia cylindrica, *G. O. Sars* 250
Bairdia minna, *Baird* 300
—— angusta, *G. O. Sars* 250
Dulichia, n. sp. 250
Clydonia borealis, *G. O. Sars*, n. sp. 300
Hyperia, sp. 250
Leucothoë articulosa, *Leach* .. 250
Ampelisca macrocephala, *Lilljeborg*? 250
Ampelisca, sp. 250
Kröyera, sp. 250
Œdicerus, sp. 250
—— obtusus, *Bruzelius* 250
——, sp. 250
Eusirus, sp. 250
Stegocephalus ampulla, *Phipps*? 250
Cerapus, sp. 250
Lysianassa magellanica, *Lilljeborg*, vix *M.-Edwards* 300–400?
Anonyx, sp. 250
Eriops elongata, *Bruzelius* 250
Lilljeborgia, sp. 250
Gammarus ?, sp. 250
—— ?, sp. 250
Paramphithoë fragilis, *Goës* .. 250
——, sp. 250
Liriope, n. sp. 250
Ischnosoma bispinosum, *G. O. Sars* 250
Macrostylis spinifera, *G. O. Sars* 250
Desmosoma aculeatum, *G. O. Sars* 250
—— lineare, *G. O. Sars* 250
Ilyarachna longicornis (Mesostenus), *G. O. Sars* 200
—— coronata, *G. O. Sars*, n. sp. 300
—— hirticeps, *G. O. Sars*, n. sp. 300
—— clypeata, *G. O. Sars*, n. sp. 250
Munnopsis typica, *M. Sars* .. 300
Eurycope cornuta, *G. O. Sars* 300
—— producta, *G. O. Sars* 250

fath.

Eurycope phalangium, *G. O. Sars* 300
—— furcata, *G. O. Sars*, n. sp. 250
Arcturus, sp. 300
Apseudes talpa, *Montagu* 300
Tanais, sp. 300
—— tenuimanus, *Lilljeborg* .. 300
Anceus oxyuræus, *Lilljeborg* .. 250
Munna limicola, *G. O. Sars* .. 250
Henopomus muticus, *Kröyer* .. 250
Ægа psora (Oniscus), *Linné* .. 250 (sec. Danielssen).
Cyclaspis longicauda, *G. O. Sars* 300
Platyaspis typica, *G. O. Sars*, n. g. et sp. 250
Campylaspis costata, *G. O. Sars* 250
—— sulcata, *G. O. Sars*, n. sp. 250
—— undata, *G. O. Sars* 300
—— horrida, *G. O. Sars*, n. sp. 300
—— verrucosa, *G. O. Sars* .. 300
Eudora emarginata, *Kröyer* .. 250
—— hirsuta, *G. O. Sars*, n. sp. 230
Leucon acutirostris, *G. O. Sars* 300
—— pallidus, *G. O. Sars* 300
—— nasicus, *Kröyer* 200
Diastylis biplicata, *G. O. Sars* 300
—— longimana, *G. O. Sars* .. 250
—— bispinosa, *Stimpson* 250
—— echinata, *Sp. Bate* 300
—— serrata, *G. O. Sars* 300
—— macrura, *G. O. Sars*, n. sp. 250
Boreomysis (n. g.) arctica (Mysis), *Kröyer* 200
—— tridens, *G. O. Sars*, n. sp. 250
Mysideis insignis (Mysis), *G. O. Sars* 250
Hemimysis abyssicola, *G. O. Sars*, n. g. et sp. 250
Pseudomma roseum, *G. O. Sars*, n. g. et sp. 450
—— abbreviatum, *G. O. Sars*, n. sp. 250
—— affine, *G. O. Sars*, n. sp. 250
Parerythrops obesa, *G. O. Sars* 250
Erythrops serrata (Nematopus), *G. O. Sars* 250
—— microphthalma, *G. O. Sars*, n. sp. 250
—— abyssorum, *G. O. Sars*, n. sp. 300
Thysanoessa neglecta (Thysanopoda), *Kröyer*? 250
Thysanopoda norvegica, *M. Sars* 250
Pasiphaë norvegica, *M. Sars* .. 300
Pandalus borealis, *Kröyer* 300

	fath.
Hippolyte securifrons, *Norman*	250
—— polaris, *Sabine*	250
Cryptocheles abyssicola, *G. O. Sars*, n. g. et sp.	300
Pontophilus norvegicus, *M. Sars*	450
Galathea rugosa, *J. C. Fabricius*	250
—— tridentata, *Esmark*	300
	=105

RECAPITULATION.

Protozoa	Rhizopoda	68 species.	
	Spongiæ	5	
			73
Cœlenterata	Anthozoa	20	
	Hydrozoa	2	
			22
Echinodermata	Crinoida	2	
	Asterida	21	
	Echinida	5	
	Holothurida	8	
			36
Vermes	Gephyrea	6	
	Annelida	51	
			57
Mollusca	Polyzoa	35	
	Tunicata	4	
	Brachiopoda	4	
	Conchifera	37	
	Cephalophora	53	
			133
Arthropoda	Arachnida	1	
	Crustacea	105	
			106
	Total		427

In addition to these, there are, moreover, several fishes, of whose range in the deep nothing has been known beyond what fishermen have happened to discover in the use of their deep lines, and have told. Of such fish some descend to 200–300 fathoms, and even deeper, although they often swim far higher up, so that some of them (as the Turbot, Ling, &c.) at certain seasons of the year approach nearer to the shore.

Sebastes norvegicus (Perca), *O. F. Müller*, *Cuvier*.
—— dactylopterus, *Delaroche* (S. imperialis, *Cuvier*).
Molva vulgaris, *Nilsson*.
—— abyssorum, *Nilsson*.
Brosmius vulgaris, *Cuvier*.
Macrourus Stroemii, *Reinhardt*.
—— Fabricii, *Sundevall*.
Hippoglossus maximus, *Minding*.
Scymnus borealis, *Scoresby*.

Lastly, there are some other fishes which are only extremely rarely, and as it were accidentally, caught on our coasts, and whose yet unknown dwelling-place may probably be the greatest depths, such as *Lampris guttatus*, Brünnich, *Trachypterus arcticus*, Nilsson, *Gymnetrus Grillii*, Lindroth, &c.

There is now, therefore, quite a considerable and unexpected multitude of forms which live in what a short time ago were considered uninhabited depths; but there are certainly still many more which are as yet unknown. It seems to me, therefore, still too early to draw from the facts we have discovered more than some general results which seem as it were to present themselves to our notice or are forced upon us as scientific conclusions.

Of the great divisions of the animal kingdom we find at these depths the mollusks to be the most numerously represented (133 species); next the Arthropoda (106 species), namely the Crustacea, for of the small number of sea-spiders only one species is yet known; then Protozoa (73 species, of which, perhaps, not a few are to be regarded as only varieties of a small number of typical species); Annelids (57 species); Echinodermata (36 species); and, lastly, Cœlenterata (22 species). With regard to the last, there is the interesting and, as it seems, tolerably certain conclusion that the Hydrozoa at these depths are very few (only 2 species known); they seem to be almost exclusively confined to the upper soundings, as, indeed, the greatest number of those animals which are subject for the most part to an alternation of generations are in their last condition or generation more or less pelagic.

It is stated by many naturalists (see Keferstein on the distribution of mollusks, Bronn's 'Classen und Ordnungen des Thierreichs,' 1864, vol. iii. p. 1098) that the Conchifera in the whole sea have a wider extension in depth than the Cephalophora (*i. e.* Gasteropoda). Examination of the depths on our coast contradict this statement, since the former are represented by 37, and the latter by 53 species, thus exceeding the Conchifera by a considerable number.

One of the rather surprising results of these present researches is that many species which are known to us as inhabitants of shoal water, far from being confined to such situations, have a considerable range in depth, and extend from the shore to the greatest depths examined on our coast.

On the other hand, we find not a few species which, according to the facts now known, are confined to the great depths.

As such peculiarly deep-sea species I have, in my earlier paper, mentioned:—the great corals *Lophelia prolifera*, *Amphelia ramea*, *Ulocyathus arcticus*, *Primnoa lepadifera*, *Paragorgia arborea* and *P. grandiflora*; the great Pennatulids

Funiculina finmarchica, *F. Christii*, *Pennatula borealis*; also, *Astrophyton Linckii*, *A. Lamarckii*, *Asteronyx Lovénii*, *Brisinga endecacnemos*, *Cidaris papillata*, *Molpadia borealis*; finally, *Terebratula septata*, *Lima excavata*, *Yoldia obtusa*.

To these, after the last two years' explorations, the following are now to be added:—

Cladorhiza abyssorum (200–300 fathoms), *Trichostemma hemisphæricum* (100–300 f.), *Funiculina Forbesii* (200 f.), *Mopsea borealis**, *Fungiacyathus fragilis* (100–300 f.), *Echinocucumis typica* (100–450 f.) †, *Stichopus natans* (200–300 f.), *Flustra abyssicola* (100–300 f.), *Halilophus mirabilis* (100–300 f.), *Axinus pusillus* (200–450 f.), *Lyonsiella abyssicola* (100–450 f.), *Dentalium agile* (250–300 f.), *Phascolosoma olivaceum* (250–300 f.), *Cytheropteron hamatum* (250-300 f.), *Cythereis mucronata* (100–300 f.), *Cytherella abyssorum* (100–450 f.), *Conchœcia elegans* (100–300 f.), *Conchœcia borealis* (about 300 f. or more), *Clydonia borealis* (about 300 f., and not rare), *Campylaspis sulcata* (100–250 f.), *Campylaspis horrida* (100–300 f.), *Cyclaspis longicauda* (100–300 f.), *Ilyarachna coronata* (300 f.), *Ilyarachna hirticeps* (100–300 f.), *Hemimysis abyssicola* (250 f.), *Pseudomma roseum* (250–450 f.), *Erythrops abyssorum* (300 f.), *Cryptocheles abyssicola* (300 f.), *Pasiphaë norvegica* (100–300 f.)—altogether 46 kinds, independent of several others that cannot yet with certainty be said to be deep-sea forms.

Although, as we see by the examples adduced, there is some variation in the limits of these true deep-water species, we can yet nevertheless generally gather, from the known facts, that *the proper deep-water zone* begins somewhere about 100 fath., since the greater part of those forms which here begin to show themselves now and then, increase in number of individuals downwards to 300 fathoms, and, in some cases in which research has been carried lower down, even to 450 fathoms. How far this zone descends into the abyss, or whether there be, as is probable, still other zones differing in character from this, is a point which for the present we cannot decide.

The sea-bottom along our coast, at the greatest depth at which it has been examined, appears to vary in condition.

* Living specimens occurred at 300 fathoms, stuck together in the direction of their longitudinal axes, which, from a great number of casts at and near to the same place, were not found higher up than 250 fathoms. A single example by chance occurred in 120 fath., but it may have been carried by the force of the current.

† In my account of the Echinodermata of Norway (p. 103), *Echinocucumis typica* is said by mistake to have been found in from 40 to 100 fathoms, instead of from 100 to 200 fathoms.

Generally it seems to consist of soft materials or so-called clay, but frequently also of harder clay mixed with sand, of sand and gravel or stones of different sizes, and also of the bare rock. It is only on this last kind of bottom (big stones or the firm rock) that the great corals sit and grow, among which numerous animals live that are never found on a soft bottom.

I shall now shortly mention some of the latest opinions advanced on the extent of animal life in the depths of the sea.

Keferstein (*l. c.* p. 1095) deduces, from the soundings most recently made at great depths, the following among other conclusions:—"That the animals there found consist of few species, but of many individuals: exactly as has been observed in the arctic zone." Again (p. 1097):—"At moderate depths of about 300–500 fathoms there seem to be the fewest inhabitants." Neither of these statements agrees quite with the abundance both of species and individuals which we find, according to the observations referred to, to be living on our coast at these very depths.

Lovén (Trans. Scand. Naturalists, Stockholm, 1863, p. 384) has expressed opinions on the range of animal life in the depths of the sea, founded apparently in great measure on the soundings of the Swedish Expedition to Spitzbergen. He affirms that from 60 to 80 fathoms, down to the greatest depth at which we have hitherto known animal life to exist, the bottom of the sea is covered with a fine mud, which is commonly called clay, and there prevails, from pole to pole, in all latitudes, a fauna of the same common character, of which some species are very widely distributed.

That in all the seas of the world, from pole to pole, in all latitudes, there should exist a deep-water fauna of the same common character, seems for the moment nothing else than an hypothesis for which he who advances it is responsible; however, I will not entirely deny the possibility that at the greatest depths there may be a greater uniformity in the fauna than has hitherto been admitted. But I may remark on this subject that, with the exception of the North Sea, we know next to nothing of the fauna of the rest, especially of the equatorial seas; and therefore next to nothing is known of its "common character."

The only point Lovén advances in support of his assertion is "that in the Antarctic Sea are found forms of Mollusks and Crustacea which seem in part to agree generically, and in part to be almost (!) specifically identical with northern and arctic forms." A certain agreement in physiognomy between the faunæ of the Arctic and Antarctic Seas is readily admitted, and has been long ago observed to exist. The cause has been sought in the similar conditions of life in either case, although it must be admitted that little can be said on this subject till the facts are more clearly known. There are, likely enough, also in both faunæ not a few identical genera; but I have seen no satisfactory evidence of any full identity of species. Lovén expresses himself on the subject with some hesitation when he speaks of an *almost specific identity*, which, in fact, is no identity at all, for the very idea of identity implies *completeness*. Finally, to conclude with Lovén, to judge of all the seas in the world from the analogy of the Antarctic and Arctic Seas seems to me rather hasty. These hasty conclusions will perhaps soon disappear when the detailed evidence on which they are supposed to rest is published, which we may soon expect from the distinguished Swedish naturalists. This uniform fauna of Lovén's begins 60–80 fathoms deep. Such a boundary line between the deep-sea and surface fauna it is impossible to draw. As has been already stated, there are many of the species dwelling in our shallow water which extend down to the greatest depth reached on our coast (commonly 300 fath.). Next appear decided deep-sea species, which at least range downwards to 300 fath., in very marked depth, and not at all at at 60–80 f. Such, *e. g.*, are the great corals, *Lophelia prolifera*, *Ulocyathus arcticus*, *Primnoa lepadifera*, and *Paragorgia arborea* (100 f.); with which *Pennatula borealis*, *Funiculina finmarchica*, and *F. Christii* first appear at 200 f., and *Mopsia borealis* at 250 f. Of Echinodermata, *Echinocucumis typica* at 100 f., *Stichopus natans* 200 f. Of Polyzoa, *Flustra abyssicola* and *Halilophus mirabilis* at 100 f. Of Conchifera, *Axinus pusillus* at 200 f., *Lyonsiella* at 100 f., and *Yoldia obtusa* at 250 f. Of Cephalophora, *Dentalium agile* at 250 f. Of Crustacea, *Cytherella abyssorum*, *Cythereis mucronata*, *Conchœcia elegans*, *Cyclaspis longicauda*, and *Pasiphaë norvegica* at 100 f. On the other hand, *Cytheropteron hamatum*, *Ilyarachna coronata*, *Hemimysis abyssicola*, and *Pseudomma roseum* first show themselves at 250 f. And, lastly, *Conchœcia borealis*, *Clydonia borealis*, and *Cryptocheles abyssicola* have hitherto been found only at 300 f.

Then with respect to the deep-water fauna living on the coast of Norway, so far as we are acquainted with it, it seems, instead of agreeing perfectly with the very little of that we know from other seas, much more to show itself *to be peculiarly and characteristically northern*, as much as can be desired. To mention some of the more striking forms, where out of the North Sea have been found *Trichostemma*, *Lophelia prolifera*, *Ulocyathus*, *Fungiacyathus*, *Primnoa lepadifera*, *Paragorgia arborea*, our great Pennatulids, *Rhizocrinus*, *Astrophyton Linckii* and *A. Lamarckii*, *Asteronyx*, *Ophioscolex*, *Ophiacantha spinulosa*, *Ctenodiscus*, *Brisinga*, *Echinocucumis typica**, *Oligotrochus*, *Terebratula septata* and *T. cranium*, *Lima excavata*, *Limopsis minuta*, *Lyonsiella*, &c. ?

With so rich a fauna as that with which we are in some degree acquainted on our coast to the depth of 200–300 fath., and in some cases to 450 fath., which already reckons 427 species *of nearly all the classes of marine animals*, there is plainly yet *no sign which indicates any diminution of animal life.* This, indeed, also agrees very well with the glimpse of that life which we have lately had through the soundings of Wallich and O. Torell in still greater depths, which show us that even at 1200–1400 fathoms, tolerably highly organized animals live, namely, Echinodermata, Vermes, Mollusks, and Arthropoda. In depths of 3000 fathoms, according to Wallich, no other living animals are found than Protozoa (Rhizopoda, Radiolaria, Spongiadæ). It is very probable that animal life, as depth increases little by little, decreases by degrees, till at last it disappears; but to take the last-named depth and lay it down as the line of zero, is to build too much on weak premises. It is of consequence in this dark and difficult field, more than elsewhere, to guard against rash conclusions. We have on this very subject a warning example in the case of the eminent Ed. Forbes, who having found in the Ægean Sea, at the depth of 230 fathoms, a pair of living species of Mollusks and Annelids, fell into the great mistake of thinking that animals were there on the verge of disappearance, and rather arbitrarily fixed his zero at 300 fathoms. And since Protozoa have been brought up from so considerable a depth as 3000 fathoms, to conclude that no other or more highly organized creatures live there is to conclude too hastily and too much,—especially considering, on the one hand, the limited number of soundings made at such depths, and, on the other, the imperfection of the instruments used. Most certainly many more researches must be made before we dare to hazard a decided opinion as to the point at which animal life necessarily lessens or disappears.

In conclusion, I will make a remark or two respecting *colours*, the intensity of which is commonly supposed to depend on the action of the sunlight.

Edward Forbes has remarked (Proc. Royal Soc. vol. i.) that Testacea taken on the British coast from localities under 100 fathoms, are *entirely white and colourless*, even when they

[* A new species of this genus, *E. adversaria*, has lately been found by Semper in the Philippine Islands.—A. M. N.]

were individuals of species which, in shoal water, are brightly banded or striped, that between 60 and 80 fathoms stripes and bands seldom appear on our shells, especially in the northern provinces; but that from 50 fathoms and upwards colours and patterns are well marked.

Against the general tenor of these statements of Forbes, that colours in individuals of the same species gradually disappear according to the depth, Jeffreys has rightly declared himself (British Conchology, vol. i. Introd. p. 49), and has used his experience of mollusks to illustrate his meaning, which I can also confirm by numerous examples.

Thus, to name some among many, and among other classes than mollusks, the dorsal surface of *Ophioscolex purpurea*, from 300 fathoms, is of as lively a bright red, or sometimes dark red, as are individuals from 45–50 fathoms. *Archaster tenuispinus* from 300 fathoms is as bright orange-red as from 30–50 fathoms. *Ophiura abyssicola* from 300 fathoms is of the same light grey, sometimes pale rose-colour, with reddish, chestnut, and dark-brown spots, as from 50–100 fathoms. *Onuphis quadricuspis* from 300 fathoms has as bright an opalescent gleam with two blood-red lines along the middle of its back as individuals taken from 50 fathoms. The shell of *Pecten septemradiatus* from 300 fathoms is as red and white-speckled as from 20–30 fathoms. *Astarte sulcata* from 300 fathoms has a chestnut-brown epidermis the same as if from 5–10 fathoms. *Natica Montagui* from 250 fathoms appears of a red-brown with a white band on its sutures, just as if from 15–20 fathoms. *Eulima bilineata* from 300 fathoms is found with two yellow spiral bands as bright as from 15–20 fathoms; and many more.

Sometimes, indeed, it happens that lively colours seem in some degree to fade with the depth, as e. g. *Hippolyte polaris*, which in the laminarian zone has many large blood-red and two sky-blue spots on the hinder part of each segment, at 200–250 fathoms is paler, the red disappearing, and has scarcely any sky-blue spots.

Thus Forbes's assertion is certainly not universally true. It seems to have been made under the influence of an idea, held by many naturalists, that light could not penetrate deep into the sea, and that therefore in the greater depths of the sea complete darkness reigned, in which all colours must disappear, as in those creatures (e. g. *Proteus*, *Amblyopsis*, &c.) which inhabit subterranean caves; and he was doubtless confirmed in his opinion by finding, as he occasionally did, at depths under 100 fathoms, white or colourless individuals of species elsewhere coloured. But such albino varieties occur at all depths.

There is another observation (if it be true), that in general certain colours prevail among animals at certain depths. This is what Œrsted (Meddelelser fra den naturh. Forening i Kjöbenhavn, 1849, p. 57) tried to establish. He believed himself to have discovered "a law which holds good among the animals that inhabit the sea, viz. that *they have the same colour as the light under whose action they live.*" He supports this by remarking "of the changes which light undergoes in its condition, that which falls upon the water is refracted so that the several coloured rays of which light is composed penetrate to unequal depths down into the sea. The violet and blue rays are first intercepted, next the green, and so on, the red reaching to the lowest depth." "The sea in this manner," he says, "may be regarded as divided into strata of colour, according to the condition of light at the different depths; and these strata will follow the order of the solar spectrum, *i.e.* from the top downwards, from violet to red." Œrsted has endeavoured to give his theory a practical form by defining six such strata or regions:—

1. *The violet or blue animals' region,* which occupies the surface of the open sea,—that is, the region of pelagic or oceanic animals.

2. *The earthy-coloured or spotted animals' region,* also beginning at the surface of the sea, but in the neighbourhood of coasts comprising the belt which lies between the highest and lowest tides.

3. *The green animals' region,* which runs in bights where the green algæ grow, and extends to about 10 feet below the mean surface of the sea.

4. *The yellow or brown animals' region,* from about 10 to about 50 feet below the surface.

5. *The red animals,* from 50 to about 500 feet.

6. *The white animals,* comprising all depths below the above.

Œrsted's theory seems to be based rather on speculative fancy than on scientific facts; at least, I never could find any particular agreement between these and the regions defined by him. Others have had the same difficulty; for the theory has been questioned, nay, sharply opposed, at least in respect to the first of Œrsted's regions, by Reinhardt and Steenstrup (*l. c.* p. 45), who produced many examples of pelagic animals of other colours than violet or blue. I think it superfluous to add my own experience of numberless pelagic animals in the Mediterranean completely agreeing with this; I shall only remark, in passing, that among our northern Siphonophora the red colour is predominant. It is, besides, undoubted that at the surface of the sea there is not *violet* or *blue* light, but *white.*

And so of the other regions or zones which Œrsted speaks of. My experience distinctly contradicts his theory. *I find white, yellow, green, brown, and red animals in them all*; or, in other words, there is in general no prevailing colour in any of them, nor any distinct connexion between the colours of animals and the belts which they inhabit, with the exception of what I shall now mention.

It is quite true, as Forbes and others since have remarked, that the brightest and most variegated colours, stripes, and bands, in greatest number and intensity, are oftenest found in animals near the shore, in the *laminarian zone* (which extends from low-water mark to about 10–20 fathoms, and in certain localities even to 30–40 fathoms), such as many Nudibranchs, *Patella pellucida*, *Trochus*, and many more; whereas, on the other hand, animals in the deeper belts are generally of one colour, not variegated.

Again, although, as has been said, there seems to be no universally prevailing colour for each zone of the sea, yet the researches on our coast have distinctly shown that *the greater number of animals at the greatest depths there touched* (200–300 and in some cases 450 fathoms) *either are red or white in colour*. So that it appears, regarding colours as depending in a general way on light, that of the coloured rays of which the sun's light is composed, the red, as a rule, penetrates deepest —much deeper than Œrsted supposed, since he fixes its limits at 500 feet (83 fathoms), beyond which he places his region of white animals, which, so far as researches on our coast tell us, are rarely or never found at that depth.

I have already on a former occasion (*l. c.* p. 60) stated that the creature *Lima excavata* from 300 fathoms depth is of as lively a bright red as *L. Loscombii* and *L. hians*, which both live in shallow water. As some further examples of the frequency of the red colour, the following larger forms may serve:—*Funiculina finmarchica*, *F. Christii*, *F. Forbesii*, *Pennatula borealis*, and *Goniaster granularis*, which are all of a bright-red colour; among our large corals, there are always some (sometimes, also, polypi) more or less markedly red; the colour of *Ulocyathus arcticus* from 300 fathoms is quite the same as from 100 fathoms (the highest limits of the species), the mouth and interior (primary and secondary) tentacles scarlet or brown-red approaching blood-red, and the rest a lighter red, and the folds of the mouth a dark blood-red or brown-red; further, *Fungiacyathus fragilis*, *Capnea sanguinea*, both our species of *Astrophyton*, *Asteronyx Lovenii*, both species of *Ophioscolex*, *Brisinga*, *Archaster tenuispinus* and *A. andromeda*, *Stichopus natans*, *Conchœcia borealis*, *Campylaspis undata*, *C. costata*, and *C. horrida* are red. Many of our deep-water Mysidea, among them *Pseudomma roseum*, are strongly rose-red, with a shade of orange or violet; and many more animals. All the Rhizopoda are white. *Echinocucumis typica*, nearly all the Polyzoa, and most of the higher mollusks (of which perhaps the colour of a sufficient number has been given above).

Although the red and white colours are thus predominant at these great depths, *other colours are by no means absent.* Thus *Actinopsis flava* is entirely yellow, *Lætmonice filicornis* has there, as in shallow water, shining yellow foot-brushes. The limbs of the three species of *Cythereis* mentioned are all yellow. The sarcode of *Cristellaria rotulata* is light citron-yellow. *Phascolosoma olivaceum* is dark olive-green. *Umbellisyllis fasciata* has interrupted olive-green cross bands on the back. *Ctenodiscus crispatus* is light reddish brown. *Ophiura abyssicola* and *Ophiacantha spinulosa* are grey or chestnut-brown and spotted; *Antedon Sarsii* more or less brown, with small yellow or brown-red blisters along its tentacular grooves; and *Eurycope furcata* has a singular yellow-brown cross band. *Molpadia borealis* is dark-brown violet, *Hornera violacea* pale violet.

It has been generally supposed that light could only penetrate into the sea to a comparatively small depth, since, according to the late experiments of Bouger and Lambert on the absorption of light in water, all trace of it disappears at 120 fathoms under the surface. Late discoveries of the existence of many *coloured animals* at much greater depths (since, as I have said, colour is held to stand in close relation to light) agree very little with these experiments, which are further contradicted by another fact learnt on our coast. Not only at the depth of 300 fathoms, but even of 450 fathoms, have been found living animals (e. g. *Pasiphaë norvegica*, *Pontophilus norvegicus*, *Cryptocheles abyssicola*, and others) possessing perfectly developed organs of vision, which could be of no use (since nature does nothing in vain) if in those depths of the sea there reigned such absolute darkness as exists in those subterranean caves whose inhabitants we find to *have no eyes.* It is much to be regretted that we have yet no certain knowledge as to how far light penetrates down into the sea, or its mode of transmission there, or other physical facts connected with it.

I add, lastly, that the many new animal forms referred to in the present paper, of which some are very remarkable, will all, as the collected materials are by degrees worked out, and as soon as possible, be described and published.

LIV.—*Notice of some New Reptilian Remains from the Cretaceous Beds of Brazil.* By Prof. O. C. Marsh, of Yale College*.

The only account of vertebrate fossils from the freshwater cretaceous deposit near Bahia, Brazil, which appears to have been published hitherto, is a short notice in a paper by Mr. S. Allport, in the 'Journal of the Geological Society of London' for 1860. In this article the author gives a description of the locality, and figures several specimens of reptilian and fish remains, but with no explanation of them except a reference to the opinions of Prof. Owen and Sir Philip Egerton as to their general affinities.

While engaged in a geological exploration of the coast of Brazil, in 1867, Prof. C. F. Hartt, of Cornell University, visited the same locality; and among the fossils obtained was a small collection of vertebrate remains, supposed to be mainly reptilian, which he has recently submitted to the writer for examination and description. Most of the specimens are too imperfect to admit of accurate determination; some, however, are sufficiently well preserved to show clearly their main characters, and a number of them prove to be identical with those obtained by Mr. Allport. Several of the specimens were found on examination to be portions of large fishes, in part referable to the genus *Lepidotus*, and some of them indicating apparently a new type. These will be described, with other fossils from Brazil, in a work on the geology of that region, soon to be published by Prof. Hartt.

The most interesting of the reptilian remains collected by Prof. Hartt in the Bahia deposit is the tooth of a large crocodilian, from the arenaceous shale near Plantaforma station, on the Bahia railroad. This specimen is in an excellent state of preservation, and indicates a species new to science. It is larger, more slender, and more pointed than the teeth of existing crocodiles, resembling most nearly those of some extinct American species. It is conical in form, round at the base, and slightly compressed at the apex. The crown is two inches and three lines in length along the outer side, and ten lines in diameter at the base. One edge is somewhat more convex than the other, and this is also true of one of the sides; and hence the tooth appears slightly curved in two directions. On either edge of the crown there is a sharp ridge, most prominent near the apex, over which it passes, but gradually disappearing before reaching the base, the specimen resembling in this respect the teeth of *Thoracosaurus*, from which, however, it differs in being longer, and less curved, than the teeth of that genus

* From 'Silliman's American Journal' for May 1869.

usually are. The sides of the crown are covered with fine, interrupted, undulating striæ, which appear to be different from the dental sculpture of the Crocodilia hitherto described. These striæ are most distinct near the middle of the tooth, becoming much more delicate at the base, and nearly obliterated at the apex.

In size and general appearance this specimen resembles somewhat the teeth of *Crocodilus antiquus*, Leidy, from the Miocene of Virginia, but differs from that species in being less tapering, and in the ridge on the edges extending further downward. It resembles still more closely the teeth of a new species of crocodile discovered by the writer at Squankum, N. J., in the tertiary greensand, which will soon be more fully described under the name *Theocampsa squankensis*, Marsh. Both species have essentially the same proportions, and similar dental striæ; but the cutting-ridge of the New-Jersey specimens is more prominent, and extends nearly or quite to the base of the crown. The two species were apparently about the same size, both being considerably larger than existing crocodilians.

Other parts of the skeleton of the Brazilian species would perhaps show generic characters to distinguish it from the modern procœlian crocodiles; but in the absence of these, it may for the present be placed in the same genus. Its form, cutting-edges, and especially its peculiar striæ, readily distinguish it from any species with which it is liable to be confounded; and it may appropriately be named *Crocodilus Hartti*, in honour of its discoverer, whose recent researches have thrown so much light on the geology of Brazil.

Several specimens of reptilian teeth collected by Mr. Allport in the same deposit at Montserrate, a locality about two miles south-west of Plantaforma station, evidently belong to this species, as the illustrations accompanying his paper (pl. xvi. figs. 1, 2, 3, and 5) clearly indicate. The explanation of the plate refers to the specimens as "Teeth of Crocodile with delicately wrinkled surface;" but no further description is given.

In the same paper Mr. Allport has given figures of several crocodilian teeth from the localities at Plantaforma and Montserrate, which are quite different from those above described. These are represented in pl. xv. fig. 5, and pl. xvi. figs. 4, 6, 7, and 8, and are referred to on p. 261 as "Teeth of Crocodile with strong continuous striæ, and coarse riblets." These specimens, taken in connexion with some imperfect remains in the collection made by Prof. Hartt, indicate the existence in this deposit of a second, and smaller, species of crocodile, probably allied to the modern gavials. The teeth are not so large as those of *Crocodilus Hartti*, and are more tapering and more curved. They also differ widely in the striæ and lateral folds. These specimens may provisionally be referred to the genus *Thoracosaurus*, and, as the species is evidently new, it may be called *T. bahiensis*.

An interesting fossil, found by Prof. Hartt at Plantaforma station, is a fragment of a bone, evidently reptilian, but the exact affinities of which it is difficult to determine from this specimen alone. It resembles in some respects the extremity of an ulna, but, after a careful comparison, the writer is inclined to consider it the proximal end of a rib. It is much flattened at the articular extremity, and tapers gradually to the broken end, which is somewhat triangular in outline. Its length is about four inches, the transverse diameter of the perfect end two and a half inches—and of the other, one and a quarter inches. The larger extremity is divided into two articular facets lying oblique to each other, the smaller one being elevated about half an inch above the other, and covering rather more than a third of the entire terminal surface. In form and general proportions this specimen is not unlike the upper end of a right dorsal rib of some of the amphicœlian crocodiles, especially a rib in which the head and tubercle have so closely approached each other that their articular surfaces are nearly confluent. The size and other characters of the specimen, however, seem to exclude it from that order; and it probably belonged to a Dinosaurian reptile, possibly the same as a large vertebra from Montserrate, which Mr. Allport figured in his paper in pl. xvii., and which Prof. Owen suggested might prove to be allied to *Megalosaurus*.

The only other specimen in this collection that need be particularly mentioned here is a small flat bone, about two inches in length, with one articular extremity partially preserved. This appears to resemble most nearly the fibula of a tortoise, and probably should be referred to that group of reptiles. The other vertebrate remains from Brazil obtained by Prof. Hartt are, in general, of less interest, but will be fully described in his forthcoming work.

Yale College, April 5th, 1869.

LV.—*Descriptions of two new Species of Fishes discovered by the Marquis J. Doria.* By Dr. A. Günther.

The Marquis J. Doria has sent to the British Museum specimens of fishes collected by him in Persia and Borneo. Several of the Bornean species have been described in this

Journal, 1868, vol. i. p. 264. I add here the descriptions of two others.

Upeneoides Doriæ.

D. $8|\frac{1}{8}$. A. 8. L. lat. 34.

The height of the body is contained thrice and three-fourths in the total length (without caudal), the length of the head thrice and two-fifths. Interorbital space flat, its width being equal to that of the orbit, which is two-thirds of the extent of the snout. Eye somewhat nearer to the end of the snout than to the gill-opening. Vomerine teeth forming a continuous angular band. The barbels do not reach to the angle of the præoperculum. The height of the spinous dorsal fin is three-fourths of that of the body. Tubes of the scales of the lateral line very simple, bi- or trifurcate. Pinkish, with a rather narrow yellow band from the eye to the upper part of the caudal fin. Spinous dorsal with traces of alternate blackish and whitish longitudinal bands.

Several examples, 4–5 inches long, from Bender Abassi, Persian Gulf.

Eleotris heterolepis.

D. 6|13. A. 11.

Scales ctenoid; numerous small scales are mixed with large ones, the smaller occupying chiefly the base of the larger. Head broad, depressed as in *Batrachus*, covered with minute scales; snout and cheeks with numerous short filaments and fringes. Eyes of minute size, the distance from each other being much greater than that from the end of the snout. Teeth in the jaws in a band, villiform; but there is an outer series of larger teeth in the upper jaw, and an outer and inner in the lower. Vomerine teeth none. None of the fin-rays produced into filaments. Caudal fin wedge-shaped, rather produced, shorter than the head; the upper and lower rudimentary caudal rays numerous, extending for some distance along the caudal peduncle. Blackish brown.

Sarawak. Seven inches long.

LVI.—*The Character of the Indigenous Icelandic Terrestrial Mammalian Fauna, with especial reference to Mr. Andrew Murray's representation of it in his 'Geographical Distribution of Mammals.'* By Prof. JAPETUS STEENSTRUP*.

THE geographical stamp presented by the animal inhabitants

* Translated by W. S. Dallas, F.L.S. &c., from the 'Videnskabelige Meddelelser fra Naturhistorisk Forening i Kjöbenhavn,' 1867, pp. 51–66.

of a country may often be very different in the different classes of animals of which its fauna consists, inasmuch as not only may the animals of the surrounding sea or the coast-fauna belong to another geographical region than the land animals, but even of the latter, again, one class, by reason either of its mode of life, or of a stronger or weaker faculty of motion, may sometimes present striking differences from the rest. Hence it is perfectly natural that an author who seeks to explain the reasons for the present distribution of animals upon the surface of the earth should choose rather to treat geographically each class of animals by itself, and to seek to ascertain and determine with regard to each class of animals the particular country's zoogeographical character. This is just what Andrew Murray has done, in his great work, furnished with 101 fine maps, 'The Geographical Distribution of Mammals.' But if we determine the geographical character of a country or of a large island in this manner, from a single class, in this case from the mammalia alone, we certainly expose ourselves to great errors, especially when this class is very poor in species, or when its species are not very well known. A striking example of this is presented by the above-mentioned work, as regards Iceland, inasmuch as the indigenous terrestrial mammalian fauna of this island, which has a surface of nearly 2000 square miles, can only be said to consist of *a single species*; and this single species therefore is that which in this case is to decide whether Iceland belongs, in a zoogeographical sense, to Greenland and North America, as the author supposes, or to the Europæo-Asiatic region, as we have hitherto believed, whether forming our judgment upon the characters of the class of mammalia or of the other classes of terrestrial animals.

This single species therefore plays, in the important problem of the origin and diffusion of animals, a part so decisive that a single species of animal can hardly have it to fulfil in any other point. Murray has, indeed, perfectly felt this *, and he has not come lightly to his result, but, on the contrary, after ample consideration; but, in order to carry this on in a correct manner he seems partly to have wanted a sufficient knowledge of the animal in question, and partly not to have perfectly

* At p. 267, for example, Murray says:—"In speaking above of the long-tailed field-mouse, I reminded the reader of the nature of its habitation with some exactness, because it is the only guide we have to enable us to determine whether that species does or does not exist in Iceland, or whether, as I suppose, it is the lemming which has been mistaken for it there—*a fact which, as the reader knows, must have rather an important bearing on the past geological history of that part of the northern hemisphere.*" The italics are mine.

understood the sources of information made use of by him. Hence I have thought it desirable to investigate the circumstances more closely—and this so much the more, as it may certainly be supposed that foreign naturalists will hit upon many of the difficulties which have led Murray astray, or at least upon some of them.

The animal which possesses this great significance is the Icelandic heath-mouse or wood-mouse, which was regarded by Thienemann as a distinct species, and described and figured by him under the name of *Mus islandicus*, Th., but which will rather be regarded by other naturalists as a variety of our common wood-mouse (*Mus sylvaticus*, Linn.*). It is, indeed, the only land mammal which can be regarded with some probability, if not with absolute certainty, as aboriginally belonging to the country; for the other land mammals are, first, domestic animals (horses, cows, sheep, goats, pigs, dogs, and cats) introduced with the inhabitants early in the middle ages; and, in the next place, at various subsequent times two wild animals were introduced, by the interference of man, in order to people the interior of the country—namely, hares and reindeer; whilst the rat and the house-mouse have been involuntarily introduced by commerce. Lastly, icebergs bring white bears to the country, if not every year, at least very frequently; but it seems to be only quite exceptionally that this animal has remained upon the island throughout the summer. Another guest which the ice likewise seems to bring frequently is the mountain-fox, the *Melrakki* of the Icelanders (*Canis lagopus*, Linn.); and although this is one of the generally distributed and common animals over the whole country, it must nevertheless also be regarded as introduced only in the above manner.

It is therefore of importance correctly to understand the nature and origin of this mouse, which is found in the open country, pretty far from human habitations.

Murray thinks that two statements, made by Eg. Olafsen and Henderson, as to the peculiar mode of life of the Icelandic heath- or wood-mouse clearly indicate that this can only be a lemming (*Myodes*)—most likely *M. grœnlandicus*, Traill, or *M. hudsonius*, Pall.,—and that they can hardly apply by any means to the genus *Mus*, or at least to our wood-mouse

* Whether *Mus sylvaticus*, Linn., is a collective species, and includes several nearly allied forms, is not thoroughly decided, but it is probable. E. Erslev made some remarks upon it, and upon an individual of Thienemann's *Mus islandicus* captured by me in 1839, far from human habitations, upon a heath at Rangaaen, at the meeting of Scandinavian naturalists in 1847 (see its 'Fordhandlinger,' pp. 944–945.).

(*Mus sylvaticus*, Linn.). The animals which Thienemann, and probably others, must have examined are, in his opinion, only domestic mice living at a distance from houses, whilst the mouse living in the interior of the country, to which he believes that Olafsen's and Henderson's statements referred, has hitherto remained unknown.

The statements of Olafsen and Henderson, upon which the author has thus built up a scientific conclusion of such importance, are here given one after the other *in extenso*. In Olafsen's and Povelsen's 'Travels in Iceland' (Band i. p. 218. § 329) we read as follows:—

"Mice here are numerous, but not of many kinds. The whitish ones (*hvidagtige**), which live in woods and heathy thickets, called *Skogar-mys* in Icelandic, seem to be only a variety of *Mus domesticus* (Linn. Syst. Nat. ed. res. 26–12) or the well-known *Mus sylvaticus*. In the wood of Huusefell there is an abundance of them. They are very good œconomists, and collect for the winter a quantity of *Arbutus*-berries (§ 260), which provision of theirs is often found by travellers. It is generally asserted here, by those who have seen it themselves, that they undertake journeys and conveyances over brooks and pretty large rivers, where the water is deep and still; and it appears that they shoot obliquely across streams. Their boats are dry cowdung, such as is dropped upon the fields, namely thin and flat. So many as intend to travel in company, four to six or ten at the utmost, help each other to carry their boat to the water. The cargo is a considerable heap of *Arbutus*-berries, which are piled up in the middle, but the mice sit in a circle outside them, so that their heads meet together in the middle point, but their tails hang out in the water, and are employed as oars in making the passage. When they get over, they carry their *Arbutus*-berries to a certain place. They are, however, often unfortunate, by the currents leading them into danger, when they suffer shipwreck, and have to save themselves as best they can by swimming, which art they understand pretty well. We have not ourselves seen these transits; but they are generally known; some even assert that they have seen them. When we consider the wonderful œconomy of the beaver and many so-called intelligent animals, this of the wood-mice cannot be regarded as incredible."

This account was made use of by Pallas, Pennant, and

* "*Hvidagtige*," in Icelandic Danish, signifies "whitish grey" or "light grey;" the Icelanders' "grey" colour is of a somewhat darker tint than ours. It is therefore very delusive that this expression, in the English translation of Olafsen's 'Travels,' used by Murray, is rendered merely "white," instead of "whitish."

others; but W. Hooker, in his 'Tour in Iceland' (1813), expressed more than doubt as to the correctness of the statement, as he affirmed that the more intelligent Icelanders laughed at the report. Henderson's attention was in the meanwhile called to this doubtful point when he commenced his second journey in Iceland; and he endeavoured, if possible, to obtain fresh information upon it. After giving Olafsen's above-cited statement and Hooker's doubts, he proceeds as follows (Journal of a Residence in Iceland in the years 1814, 1815, and 1818, vol. ii. p. 186):—

"Having been apprised of the doubts that were entertained on this subject before setting out on my second excursion, I made a point of inquiring of different individuals as to the reality of the account; and I am happy in being able to say that it is now established as an important fact in natural history, by the testimony of two eye-witnesses of unquestionable veracity, the clergyman of Briâmslæk and Madame Benedictson of Stickesholm, both of whom assured me that they had seen the expedition performed repeatedly. Madame Benedictson in particular recollected having spent a whole afternoon, in her younger days, at the margin of a small lake on which these skilful navigators had embarked, and amused herself and her companions by driving them away from the sides of the lake as they approached them. I was also informed that they make use of dried mushrooms as sacks in which they convey their provisions to the river, and thence to their homes. Nor is the structure of their nests less remarkable. *From the surface of the ground a long passage runs into the earth, similar to that of the Icelandic houses, and terminates in a large and deep hole, intended to receive any water that may find its way through the passage, and serving at the same time as a place for their dung. About two-thirds of the passage in, two diagonal roads lead to their sleeping-apartment and the magazine, which they always contrive to keep free from wet.*"

By comparing Olafsen's statement with Henderson's, it will be easily seen that the latter is not merely a confirmation of the remarkable navigation of the Iceland mouse*, but also gives further information as to the sacks, the dried fungi, which the mice make use of, besides adding complete and very significant information as to the burrows of these little animals. These are described as consisting of three parts: a long passage or gallery, like that of an Icelandic house, leads

* A pictorial representation of the mode of navigation, from the descriptions of Olafsen and Henderson, is to be found in a work which may generally be consulted with advantage, 'The Pictorial Museum of Animated Nature' (vol. i. p. 63. fig. 266).

from the surface of the ground deep into the earth, and terminates in a wide and deep cesspool, destined to receive both any water that may run in and the fæces of the animals; at two-thirds of its length inwards, two passages issue from this obliquely, one on each side, one leading to the dwelling-chamber and the other to the magazine, which they always endeavour to keep dry.

It cannot be denied that a statement so particular, and apparently so founded on the observation of nature as that relating to the arrangement of the burrows, likewise casts a certain amount of credibility upon the accounts of the marvellous voyages performed by the mice on the water, in order to seek their favourite food, the *Arbutus*-berries. Inasmuch, then, as I regard the whole narrative as credible, I at once open up the question whether the sketch of the mode of life of the Iceland mouse given by Olafsen and Henderson is decidedly in favour of this animal being an Arvicoline, and especially a lemming, or even renders such a supposition to a certain extent probable; and to this I can distinctly answer no. But Murray answers it with yes, and at p. 269 of his work he speaks on this subject in detail as follows:—

"That an economic Rodent lives in Iceland, is, I think, established; but the account given of its runs and granaries makes it not less clear that it is not *Mus sylvaticus*. There is no European mouse that makes a nest in the manner described by Henderson.

"But there is an animal very like a mouse (the lemming) which does make extensive burrows: it is provided with powerful sickle-shaped claws specially adapted for digging; and although I have not met with any account of the plan on which their burrows are constructed*, there is abundant evidence that they do make them. Captain M'Clintock says, in his diary of the expedition of the 'Fox':—'Hare-tracks are pretty common along the shore, and upon the sides of steep hills; they make burrows under the snow, but we have never found them in the earth like those of the fox and lemming.' Von Baer says that in Nova Zembla gentle declivities are frequently burrowed through in every direction by them. In fact, the habit is notorious.

"Another point in favour of the Iceland animal being a lemming is, that Olafsen speaks of it as often white. Now,

* John Wolley mentions only simple galleries in the turf at the surface of the ground, and holes in the sides of small hills in which they dwell, and outside of which the excrements occur in large heaps (Skand. Naturf. Möde 1863, p. 217 *et seq.*).

although the *Mus sylvaticus* sometimes may be found white, when such a thing occurs it is only a case of albinism, and rare; but the lemming in America is said regularly to become white in winter, although not so completely so as the weasels. Both in Spitzbergen and Nova Zembla a little white animal has been observed. MM. Pachtisson and Ziwolka, during their winter stay in Nova Zembla, saw a little white animal in their hut, which they, in their journal, call a mouse. According to Mr. Ziwolka it was larger than a common domestic mouse, and therefore could not have been a white individual of that species; it was doubtless a lemming. According to Von Baer there are two species of lemming found in Nova Zembla, one of which he considered identical with the *Myodes hudsonius.*

"As the lemming is an Arctic animal, it must pass a longer night of winter than ordinary torpidity could survive. Some arrangement for a winter supply is therefore plainly necessary, and it is scarcely possible to conceive anything better adapted to the purpose than that described by Henderson.

"I have, therefore, no doubt in my own mind that the economic mouse of Iceland is a lemming; and as Greenland is the nearest point where lemmings have been found, I think it a fair conjecture, until rebutted by direct evidence, that the species found there is the American lemming, *Myodes hudsonius.*"

In accordance with this notion, Murray's map lxxv. (of the geographical distribution of the lemmings) represents Iceland as a lemming-country; and his map ci. (of the provinces of the terrestrial Mammalia) represents Iceland as a country with a Western or North-American fauna.

I cannot accept either these arguments or their results. Let us even admit provisionally that the account given us of these mice, that they collect great stores of food, and that they dig hollows for the preservation of this, for their dwelling-place, and also for their impurities, may apply in general to certain species of lemmings; there are nevertheless interwoven several particular circumstances which in my eyes prove that it does not relate to Rodents of this group, but must refer to such as belong to the same group as the common mouse. In the first place, both statements represent the principal food of this mouse as consisting of berries, especially *Arbutus*-berries; and the carrying of these home is indeed the object of its journeys. But the Arvicolines and lemmings are addicted chiefly to quite a different kind of vegetable food, as indeed is proved both by observation and by the dental system; and even if a lemming may exceptionally feed on berries, yet these can never be its chief food. In the second place, there is the statement that the tails of these little sailors hang down in the water, nay, that they even perform their little voyage by using their tails as oars, whilst they sit upon the cowdung around the little heap of berries placed in the middle. But it is one of the general characters of an Arvicoline or lemming to have a short, stout body, and a very short tail; and as regards the species which Murray thinks must most probably be referred to here, *Myodes grœnlandicus* or *M. hudsonius*, I need only refer to the well-known figures of this animal in Schreber's 'Säugethiere,' vol. iv. tab. 194–196. Both figures and text indicate the tail as so short (altogether only a few lines long) that it scarcely reaches beyond the body, not to speak of the margins of the rafts; and the animals certainly could not row the rafts with their tails. In the third place, the animal's whole mode of life is opposed to it; for, although I cannot lay very much stress upon the fact that one would rather expect the described position to be that of a mouse than of an Arvicoline or lemming, it may nevertheless be decidedly maintained that the Icelanders, who are so well acquainted and familiar with house-mice, could not for a single moment see in such short, stout Arvicolines, or, still more, lemmings, furnished with great fossorial claws, such a likeness to house-mice that they would mistake them for the latter. I should even strongly doubt, from my knowledge of the Icelanders, that they would give such different animals the same name.

I have already called attention to the misunderstanding which has taken place with regard to the colour given in English as *white*; it will be seen that Murray has built further upon this misunderstanding, and supposed that by it must have been meant either animals that were *albinoes*, or animals in a *white* winter dress; and in this case it would be most natural to think of the lemmings. Murray remarks correctly that Olafsen cannot have meant isolated albino individuals, as his "whitish" colour is ascribed to this mouse generally; but it has escaped him that Olafsen cannot any more have intended animals in a winter dress, as the collecting-journeys which he describes (no less than those of which Madame Benedictson had been a witness) must have occurred in the fine season!

If therefore, for the reasons given, it is not possible to make the above-mentioned description agree with the habits and mode of life of the lemmings, as the sketch decidedly calls up the picture of a true mouse, there remains the next question, whether there is anything in the whole statement which cannot be applied to the mouse known to come from Iceland, which, as I have already stated, was named by Thienemann *Mus islandicus*, but which must certainly be regarded as a variety of our wood-mouse, *Mus sylvaticus*, Linn. But even this question I find myself in a position to answer decidedly in the negative. Everything agrees precisely with what we know of the wood-mouse.

In the first place I must remark that the geographical distribution presents no hindrance, as the wood-mouse is spread over the whole of Scandinavia, even up to Finmark, and therefore occurs under climatal conditions which at any rate are quite as severe, if not considerably more severe than those of Iceland.

In the second place, this mouse lives upon a food of the same nature, namely a mixture of fruits, nuts, and berries, and likewise collects great stores of them.

In the third place, it digs large store-chambers, dwelling-chambers, and impurity-pits for itself, exactly as described by Henderson (*vide suprà*, p. 449) from the statements of the Icelanders.

As the last-mentioned circumstance is apparently a main point in the foundation of Murray's opinion, and is therefore in his work made prominent by italics, I shall not refrain from appealing to definite evidence; and for this purpose I reproduce, in their own expressions, what I find given upon the subject by two of the most accessible writers, Schreber and Nilsson, whilst I shall afterwards add a third piece of evidence from an author with whom I have not the same right to assume that Murray was acquainted.

In Schreber's 'Die Säugethiere,' vol. iv. p. 653, it is said of the wood-mouse (*Mus sylvaticus*, Linn.) :—

"They are very fond of taking up their abode under thickets and ruins. Their holes are from one-half to a whole ell under the earth, and consist frequently of two chambers, in one of which is the store of provisions, and in the other the mouse lives alone. The approaches are a perpendicular and oblique tube, in front of the opening of which no cast-out earth is to be observed.

"It feeds both upon corn and upon all sorts of wood-seeds, especially nuts, acorns, and beech-mast. Of these it carries in great provisions."

Nilsson says of the same mouse, in his 'Skandinavisk Fauna,' pp. 348 & 349 :—

"In fields, woods, orchards, and the borders of fields it digs itself holes and galleries in the earth, or makes use of such as are ready to hand, which it enlarges for its own convenience. Here it collects stores of *provisions*, consisting of acorns, fir- and spruce-seeds, nuts and berries, especially mountain-ash-berries, seeds, and juicy roots, which are sometimes accumulated in great quantity. It also peels off the bark from young trees and their roots, especially in winter, under the snow."

These quotations suffice to show that the wood-mice both collect provisions and have large holes for them, whilst they have others for their dwelling-place. But a still closer agreement with the statements given by Henderson will be found in the following short description of the mode of life of the wood-mouse, taken from Melchior's 'Den danske Stats og Norges Pattedyr' (pp. 102 & 103):—

"They live principally," he says, "in woods and gardens and also in fields on the borders of woods. Just under the surface of the ground they dig horizontal galleries, sometimes of half a score yards in length, from which smaller oblique galleries lead down to their domicile, which consists of two small cavities, one for a store-room, the other for the dwelling-place of whole families; and near this last there is again a peculiar small space for impurities, which they never deposit in the proper dwelling-place. Such a residence is commonly from half to one yard below the surface of the ground; but one sees no earth that has been thrown up from it or from the galleries. In winter they visit corn-stacks and sometimes barns.

"Their food, like that of the preceding, consists of corn, stone-fruit, &c., of which they collect a winter supply, but often without making use of it. They likewise eat like the preceding, sitting on their hind legs and holding the food between the fore feet."

We have here the store-chamber, the domicile, the impurity-pit (or cesspool), the long gallery, &c.; and we may lay all the more weight upon this description, if we remember that Melchior had particularly and through a long series of years studied the life of this animal, both in the woods and at home. I can further add, from my own observation, that earth thrown out or up is no more found near the holes of our *Mus sylvaticus* than near those of the Icelandic heath- or wood-mouse—a circumstance which has often struck me. We see from this how completely unwarranted Murray was in expressing himself as he has done at p. 269 (see p. 450):—"That an economic rodent lives in Iceland, is, I think, established; but the account given of its runs and granaries makes it not less clear that it is not *Mus sylvaticus*. There is no European mouse that makes a nest in the manner described by Henderson." It may serve to excuse him, however, that the English faunists have possessed only an imperfect acquaintance with the subterranean home of the wood-mouse. We will here conclude with two of these which are particularly cited by Murray.

T. Bell, in his 'History of British Quadrupeds,' says expressly of *Mus sylvaticus*, Linn.:—"Each one laying up a winter store in its subterranean retreat, the devastations committed by it are considerable." And further:—"Its retreat is formed underground, either in holes formed by its own labour or more frequently in small natural excavations under the trunks or roots of trees, enlarged by themselves, or in the deserted runs of the mole. The quantity of food which is here hoarded is astonishing: it consists of acorns, nuts, corn, and various seeds, or even roots, &c."

Pennant also, in his 'British Zoology,' had already stated the same; for at p. 103 he says, with the addition of two lines from Virgil's Georgics:—"They feed also on nuts, acorns, and corn, forming in their burrows vast magazines of winter provisions.

"Sæpe exiguus mus
"Sub terris posuitque domos atque horrea fecit."

It is perfectly clear that both were well acquainted with the enormous provision-chambers or "granaries" which the mice form, whilst they did not know much about their dwelling-place, galleries, &c. But even their provision-chambers also lead Murray into some confusion, inasmuch as at p. 266 he refers the mouse ("the long-tailed field-mouse") to which the passages just quoted from Pennant and Bell apply to the *Arvicolinæ*, probably because he calls these "voles" or "field-mice," and in a moment of inattention forgot that the "long-tailed field-mouse" of the above-mentioned authors is a true mouse and *Mus sylvaticus*, Linn.

By these observations I think all doubt is removed with regard to the question how far the reports of the Icelanders as given by Olafsen and Henderson can apply with any probability to any other Icelandic mouse than the one which we already know from Iceland under the name of *Mus sylvaticus*, Linn., or *M. islandicus*, Th. After this, Murray's map lxxix. p. 270, which represents the geographical distribution of the species of mice which live in the open, will have to be altered.

But as Murray's view is the clear expression of the thought that there probably lives in the interior of the country another mouse (an Arvicoline form, and most likely a lemming), which has hitherto escaped observation, and as, at any rate, in a letter to me (for which I am much indebted to him, and in which he kindly replies to some epistolary remarks upon his hypothesis made with great brevity and only *en passant*) he has strongly affirmed the possibility of this, and at the same time urged me to obtain information from Iceland to clear up the matter, I may be permitted to add the following further explanations.

It is far from being the case, as some might perhaps think, that the statements given by the Icelanders to Olafsen and Henderson relate to a mouse living in the interior or very far from buildings. Madame Benedictson, when she was a young girl, would certainly not have amused herself for half a day in such deserts; and the wood of Husefell was and is a much frequented place* through which a highway passes from Borgarfjorden; the situation therefore was such that the Icelanders had good opportunities of noticing the animals' proceedings; and Olafsen himself states expressly that travellers often meet with the store of provisions laid up by the mice. Moreover, how could it be possible for a mouse which lived far from dwellings, or far in the interior of the country, to obtain cow-dung for its rafts?

On the other hand, it must not be forgotten that even if the animal that was the subject of these reports had been a lemming, it need not have lived in the interior: the very species of lemming that Murray thinks it might have been is not an inland animal, but occurs near the coasts.

Finally, it must be remembered that the interior of the country far from habitations is by no means unfrequented or unknown, and least of all the districts which still have an abundant vegetation of bushes and berry-bearing plants. Not to mention the journeys of the Icelanders and foreigners through a great part of the interior in passing from one principal part of the country to another, the roads between which, indeed, chiefly pass through uncultivated districts, I shall only say that I myself moved about the country with a tent for two summers, and often and for a long time remained far from houses, and that my travelling-companion Hallgrimsson has done just the same in other corners of the country. Neither of us saw the least trace of any animal resembling a lemming, or heard the Icelanders mention any such animal; and I must also add that our attention was already called to the subject in consequence of the discovery by Scoresby of a *Hypudæus* or *Lemmus* on the east coast of Greenland.

* It is frequented by people from nearly the whole of Borgarfjorden, who obtain from it birch wood for charcoal and for building-purposes. (Smlgn. Eg. Olafsen, i. pp. 167, 168.)

Thus also we get rid of every reason for placing Iceland in the map* as belonging at present to the circle of distribution of the lemmings, and likewise for placing it among the countries which have a western or American fauna of terrestrial mammals†; for, provided the Iceland mouse is to be regarded as a terrestrial mammal of the island before its peopling, there cannot be the least shadow of doubt that, like the species of *Helix* and the other land and freshwater mollusca, with the whole of the land flora, it points towards Scandinavia and Lapland, and removes the island from Greenland and North America. It was also in opposition to this *eastern* type in the existing flora and fauna of Iceland that the distinctly expressed *western* or *American* type which I found in the Icelandic Tertiary flora of the Surturbrands had already struck me as so remarkable.

But these discussions lead in the end to a pressing request to the Icelanders that they will send to the Zoological Museum from different districts of that great island the mice living in the open country and far from human habitations, especially preserved in spirits; for, although there is no particular reason for supposing that there would be among them forms which we do not already know, still several important scientific questions attach to this mouse:—first and chiefly whether the definite peculiarities upon which it has been thought that it might be set up as a peculiar species, or a peculiar Icelandic variety of another allied mouse, are always present; and next, whether, if this be the case, these peculiarities can be supposed to have been developed in Iceland, or whether they also occur elsewhere and may have come thence with the mice to Iceland.

BIBLIOGRAPHICAL NOTICE.

Preglacial Man, and Geological Chronology. By J. Scott Moore. 8vo, pp. 120. Dublin and London, 1868.

When the Hebrew sage gave expression in his native language to a view of creation and cosmogony according to the wisdom of the Egyptians, he began his divine mission by withdrawing his people from the superstitions of ignorance and fear, and fixing their attention on the one omnipotent and omniscient Creator. What remains

* See map lxxxv., p. 266, of Murray's work.

† See Murray's map ci., p. 308. If the synonymy given by Murray be correct, and *Myodes grœnlandicus* be really identical with one of Pallas's species from Siberia, this will prove that this lemming's occurrence in Iceland would just as well indicate an eastern as a western fauna for that island.

to us, in altered language, of his grand but vague conception of earth's earliest days has been a light indeed to millions, who would have had no thought of Nature's unity and order, but would have lived in alternate apathy and fear, trembling at the tempest-god and basking in the sun-god's rays. Who knows how many generations of active, observant, meditative men, born and bred amidst Asiatic and Egyptian civilization, lived and died before the fruits of their observation and thought had ripened in the form that Moses found in Egypt, and with which he vivified and fed the Israelitish mind, giving it strength for future greatness? Whether fashioned in the visions of the night, or in the waking ecstasies of the day, or worked out in cool and sober exercise of his judgment, the Mosaic Cosmogony is such as the philosopher of Egypt, knowing something of the nature of things, and recognizing something of the relationships of living beings, would represent in his picture of new-born Nature—the universal preceding the special, the inert preceding the active, vegetation preceding animal life, the fish and bird preceding four-footed creatures, and the brute beast preceding intelligent Man. For he knew that the land comes from the sea, grass from the earth, that water must preexist for the inhabitants of water, and that for the animals that feed on grass, and for those that eat their fellows, the conditions of life must preexist—that the great come from the small, and that the brute, by analogy, must have preceded the intelligent.

In after ages several of the aspects, conditions, and phenomena of heaven, earth, and animated nature were better understood; and in still later times a knowledge of their mutual relationships, probable origin, and manifold changes has been, in many cases, either mastered or approached. The physician of the middle ages was both hampered with the (to us absurd) notion that the Aristotelian system of philosophy was perfect and not to be infringed, and further fettered with the belief that all would be wrong if the Hebraic legends of Nimrod, Noah, Tubal, Jubal, Jabal, Cain, and Adam were not fully accepted. Nor, indeed, can we at the present day, free as we are from the proofless fancies and needless errors of mediæval thinkers, separate for ourselves the useful moral lessons of the old Hebrews from the long-cherished influence of their local traditions, vague legends, and mythical poetry, and cease altogether to be trammelled with a universal deluge, a single human race (whether Adamitic or Noachian), a primeval golden age, and a "hexaëmeron" of creation for the universe,—all incongruous with the exact results of observational, experimental, mathematical, and inductive science.

Astronomy has corrected many of the old-world notions, and yet the Mosaic writings have not lost their moral power in guiding the hearts of men. Geology has proved that the readily suggested idea of sea-shells and mammoth-bones having been left on high hills by a deluge is totally incorrect, and that the earth's crust has been formed of innumerable layers of sediment, each dating by years or ages, often interrupted for long periods, and moreover warped into undulations, like crumpled cloth, by the crush of slow contraction—

that these strata, too, have been pared down by the slow action of sea-waves, or of the weather, rain, and glaciers—and, besides, are full of the remains of successive groups of animals and plants, for any one of which successions our history seems too short a term. Nor does geology fully confirm the bold generalization that the higher kinds of animals did not exist in early times; for though the evidence is strong in that direction, it is not so powerful as it was some years ago. And yet the good old sage's teaching, that the earth is God's, and is not self-existent, that man is God's, and is not to worship earth nor seek wholly his pleasure in himself and in the present, is not weakened—it is enforced; for every added fact of the earth's great history supplies a link for us in the great chain of orderly succession, connecting the beginning, when God created the heaven and the earth, with the beauty and progressive order of to-day.

But anthropology does no less, and philology, with clear-headed antiquarian research; all help to take the history of man out of the domain of tradition and the region of legendary myths,—finding the lost places of habitation by the broken column of the city or by the shell-heap and stone knife of the cave-dweller, piecing the broken languages of sculptured rock and tablet—finding the real meaning of names, and tracing the nursery-tale, through legend and myth, to its simple germ among the child-nations, giving simple utterance to their thoughts of nature and their gods, of their people, their wanderings, their conflicts, and their prowess—and, lastly, comparing man with man, in his many forms and in his widely separate abodes, undreamt of by the sages of antiquity. And when man shall have been known in all his present and past modifications, far exceeding already the limited ethnology of the genealogist of Canaan, Judæa, and Syria, his religious teaching will still be based on the grand and true enunciation of Moses, that his Creator is an eternal, omnipotent, omniscient, and loving Father.

As information is collected year by year, the old notions concerning the history of the earth and man are broken one by one; but few of those most concerned in finding and proving new facts can do more than follow their own line of research, and give their knowledge to their fellows and the world. There are, however, many intelligent readers of scientific books and memoirs who, without original research of their own, appreciate the labours of others, and strive, with good intentions, to lay before the public their best digested views of how things are now to be understood, boldly setting aside some of the old notions—leaving others, reduced in importance, to survive awhile for those with whom they are sacred beliefs,—turning the oft-translated word of forgotten alliance in a new direction, and shaping the obsolete phrase to a new meaning,—finding undreamt-of analogies and curious coincidences in a simple statement of hoar antiquity,—matching the known prehistoric remains of man with mythical nations,—and once again, like previous compilers of half-mastered statements, expounding, sorting, and patching the ill-understood researches of geologist and anthropologist until they agree with the grand and vague system of primæval nature which, with its literal simplicity, general truthfulness, and sublime import, prefaces the old records of Hebrew and Canaanite, their wars and their wanderings in narrow limits between the Euphrates and the Nile.

Since Mr. J. S. Moore's book entitled 'Preglacial Man' was published, he will have discovered probably that geologists know of no 'Preglacial Man' as yet: if he has learnt this, he will know of several other weaknesses in his book ; if he has not, it matters little, for the book can influence no scientific person, and its other readers may live and learn.

We notice this book as one of those very numerous attempts to widen the spread of scientific knowledge, though the information offered is not what it ought to be, and though its hypotheses are the vain offspring of hypotheses as yet unproved,—altogether the result of a partial study of modern British geology, shaped by the author's views, and framed with the fragments of a belief in the Mosaic cosmogony, laboriously worked up with his present notions of natural science as elucidating the history of the earth and man.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

April 22, 1869.—Joseph Prestwich, Esq., Vice-President, in the Chair.

"Description of *Parkeria* and *Loftusia*, two gigantic Types of Arenaceous Foraminifera." By Dr. Carpenter, V.P.R.S., and H. B. Brady, F.L.S.

The Authors of this Memoir commence by referring to the separation of the series of *Arenaceous* Foraminifera from the *Imperforate* or *Porcellanous*, and from the *Tubular* or *Vitreous*, first distinctly propounded in Dr. Carpenter's 'Introduction to the Study of the Foraminifera' (1862), on the basis of the special researches of Messrs. Parker and Rupert Jones, who had pointed out that whilst there are several genera in some forms of which a cementation of sand-grains into the substance of the calcareous shell is a common occurrence, there are certain genera in which a "test" formed entirely of an aggregation of sand-grains takes the place of a calcareous shell, and that these genera constitute a distinct Family to which important additions might probably be made by further research.

The propriety of this separation of the *Arenacea* from the calcareous-shelled Foraminifera has been fully recognized by Prof. Reuss, the highest Continental authority upon the group, who had come to accept the principle laid down in Dr. Carpenter's successive Memoirs (Phil. Trans. 1856–1860), that the *texture of the shell* is a character of fundamental importance in the classification of this group, the *plan of growth* (taken by M. d'Orbigny as his primary character) being of very subordinate value, and who had, on this basis, independently worked out a Systematic Arrangement of the entire group, which presents a most remarkable correspondence with that propounded by Dr. Carpenter and his coadjutors. And their anticipation of important additions to the Arenaceous series has been fully borne out, on the one hand by the discovery of several most remarkable new forms at present existing at great depths in the Ocean, which has been made by the dredgings of M. Sars, Jun., and those of the 'Lightning' Expedition, and on the other by the determination of the real characters of two fossils, one of the Cretaceous, and the other probably of the earlier Tertiary period, which prove to be gigantic examples of the same type.

The first of these, discovered by Prof. Morris more than twenty years ago in the Upper Greensand near Cambridge, was long supposed to be a Sponge; but his more recent discovery of two specimens which had been but little changed by fossilization, led him to suspect their Foraminiferal character; and this suspicion has been fully confirmed by the careful examination made of their structure by Dr. Carpenter, to whom he committed the inquiry, and by whom, with his concurrence, the name *Parkeria* was assigned to the genus. The second, which was obtained by the late Mr. W. K. Loftus from "a hard rock of blue marly limestone" between the N.E. corner of the Persian Gulf and Ispahan, bears so strong a resemblance in its general form and mode of increase to the genus *Alveolina*, that its Foraminiferal character was from the first recognized by the discoverer; but as all the specimens brought by Mr. Loftus had undergone considerable alteration by fossilization, their minute structure, though carefully studied by means of transparent sections, could not in the first instance be satisfactorily made out. When, however, Dr. Carpenter's investigation of *Parkeria*, with the full advantage of specimens but little changed by fossilization, revealed the very remarkable plan of its structure, the investigation of this type was resumed by Mr. Brady (who assigned to it the name *Loftusia*), with the new light thence derived: for as transparent sections of infiltrated *Parkeriæ* furnish a middle term of comparison between specimens of the same type which retain their original character, and transparent sections of infiltrated *Loftusiæ*, the last-mentioned can now be interpreted by reference to the preceding; so that the obscurities which previously hung over their minute structure have been almost entirely dissipated.—The description of the structure of *Parkeria* in this Memoir is by Dr. Carpenter, and that of the structure of *Loftusia* by Mr. H. B. Brady; but each has gone over the work of the other, and can testify to its correctness.

The specimens of *Parkeria* which have been collected by Prof. Morris* are spheres varying in diameter from about 3-4ths of an

* Since this Memoir was completed, the Author has learned that Mr. Harry Seeley, of Cambridge, has collected several specimens of this type, and has been studying it independently with a view to publication. And Mr. Henry Woodward has placed in his hands a specimen from the Upper Greensand in the Isle

inch to about $1\frac{1}{4}$ inch. The character of their external surface differs considerably in different individuals; but the Author gives reason for believing that it was originally tuberculated, like a mulberry, and that the departures from this have been the result of subsequent abrasion. The entire sphere is composed of a great number of concentric layers, all of which, except the innermost, are arranged with very considerable regularity around a central "nucleus," which consists of five chambers, disposed in *rectilineal* sequence, thus unmistakably indicating the Foraminiferal character of the organism, which might otherwise have remained in doubt, on account of the entire divergence from any known type presented in the structure of the concentric layers. The first of these layers is moulded (as it were) on the exterior of the nucleus, and partakes of its elongated form; but the parts of every additional exogenous layer are so arranged as to bring about a gradual approximation to the spherical form, which is afterwards maintained with great constancy. Each layer may be described as consisting of a lamella of "labyrinthic structure" (that is, of an assemblage of minute chamberlets, whose cavities communicate freely with one another), separated from the contiguous lamellæ by an "interspace," which is traversed by "radial tubes" that pass from each lamella to the one external to it. All these structures, in common with the chamber-walls and septa of the "nucleus," are built up by the *aggregation of sand-grains of very uniform size*. These sand-grains are found to consist of *phosphate of lime*; and they seem to be united by a cement composed of *carbonate of lime*, which was probably exuded by the animal itself. Although there is a very general uniformity in the thickness of the successive layers, the proportion of their several components varies considerably in different parts of the sphere. In those which immediately surround the nucleus, the solid lamellæ, which are composed of labyrinthic structure, are comparatively thin; whilst the interspaces which separate them from one another are very broad, so that the radial tubes which traverse these interspaces are very conspicuous. As we pass outwards, we find the labyrinthic lamellæ increasing in thickness, whilst the breadth of the interspaces diminishes in the same degree, until we meet with layers in which the interspaces are almost entirely replaced by labyrinthic structure. With this increased development of the labyrinthic structure in the concentric lamellæ themselves, we find it extending between one lamella and another, as an investment to the radial tubes—thus forming "radial processes" of a subconical form, which occupy a considerable part of what would otherwise be the interspaces between the successive lamellæ. Still every lamella is separated from that which invests it (except where brought into connexion

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of Wight, which is not less than $2\frac{1}{4}$ inches in diameter. It is interesting to remark that the "nucleus" of a smaller specimen from the same locality consists of a considerable number of chambers arranged in a *spire*, the structure of its concentric spherical layers being exactly the same as in the specimens described in the text.

with it by its radial processes) by a system of cavities, which are in free communication with each other, and which may be collectively designated the "interspace-system;" and from this system the labyrinthic structure of the investing lamella is entirely cut off by an impervious wall, which bounds it upon its *inner* side; whilst its chamberlets open freely upon the *outer* side of the lamella, into what, when it is newly formed, is the surrounding medium, but, when it has itself been invested by another layer, into its "interspace-system."—In the larger of the two non-infiltrated specimens which have furnished the materials for the present description, the number of concentric layers is 40, and their average breadth about 1-65th of an inch.

The Author discusses the mode in which this composite structure was formed; and comes to the conclusion that the production of each new layer was probably accomplished by the instrumentality of the sarcodic substance, which not only filled the chamberlets of the preceding layer, but projected beyond it—that the radial processes were first built up like the columns of a Gothic cathedral, and that their impervious investing wall spread itself from their summits, so as to form a continuous lamella over the sarcodic layer, in the manner that the summits of such columns extend themselves to form the arched roof of the edifice—and that, on the floor of the new layer thus laid, the partitions of the chamberlets were progressively built up by the agency of the sarcodic substance conveyed to the outer surface of that floor through the radial tubes. The author further argues, from the analogy of living *Foraminifera*, that notwithstanding the indirectness of the communication between the cavitary system of the inner layers and the external surface, the whole of that system (consisting of the labyrinthic structure of the successive lamellæ, and of the interspaces which separate them) was occupied during the life of the animal by its sarcode-body.

The *plan of growth* in *Loftusia* is stated by Mr. Brady to differ extremely from that of *Parkeria*, whilst its *intimate structure*, on which its physiological condition must have depended, is essentially the same—thus affording a conspicuous example of the validity of the principle of Classification already referred to. This difference is indicated by its shape, which closely resembles that of many *Alveolinæ* and *Fusulinæ*, being a long oval, frequently tapering almost to a point at either end, though sometimes obtusely rounded at its extremities. Of two large and perfect examples in the collection of the late Mr. Loftus, one measures $3\frac{1}{4}$ inches by 1 inch, the other $2\frac{1}{4}$ inches by $1\frac{1}{4}$ inch. A transverse section at once indicates that the plan of growth is a spiral, formed by the winding of a continuous lamina around an elongated axis, the general disposition of the chambered structure being very similar to that which would be produced if one of the simple *Rotalinas* were thickened and drawn out at the umbilici. The space enclosed by the *primary lamina* is divided into chambers by longitudinal septa, which may be regarded as ingrowths from it, extending, not perpendicularly (as in *Alveolina*), but very obliquely. The chambers, separated by these principal or *secondary* septa, are long and very narrow, and extend from one end of the body to the other. Their cavities are further divided into chamberlets by *tertiary* ingrowths, which are generally at right angles to the septa or nearly so, but are otherwise irregular in their arrangement. No large primordial chamber, such as is common among Foraminifera, has been yet discovered in *Loftusia*; but its absence cannot be certainly affirmed. In fully grown specimens the turns of the spire, which succeed each other with tolerable regularity at intervals of from 1-50th to 1-30th of an inch, are usually from twelve to twenty in number; but as many as twenty-five have been counted in one instance, and a yet larger number might not improbably be met with. The *spiral lamina* and its prolongations, forming the accessory skeleton, are all constructed of almost impalpable grains of sand, which is proved by analysis to have consisted of *carbonate of lime,* united by a cement of the same material.

The Author then describes in detail the several components of the fabric of *Loftusia,* and compares them with the corresponding parts of *Parkeria.* The continuity of increase of the spiral lamina always leaves an open fissure between its last-formed margin and the surface of the previous whorl; and through this aperture the whole system of chambers included within its successive laminæ communicates with the exterior, through the passages between their cavities, which are left in the building up of the septa. As already explained, the labyrinthic structure takes its origin from the *inner* surface of the impervious spiral lamina, the septa being directed towards the central axis. These ingrowths have in many instances the form of tubular columns, which traverse the chambers in a radial direction (*i. e.* perpendicular to the spiral lamina), terminating either on the septum of the previous chamber, or on the exterior wall of the preceding whorl of chambers. But these tubes do not seem to be homologous with the "radial tubes" of *Parkeria,* whose relations differ in important particulars. The range of variation in a number of specimens, as to the amount of the "secondary" and "tertiary" ingrowths which divide and subdivide the chambers in *Loftusia* is very great. The principal office fulfilled by this accessory skeleton seems to be that of a support to the primary spiral lamina, imparting the necessary solidity to the organism. The degree of subdivision of the chambers into chamberlets seems to have little bearing on the general economy of the animal.

The Author attempts to determine from the other Foraminifera, of which the remains are found associated in the same Limestone with those of *Loftusia,* what was its probable geological age, and under what conditions it was deposited; and he thence draws the conclusion that the rock belongs to the lowest portion of the Tertiary period, presenting a microzoic fauna very similar to that of some of our Miliolite Limestones, but richer in the small arenaceous *Rhizopods,* and that the sea-bottom was a soft Calcareous mud lying at a depth of from 90 to 100 fathoms.

MISCELLANEOUS.

The English Pterodactyles.

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

Gentlemen,—In February 1865 a paper of mine was printed in the 'Annals' "On the Literature of English Pterodactyles," written chiefly as a note to Prof. Buckland's account of the *Dimorphodon*. Since then, additional materials have come under my notice, and I wish here to modify, in accordance with our newer knowledge, some of the conclusions then arrived at.

Dr. Buckland's figure is pl. 27, Geol. Trans. ser. 2. vol. iii.

The vertebræ at K, which Dr. Buckland had supposed to be the tail, I then showed reason for regarding either as cervical or sacral. They prove to be sacral, and show a remarkable character (probably ordinal) in being unanchylosed.

The vertebræ which appeared, in the drawings that my notes were written from, to have the centrum convex in front, have the neural arch crushed, so that zygapophyses which seem to look down really look inward. The *Dimorphodon*, like most other Pterodactyles, has the vertebræ of the trunk procœlian, as Prof. Owen long since stated.

The bone figured in the Palæontographical Society's Monograph for 1851, pl. 30, in the collection of the late Mr. Toulmin Smith, has lost its proximal epiphysis. It is the first phalange.

The bone which Prof. Owen, in his Monograph of 1859 (pl. 4. f. 6–8), regarded with doubt as a frontal, and which in 1865 appeared to be the vomer, is almost certainly part of the sacrum.

The skulls and casts of the brain-cavity since found more than justify all that was urged, in the 'Annals' of May 1866, in favour of the claim of Pterodactyles to take rank altogether above reptiles, and as a parallel group with birds.

St. John's College, Cambridge. Harry Seeley.

Impregnation of the Balani.

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

Gentlemen,—Reading a short time since in Dr. Fritz Müller's 'Für Darwin' that he had strong reasons to believe that the gregarious *Balani* were not only hermaphrodite, but also impregnated one another (he came to this conclusion from having observed specimens that, from their colour and general appearance, were hybrid between two species), recalled to my recollection that some few years since Mr. R. Bishop, of this town, informed me that he had actually seen this impregnation take place. At the time I asked him to write me an account of it, which I sent to Mr. Darwin. I have now asked him to recommit his observations to paper, which I send to you for the benefit of the readers of your journal, and which I think sets the doubt at rest.

I am, Gentlemen, yours faithfully,
C. Spence Bate.

8 Mulgrave Place, Plymouth,
May 16, 1869.

"My dear Sir,—Natural history has been so little my study that I should not have presumed to claim a place among observers if you had not encouraged me to believe that a record of an observation which I made some time since on the habits of the *Balanus* may possess some interest among naturalists. I had at that time a small marine aquarium, in which I often kept specimens of Serpulæ, Sea-anemones, *Balani*, &c. It was placed on a shelf, where it had a good through light, and any movements or actions of its occupants could be well seen. On one occasion I watched for some minutes a proceeding in a group of the common *Balanus*, which I have no doubt was the process of impregnation. A long flexible thread-like instrument, of at least double the length of the cirrus, proceeded from near the centre of one of the creatures, and was waved around as if in quest of something. On meeting the cirrus of some of the surrounding animals this was eagerly seized and inserted into them successively, all the animals during the operation giving evidence of a high state of excitement. I regret that, from not being aware at the time that the observation might possess any value, I did not make a record of it, nor did I observe the details with as much minuteness as I should otherwise have done; but I have no hesitation in asserting that the above is substantially correct, and I should think the observation might be easily repeated if desired.

Yours truly, R. B."

Calcareous Sponges. By H. J. Carter, F.R.S.

With reference to the statement in the 'Annals' (vol. iii. p. 16, 1869) that the spicules of *Grantia ciliata* &c. which I had examined had no central canal, I now find, by subsequent examination, that a trace of something like one may often be seen towards the base of the straight arm of the triradiate spicule; and perhaps this may be patent here and there; but it is as often represented by a cast, probably of the same material as that composing the spicule, projecting from its fractured end, and this only in the fresh state, for the heat of mounting in balsam destroys it, while for the most part there is no trace whatever that I can observe. Nor does the calcareous spicule present the concentric lamination seen in the siliceous one, although both break with a similar conchoidal fracture. Perhaps the material, and not the organology, may account for these differences. At any rate, you have only to look for the axial canal in the siliceous spicule to see it, whereas in the calcareous one you can only fancy its existence here and there, in *Grantia ciliata*.

Budleigh-Salterton, May 28, 1869.

Are *Unios sensitive to Light*? By Isaac Lea.

In the March No. of this Journal, p. 286 ('Annals,' May 1869, p. 399), Mr. C. A. White heads an article with "Are *Unios sensitive to light*?" He then gives some experiments which he instituted on the subject, and he seems to be under the impression that his observations were entirely new.

If your readers will turn to the 'Proceedings of the Acad. Natural Sciences of Philad.' for 1857, they will find a communication from me where the subject of *touch, hearing, and sight in the Unionidæ* was pretty fully stated. It will be found in my paper that I experimented on various species of the family, and pointed out some which gave no indication as to sensitiveness to light, while others were particularly sensitive, especially the *Unio radiatus*, Lam. I there stated that the *visual organs* were placed on the fringes of the siphonal opening—that "with a good lens the terminal point of the tentacula may be observed to be rounded and furnished with at least the appearance of an eye; and that it would prove to be a true eye, however imperfect, there can be little doubt." I also stated that I left the subject to Dr. Leidy, believing that "he would be able to make out the complete anatomy of the eye of the Unio."

It was mentioned also in this paper that the females were more sensitive to light than the males.

Subsequently, in the introduction to my vol. vi., "Observations on the Genus *Unio*," &c., I mentioned the subject again, and stated that I had found that the *Unio rubiginosus*, Lea, *U. cylindricus*, Say, and *An. imbecillis*, Say, were all sensitive to light.

On referring to my notes made since the above-mentioned publication, I find that during the years 1858–60, I found the following species "very sensitive to light," viz. *Unio subrotundus*, Lea, *U. pyramidatus*, Lea, *U. obscurus*, Lea, *U. pustulosus*, Lea, *U. Æsopus*, Green. The further investigation of the subject is well worthy the attention of malacologists who are so situated as have all the conveniences of exploration, investigation, and time.—*Silliman's Journal*, May 1869.

On a new mode of Development of the Siphonophora. By A. Pagenstecher.

The author describes a new young form of Siphonophore captured by him at Mentone. It consists of a spherical membranous envelope cut off as it were at one pole, reaching a diameter of half a centimetre, within which a small Siphonophorous colony is suspended by a short cord. The attachment is effected in such a manner that there is upon one side of it a portion comparable to the swimming-column, but not furnished with pieces differentiated into bells—and on the other side the axial filament or stem, on which polyp-bodies are gradually developed by notching of the margin; these subsequently develope urticating apparatus at their base, and each draws out a separate peduncle.—*Verhandl. des Naturh.-medic. Vereins zu Heidelberg*, Band iv. p. 196.

Anomalurus fulgens, *a new Species from the Gaboon.*

The British Museum has just received a specimen (without the skull) of a beautiful and distinct species of *Anomalurus* from the Gaboon. The tail is short, and studded with distinct spines on the underside of the base. The fur is very soft and bright, nearly uniform orange-red; the head rather brighter, with a tuft of white hairs at the outer side of the base of the ears. The underside is rather paler, and whitish on the sides of the abdomen. The upper lip is yellow. The tail is very slender, pale brown, with a pencil of darker hairs at the tip. The hair of the back is pale red for the greater part of its length, with bright dark-orange-red ends, which are frequently terminated by a pale-yellow tip.—J. E. Gray.

INDEX TO VOL. III.

END OF THE THIRD VOLUME.

PRINTED BY TAYLOR AND FRANCIS,
RED LION COURT, FLEET STREET.

G. Jarman Sc.

Ventral aspect. A

x 280

Lateral aspect. B

Fig. 1.

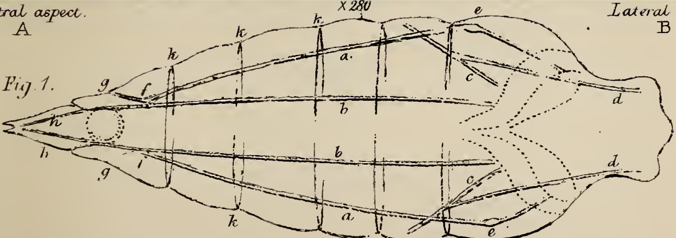

Fig. 2.

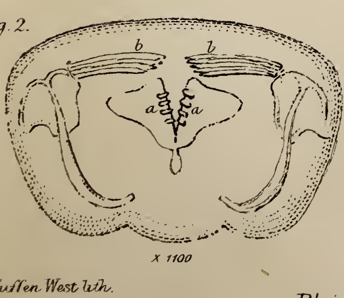

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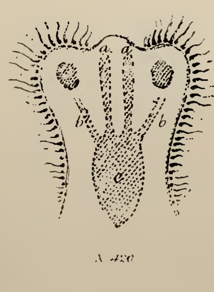
Fig. 3.

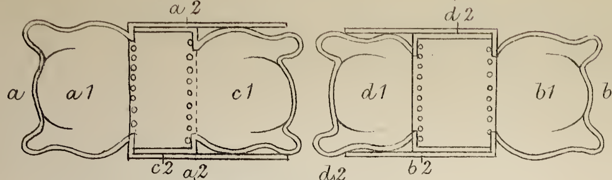


Tuffen West lith.

Rhinops vitrea.

W. West imp

Fig. 3.



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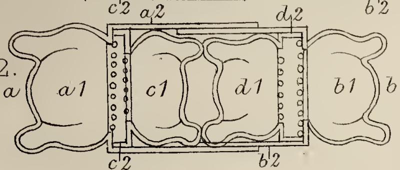


Fig. 1.

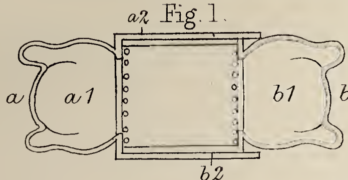


Fig. 4.

Biddulphia pulchella.

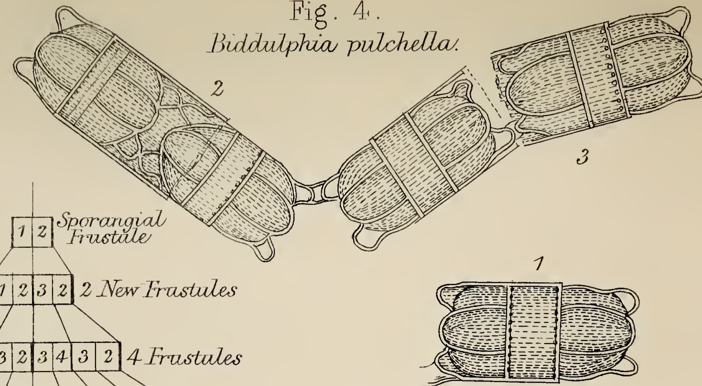
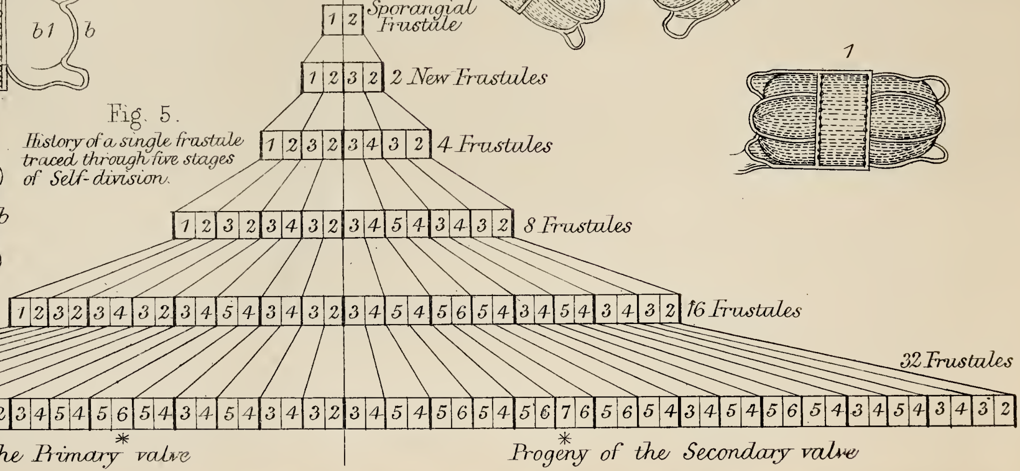


Fig. 5.

History of a single frustule traced through five stages of Self-division.



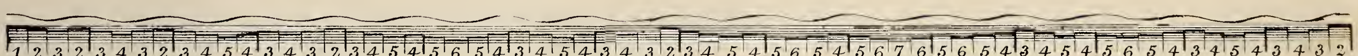
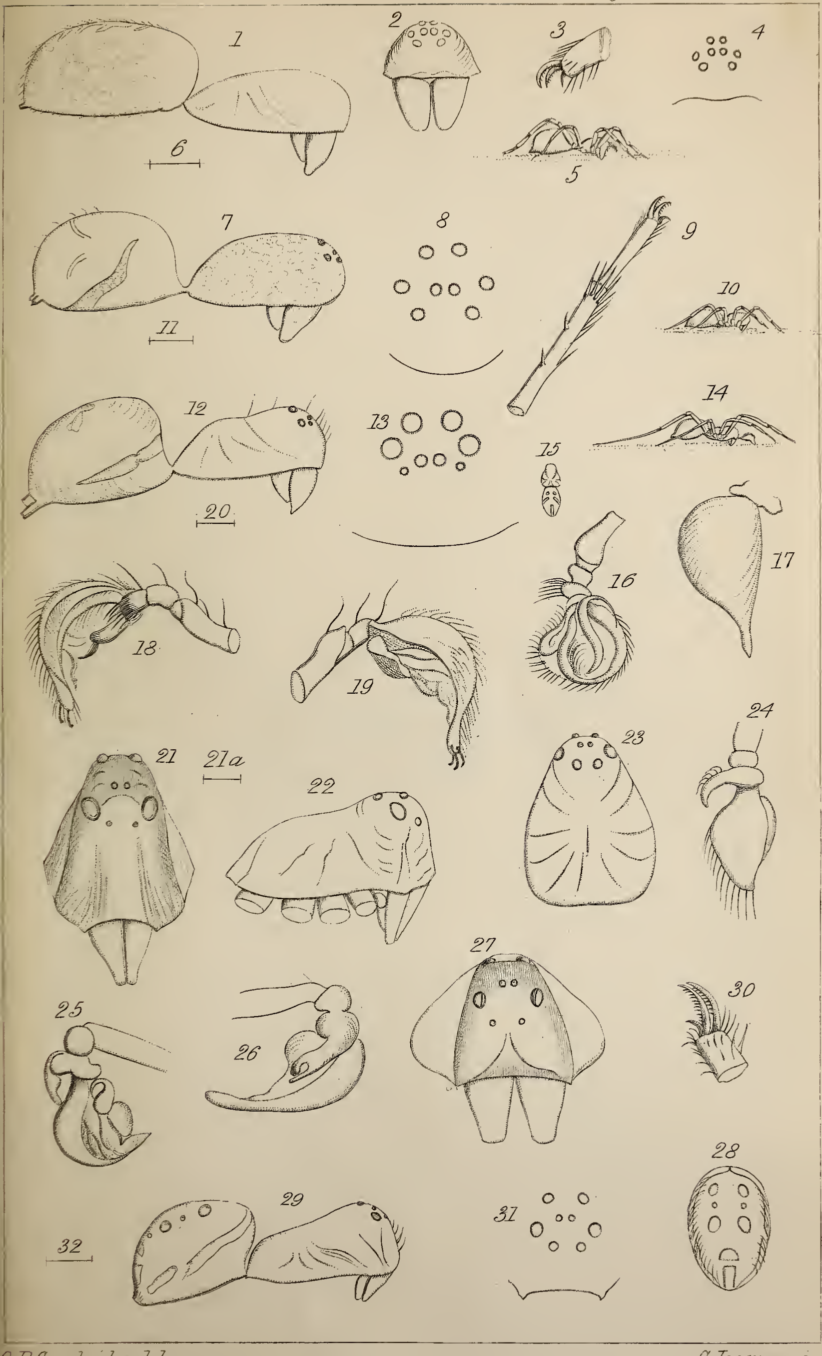


Fig. 6.

J. D. Macdonald ad nat. del. J. Basire lith.



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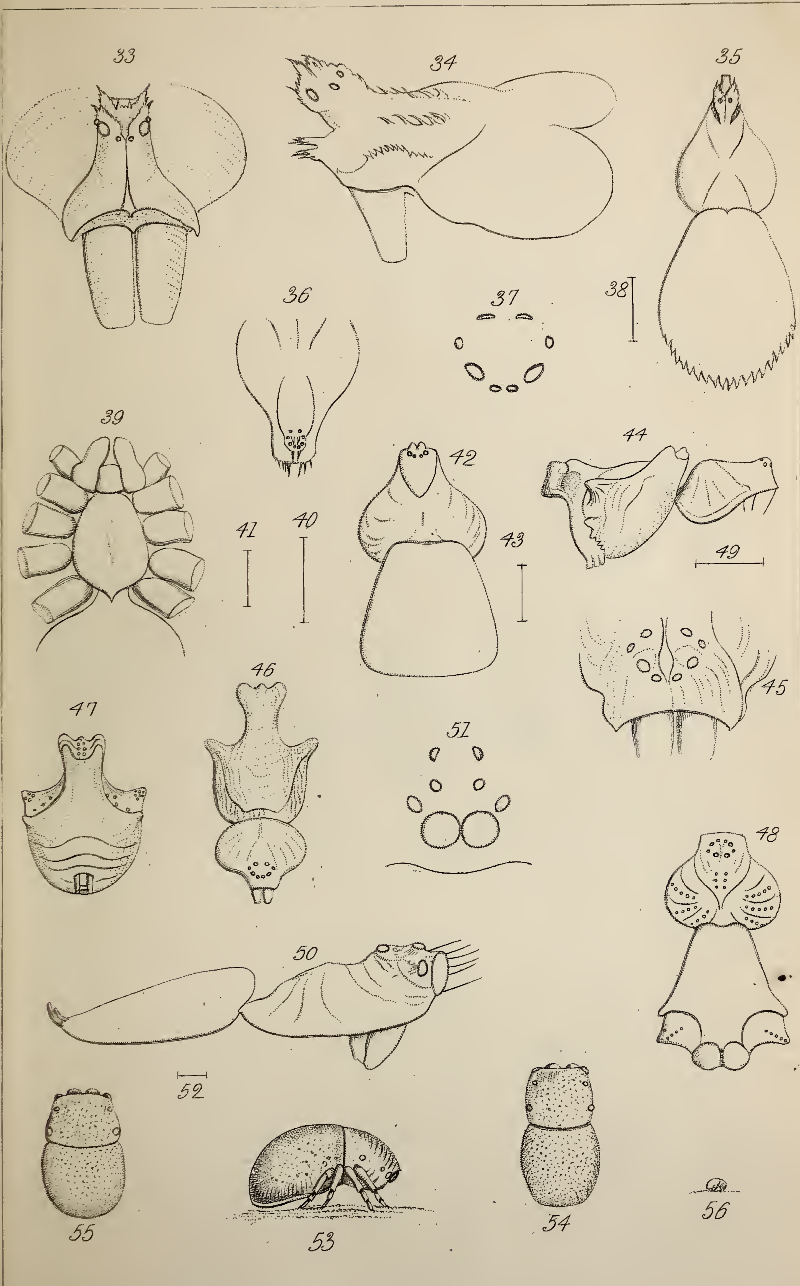

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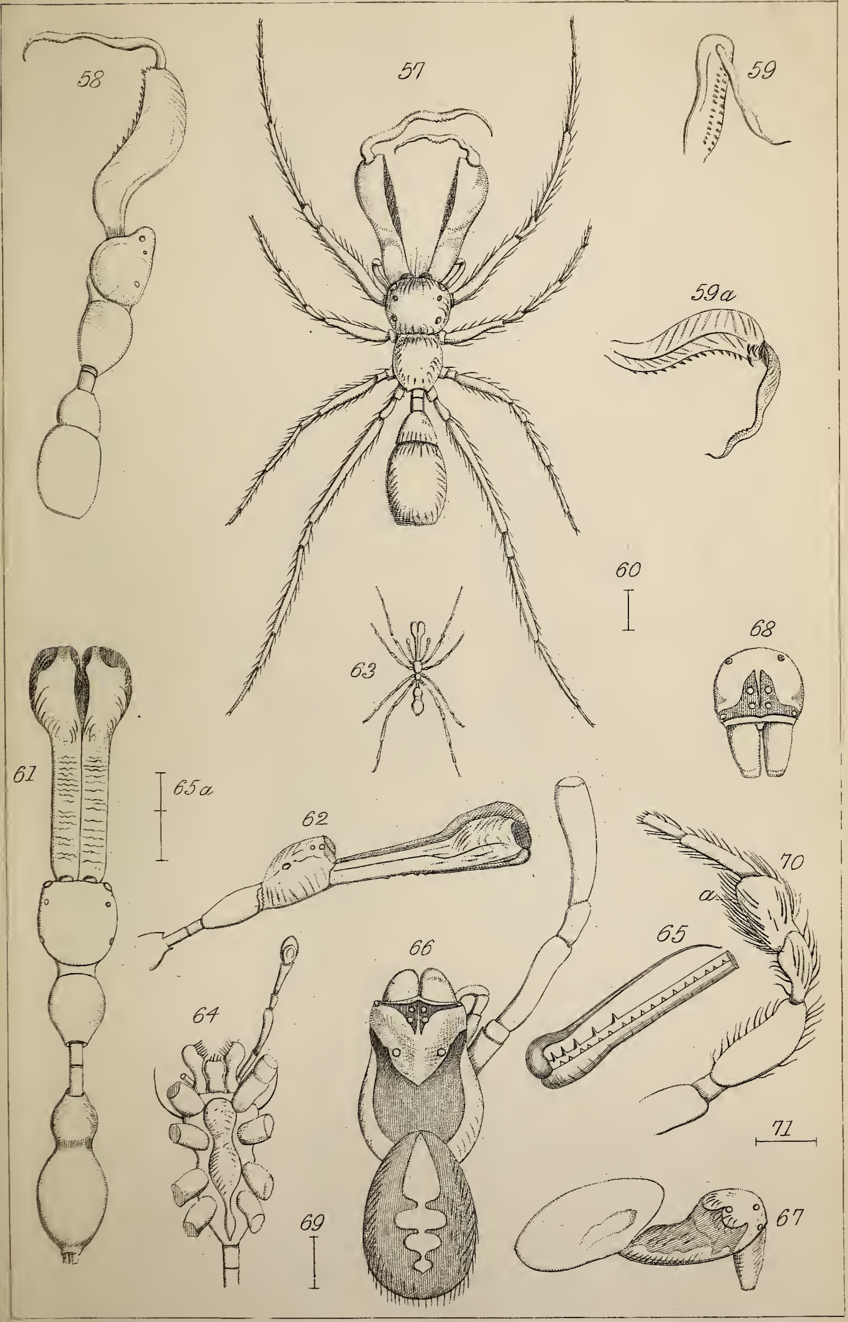

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G. Jarman sc.

Ann. & Mag. Nat. Hist. S.4. Vol. 3. Pl. VII.

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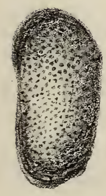

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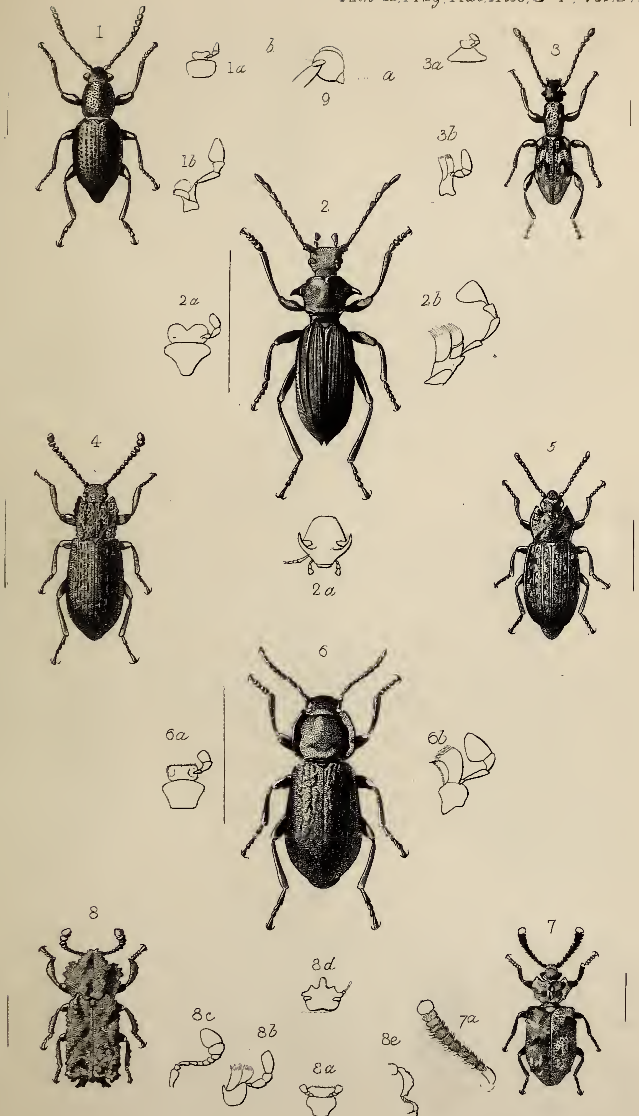
G.S. Brady del. et lith. W. West imp.

G.S. Brady del. et lith.

W. West imp.

A. G. Butler del et lith. Nov 1868. W. West imp.

1. *Heliconius Zelinde*, Butler. 4, *Idiomorphus Zinebi*, Butler.
2. " *primularis*, " 5, *Diadema octocula*. "
3. " *Zobeide* " 6, *Romalæosoma Crockeri*, "

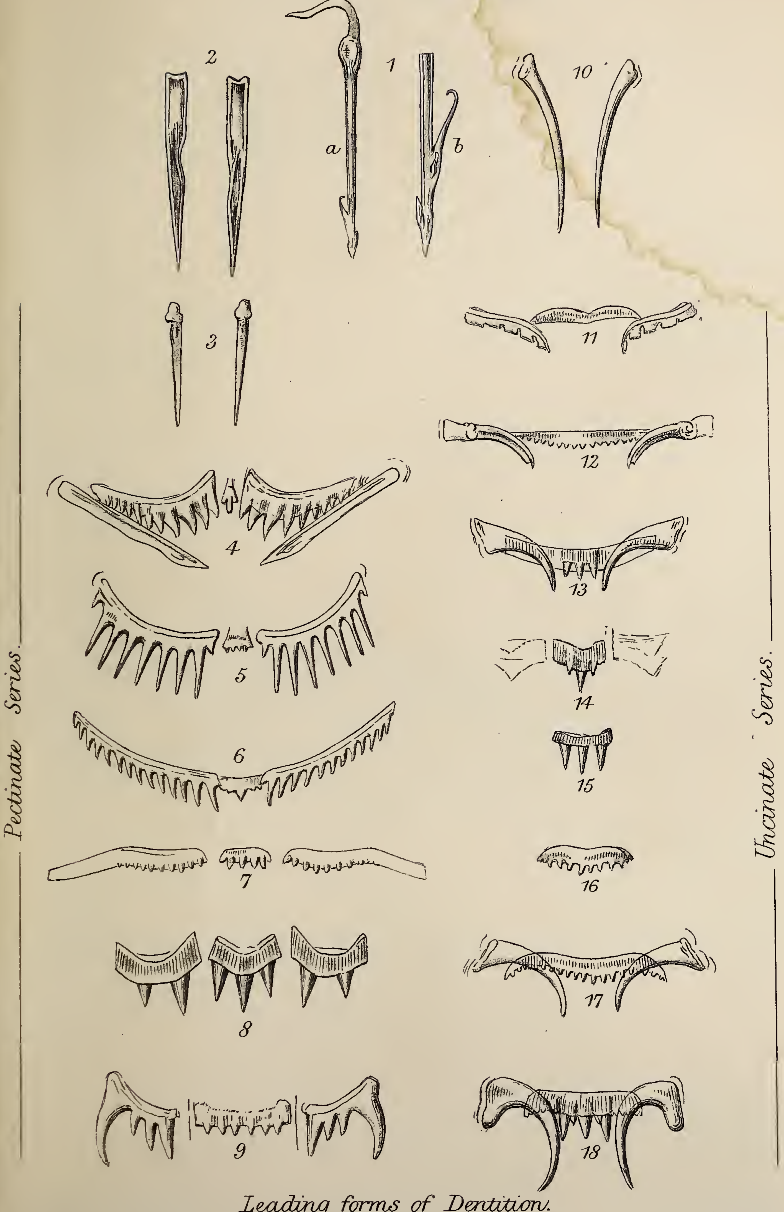


E.W. Robinson Del et Scp. 1868.

E. W. Robinson Del^t et Sc^t 1869

E. W. Robinson, Del.t et Sc.t 1869.

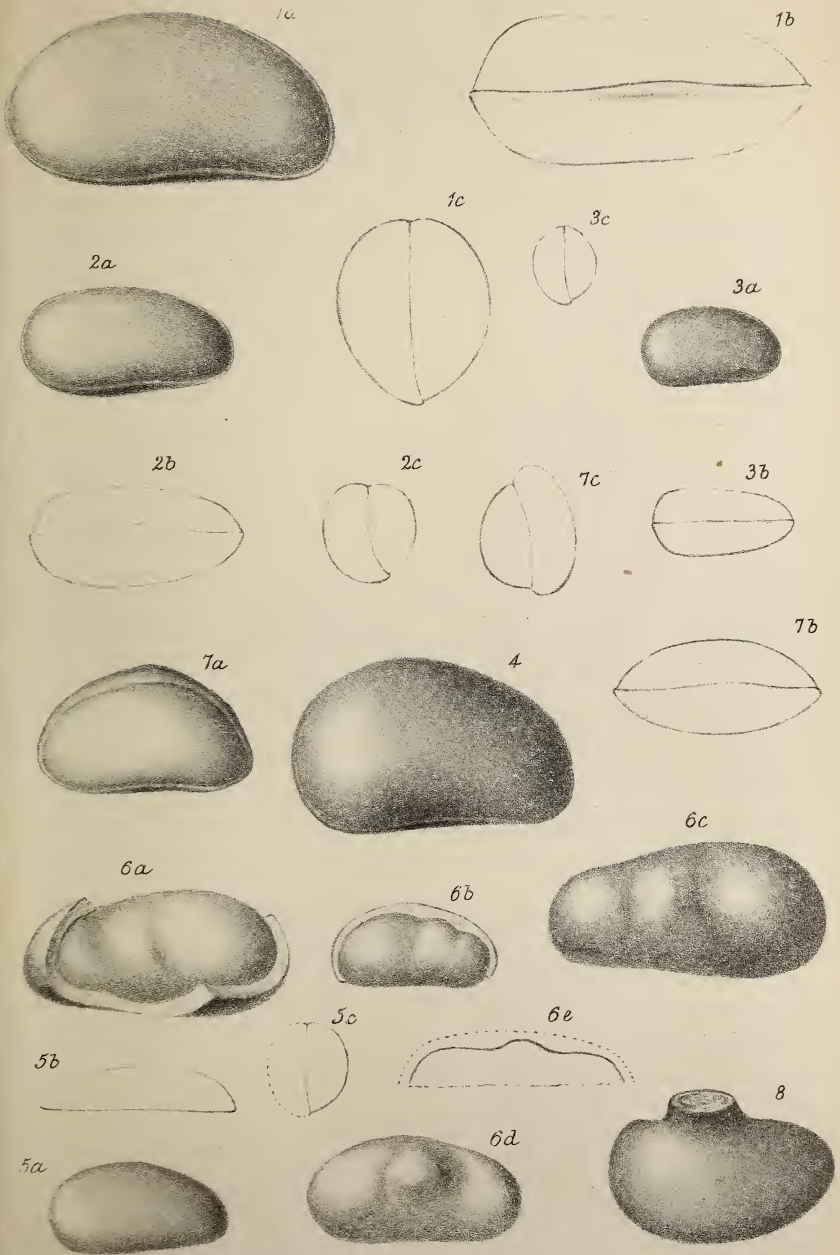
Proboscidifera Orthodonta.



Leading forms of Dentition.
Family Types.

J. D. Macdonald ad nat. del.

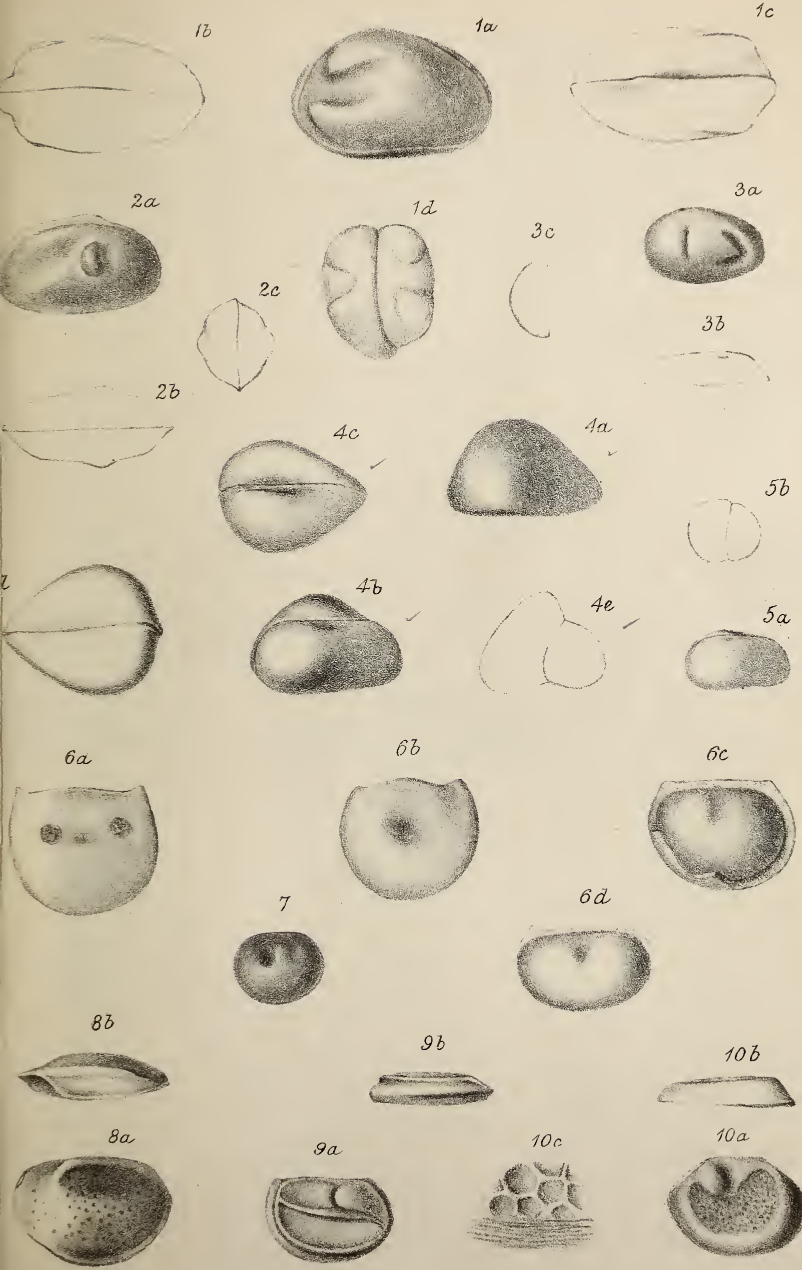
J. Basire lith.



G. West del & lith.

Silurian Entomostraca.

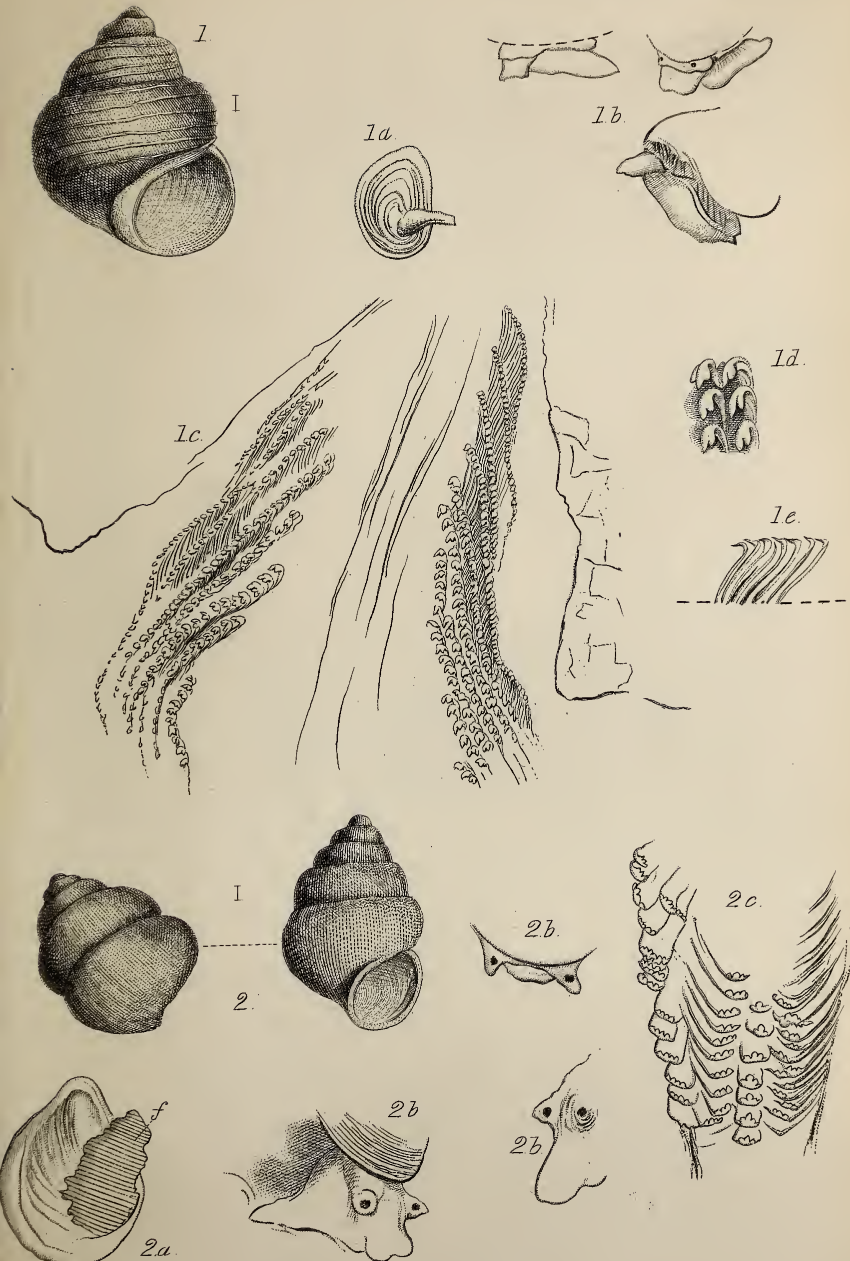
W. West imp



G. West del & lith.

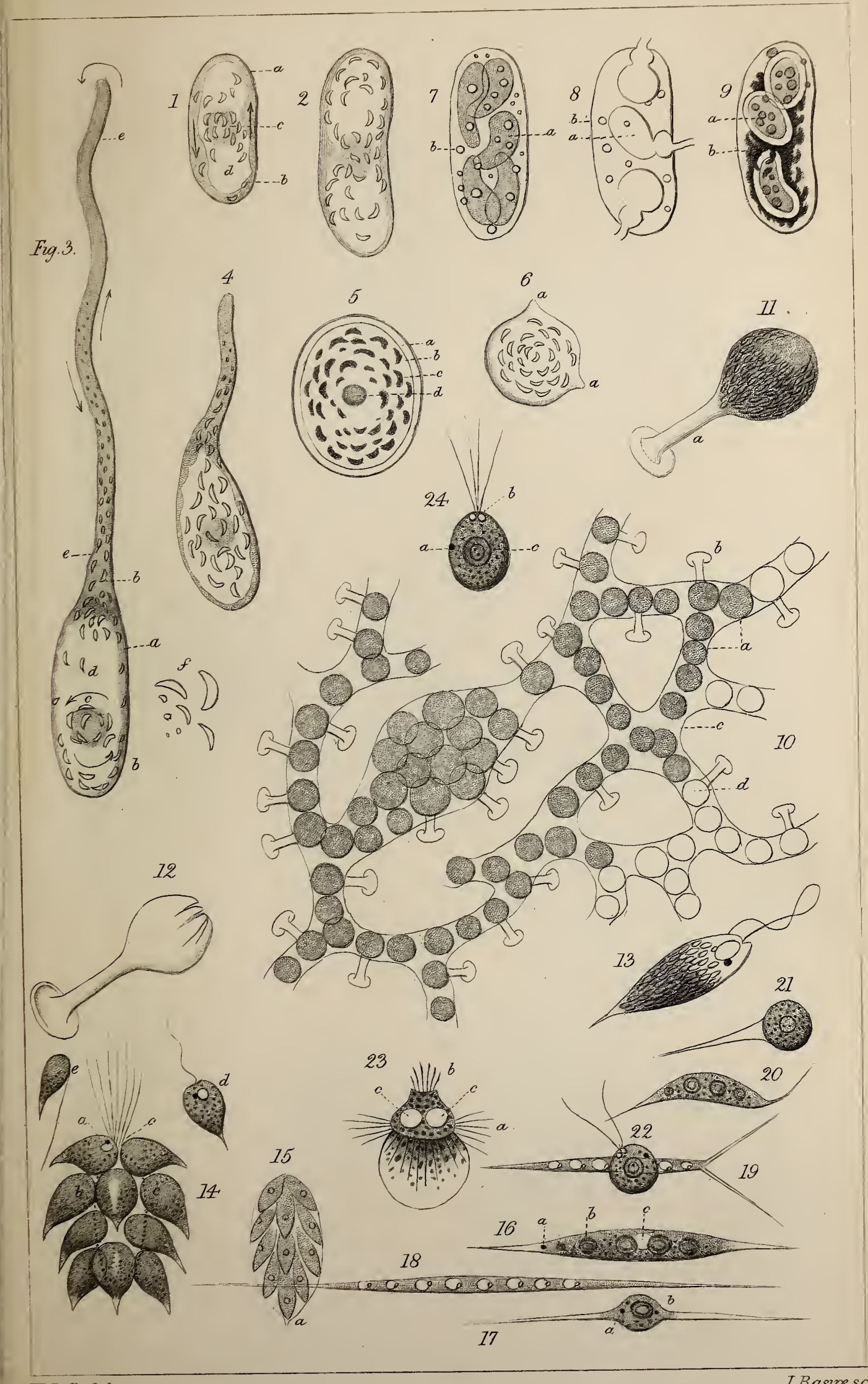
Silurian Entomostraca.

W West imp.

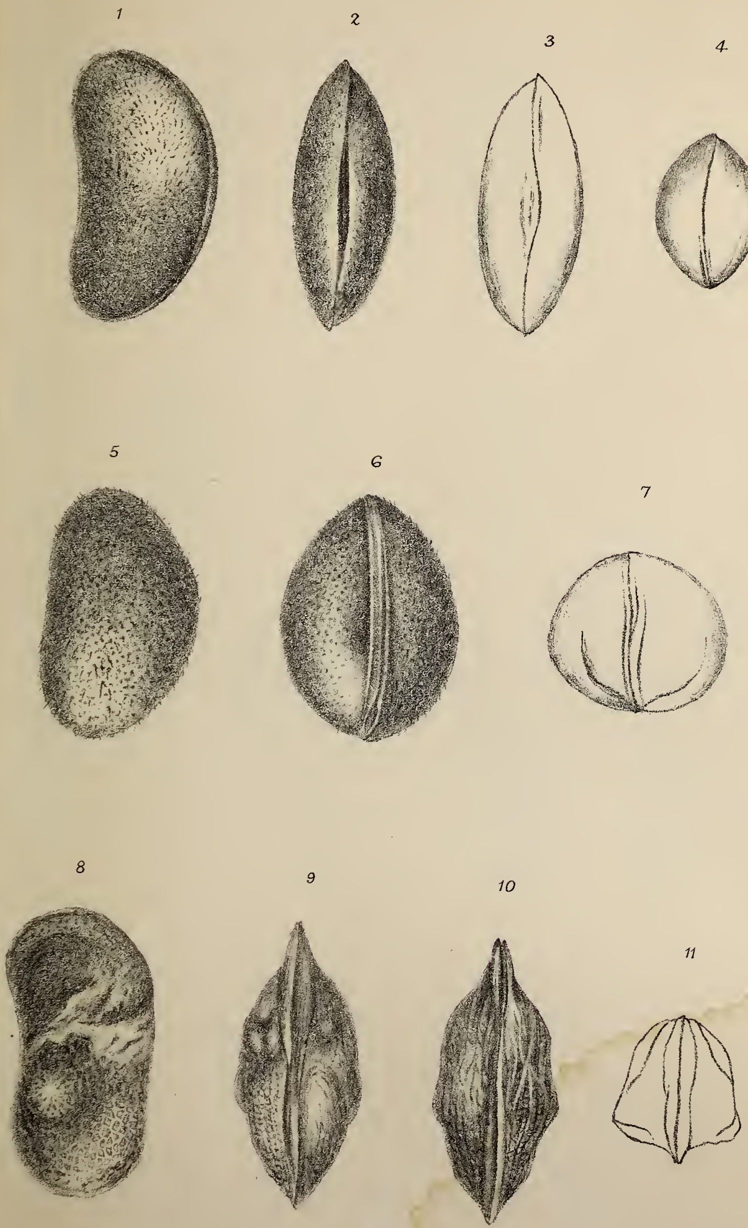


1-Georissa sarrita.
2-Acicula (Acmella) tersa.

G. Jarman sc.



H.I.C. del. *J. Basire sc.*



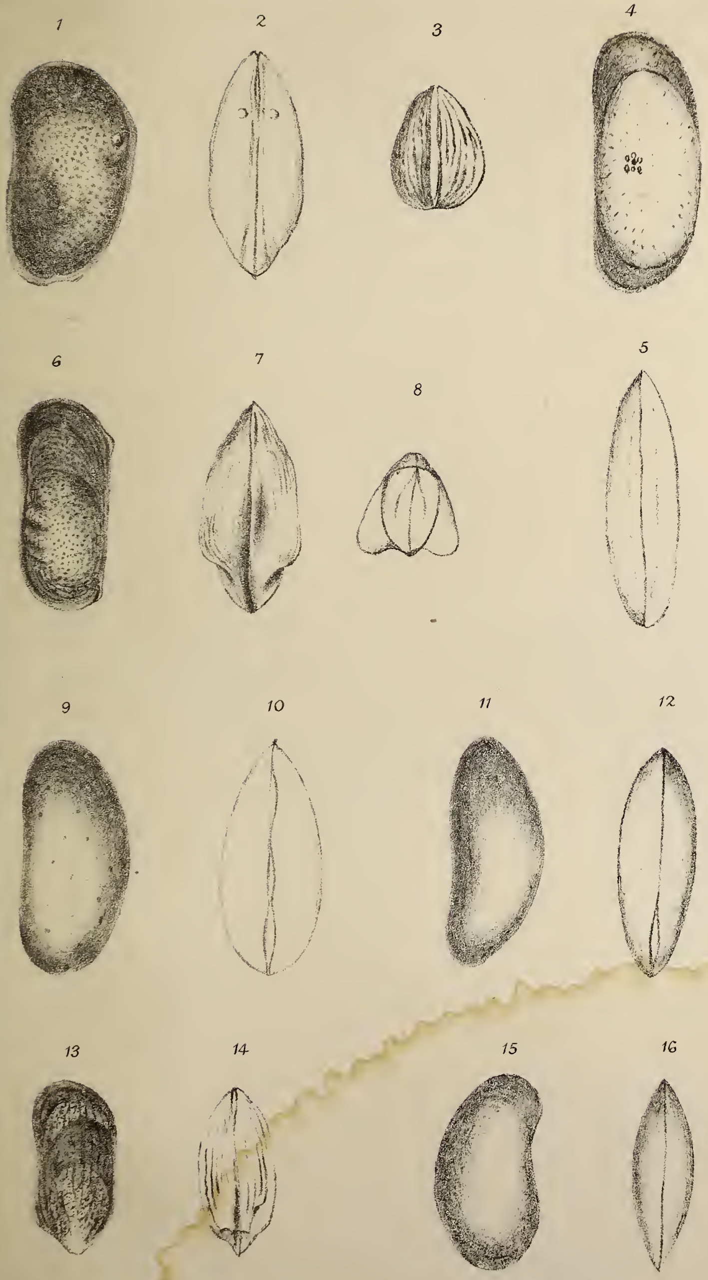
G. S. Brady del et lith.

W. West imp.

G. S. Brady del et lith.

W. West imp

Ann. & Mag. Nat. Hist. S. 4. Vol. 3. Pl. XX



G. S. Brady del. et lith.

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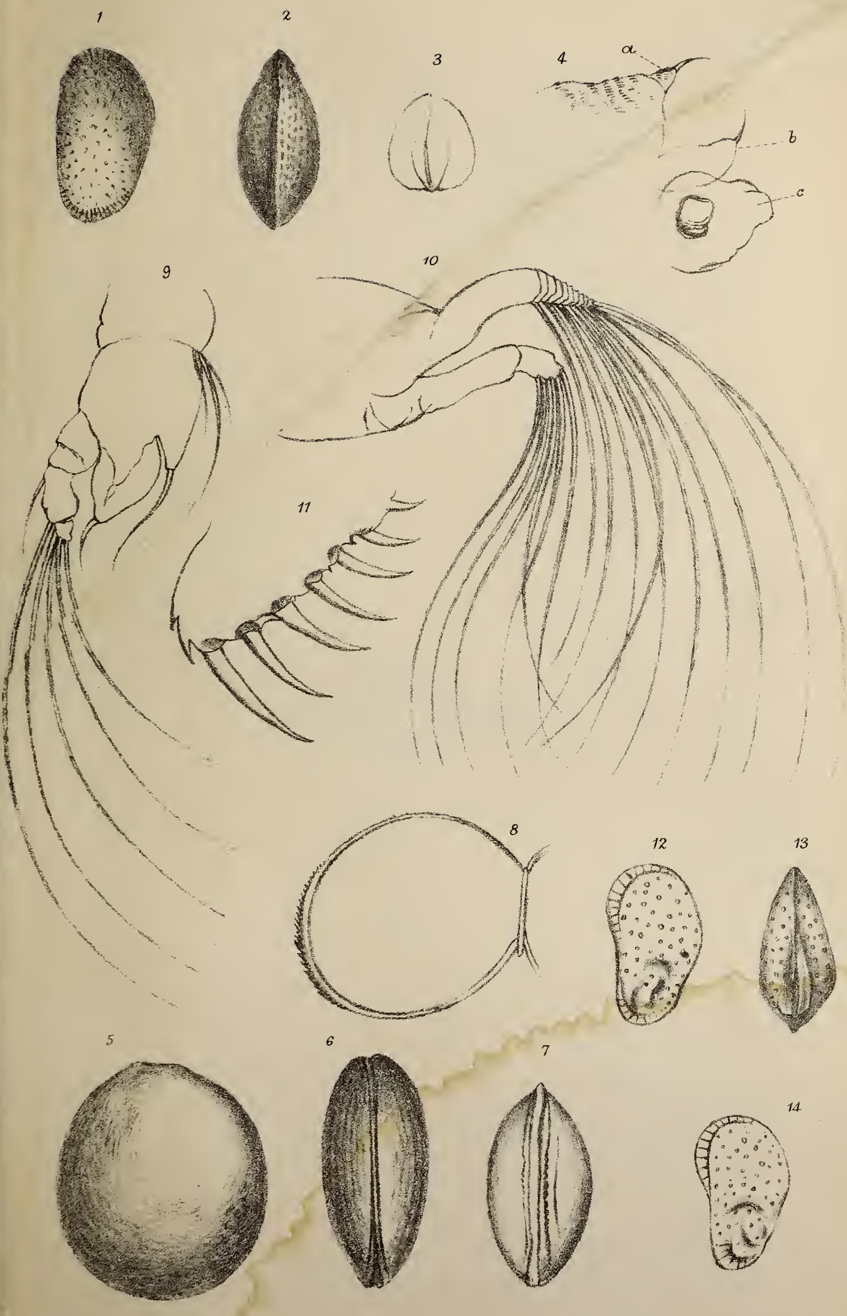
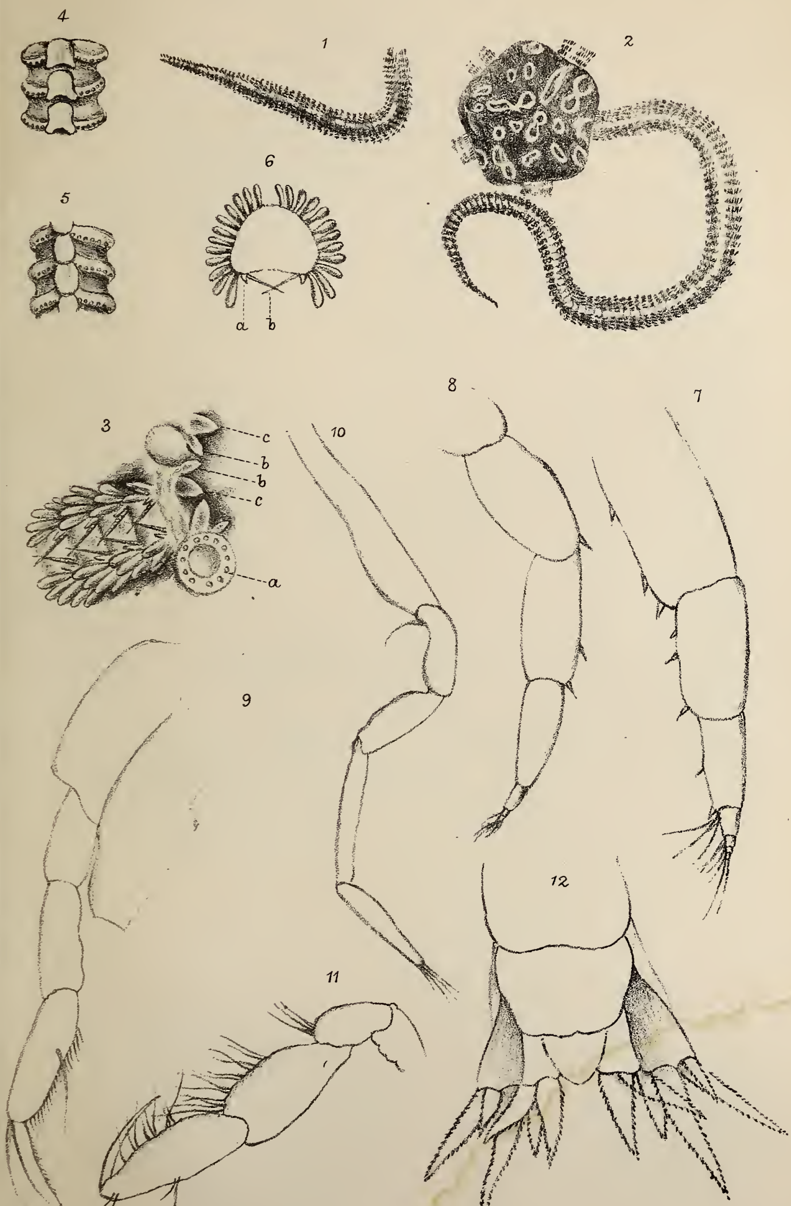


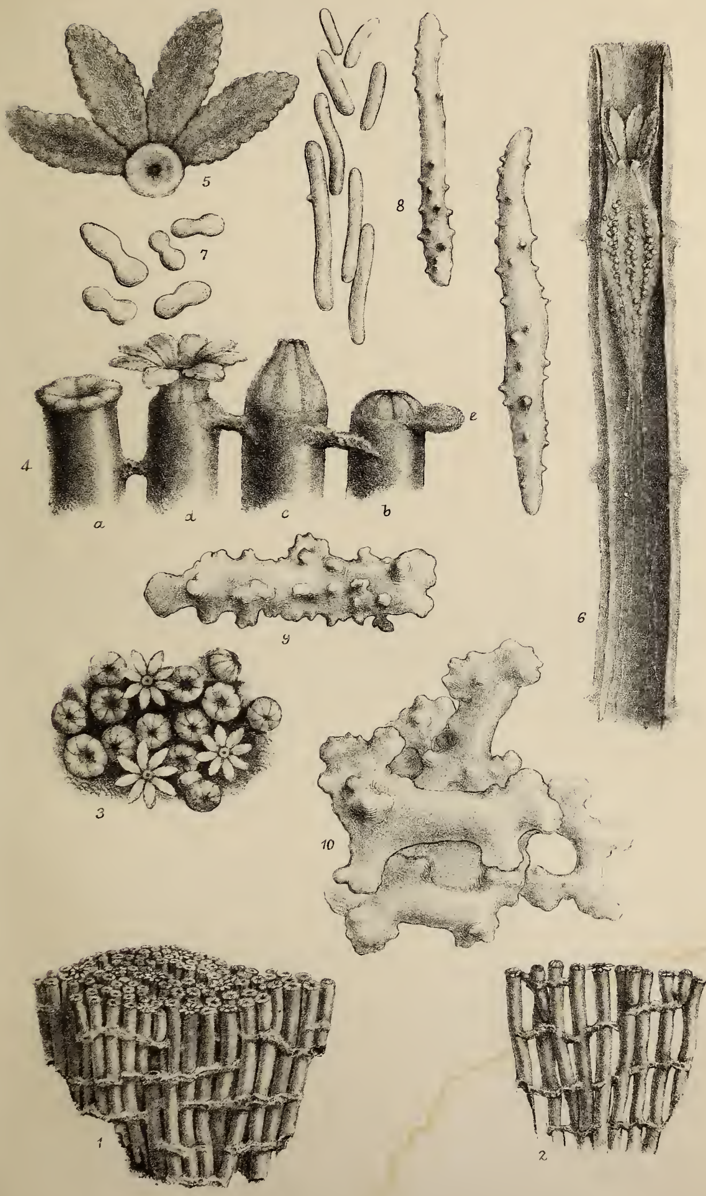
G. S. Brady del. et lith.

W. West imp.



S Brady del et lith.

W. West imp.



G. H. Ford lith.

W. West imp.

Tubipora musica.