THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

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

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1861.

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

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

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

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

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

No. 43. JULY 1861.

I.—*On the Morphology of some* Amphipoda *of the Division* Hyperina. By C. Spence Bate, F.R.S., F.L.S., &c.

[Plates I. & II.]

THE changes that the Crustacea pass through in their passage from the earliest larval condition to the adult form, have been looked upon as among the most interesting features in their history. Changes that assume a character approximating to what some have termed metamorphosis have only been recognized in the development of the Podophthalmous and Entomostracous forms, while the intermediate orders, known as the Edriophthalma, have been known to vary little in form between the parent and the larva. Milne-Edwards and Gosse have both indicated that some more than ordinary difference of form exists between the adult and young animals belonging to some genera of the division Hyperina; but their observations do little more than show that an exaggeration of one part takes place at the expense of another, and that some of the least important organs have yet to be developed.

It is not my intention to allude here to the development of *Hyperia*, since there will be an opportunity for that in the work on the British Sessile-eyed Crustacea, shortly to be published.

The favourable opportunities afforded me for the study of this division of the Amphipoda while engaged upon the Catalogue for the British Museum (which is near its completion) have enabled me to make some observations that certainly in one direction must extend our knowledge of these creatures. In the collection of unexamined Amphipoda that was kindly entrusted to me by M. Milne-Edwards, belonging to the Museum of the Jardin des Plantes, were specimens of three species, each bearing young animals within the incubatory pouch. These species fortunately belong to three separate genera, namely: *Vibilia*, Edwards; *Platyscelus* and *Brachyscelus*, mihi.

Vibilia has been described by Milne-Edwards; and there will be no occasion to do more than allude to those organs that exhibit a difference of form in the adult and the larva. The species is a new one, and may be recognized by the specific name of *V. Edwardsii.*

The superior antennæ consist of a peduncle formed of one long and two very short joints, and a flagellum formed of one short, broad, obtuse-pointed, compressed articulus. The inferior antennæ are short, and consist of two long joints and several short articuli. The gnathopoda are imperfectly complexly subchelate. The first two pairs of pereiopoda are simple, and a little longer than the gnathopoda; the third and fourth pairs are twice the length of the preceding, and have the propodos nearly as long as all the other joints, with the anterior margin serrated; the fifth pair are shorter and more feeble in appearance than the third. The three anterior pairs of pleopoda are normal in form: the three posterior are flat, broad, biramous; rami lanceolate. Telson narrow and triangular.

Length $\frac{14}{20}$ inch. Larva $\frac{1}{40}$ of an inch.

Hab. "Near Iles de Powel. *Expédit. de la Zélée*" (*Label on bottle*).

The larva of *Vibilia Edwardsii* has the peduncle of the superior antennæ consisting of three joints gradually decreasing in size, and a flagellum consisting of four articuli gradually decreasing in size, the two terminal being tipped with short hairs. The inferior antennæ consist of a single joint, cylindrical, short, and subapically tipped with two curved hairs. The gnathopoda are uniform, short, consisting of five subequally short joints and a narrow and obtuse terminal one. The first two pairs of pereiopoda are longer than the gnathopoda, and are simple in form. The third pair are not much longer than the second, and have the carpus antero-distally produced into a long process; the propodos distally increases in diameter, and is latero-distally produced on each side of the articulation with the dactylos to a sharp point, the anterior surface being concave; the dactylos, when closed, impinges against the hollow of the propodos. The fourth pair resembles the third, except that the antero-distal angle of the carpus is considerably more produced, reaching nearly to the extremity of the propodos; the propodos is long, having the anterior surface concave, and the infero-distal angles on each side produced to a point; dactylos half the length of the propodos, and terminating in a curved unguis capable of shutting into the concave surface of the propodos. The fifth pair are rudimentary, the last joint terminating subapically in an unguiculate spine. The pleopoda are but imperfectly developed, two or three pairs only being present, and these consisting of a peduncle and two inarticulate rami, which probably are those of the three anterior pairs. The telson is as broad at the base as the preceding segments, and terminates obtusely.

The earliest and latest stages of this creature offer a considerable degree of variation in some points. The form of the cephalon differs: in the adult it is truncate in front, oblique beneath; in the young the dorsal surface gradually declines to the anterior margin, which is on a line with the inferior surface of the cephalon. The superior antennæ in the adult consist of a peduncle of three short joints, and a long, broad, flat, internally concave, uniarticulate flagellum, and are situated in the frontal surface of the cephalon; in the young they consist of six joints, decreasing gradually in length and breadth to the extremity, where they are tipped with four small stiff hairs; they are situated at the anterior extremity of the cephalon. The inferior antennæ in the parent are six- or seven-jointed, while in the young animal they are almost obsolete, consisting of a single joint of small dimensions tipped with two hairs. In the adult we find the gnathopoda strong, well-developed, and efficient grasping organs; in the young they still retain an embryonic condition, and exhibit none of the characteristics peculiar to their future form. The first two pairs of pereiopoda bear a strong relative resemblance to one another, those of the young differing but little from those of the parent. The two succeeding pairs in the adult are long, and evidently formed for seizing upon certain substances and securing itself in position, while those of the young are not longer than those of the preceding pair; they are also capable of holding certain substances; but while they possess this power in common with the adult animal, the plan by which it is attained differs considerably. In the adult the long slender propodos has the anterior margin minutely serrated, and is capable of being bent against the anterior margin of the meros and carpus; and, to make the grasp more secure, it impinges between two short spines at the distal extremity of the carpus. In the young, the two pairs are not exactly uniform; they agree in character, but differ in degree and, perhaps, in power: in the fourth pair, the carpus has the anterior distal angle produced nearly to the extremity of the propodos; in the third, it does not reach to half that length; in each the propodos is anteriorly hollowed and distally produced, so that the dactylos impinges between two processes, and terminates in a distinctly curved unguis. The fifth pair of pereiopoda, both in the adult and in the larva, are very short, appearing in the full-grown animal as a perfectly formed but feeble organ, whilst in the young they resemble an imperfectly developed appendage. In the young, none of the pleopoda are properly developed, and only two pairs are present, in an embryonic condition; the telson appears as broad as the previous segments; while in the adult the three posterior pairs of pleopoda are long and biramous, the telson being small and lanceolate.

PLATYSCELUS, nov. gen.

This genus agrees in every respect with Dana's genus *Dithyrus*, except that, after the basa in the third and fourth pairs of pereiopoda, the remaining joints are developed, whereas in *Dithyrus* they are wanting.

Platyscelus serratus.

Cephalon transversely ovate. Pereion broadly distended. Pleon narrow. Eyes occupying the entire lateral walls of the cephalon. Superior antennæ short, six-jointed; the first three, or peduncle, stout; the fourth, or first articulus of the flagellum, equally stout, truncate at the extremity, where stands a bunch of auditory cilia; the last two articuli are narrow, and terminate sharply. Inferior antennæ short, four-jointed, the joints not inflected one upon the other, but lying extended and hidden beneath the cephalon. First pair of gnathopoda complexly subchelate; meros broad; carpus broad and long, the inferior margin anteriorly produced, and serrated both on the anterior and inferior margins; propodos a long-ellipse, and strongly serrated both on the superior and inferior margins; dactylos sharp and smooth. Second pair of gnathopoda formed upon the same type as the first, but longer and not quite so broad. First two pairs of pereiopoda simple, but having the posterior or flexible margins minutely serrated. Third pair of pereiopoda short, having the basos long, being as long again as broad; anterior margin nearly straight, having the distal extremity serrated; posterior margin arcuate, the internal surface concave; the remaining joints scarcely more than half the length of the basos, and having the anterior or flexible margin serrated; dactylos smooth, sharp. Fourth pair of pereiopoda having the basos extremely developed; the anterior margin excavate, corresponding in form with the posterior of the preceding pair; posterior margin parallel with the anterior; distal extremity rounded; internal surface concave, near the centre of which the succeeding joints articulate, but altogether they are not more than one-fourth the length of the basos, and are serrated upon the flexible margin. Fifth pair of pereiopoda represented by a membranous scale, not unlike one of the branchiæ, but furnished at the extremity with a small tubercle. Three anterior pairs of pleopoda biramous; three posterior also biramous, but each ramus is developed into the form of a broad, thin, membranous plate. Telson as broad at the base as the preceding joint, and terminating obtusely.

Length $\frac{3}{4}$ of an inch; of young, $\frac{1}{20}$ of an inch.

Habitat unknown. Taken by M. Morrisse of Havre.

Having given a description of the form of the adult animal, it will be interesting to compare it with that of the young before it has quitted the care of the mother.

Animal long and narrow. Cephalon anteriorly produced, the apex recurved beneath. Superior antennæ nearly as long as the cephalon, two-jointed, and tipped with four hairs nearly as long as the last joint. Inferior antennæ single-jointed, the extremity tipped with four hairs. First pair of gnathopoda having the meros and carpus broadly developed, with the inferior angle of each rounded-off and furnished with a solitary hair; propodos not half so broad as the carpus, increasing in diameter towards the distal extremity, where a small concave palm is apparent; dactylos long and sharp. The second pair are uniform with the first. First pair of pereiopoda longer than the gnathopoda, simple in character, and having the meros, carpus, and propodos each furnished with a single hair at the infero-distal extremity. The second pair of pereiopoda are uniform with the first. The third pair is about the same length as the preceding, but having the basos broadly developed, increasing in diameter towards the distal extremity, where it is produced posteriorly beyond the point at which it articulates with the ischium; the ischium, meros, and carpus are all broadly developed, and the two latter are furnished with a single hair at the antero-distal angle; the propodos is very narrow, and the dactylos long. The fourth pair of pereiopoda are uniform with the third. Fifth pair as long as the preceding, having the basos long and narrow, being scarcely dilated at all, and the remaining joints, which articulate at the extremity of the basos, fully developed, except the dactylos, which exhibits the appearance of an arrest of development, forming, apparently, a rim round the extremity of the preceding joint. Three anterior pairs of pleopoda present, but not developed beyond the first two joints of each of the rami; three posterior more matured, consisting of a peduncle and two sharp styliform rami. Telson narrow and rounded.

The points in which the larva appears to differ most conspicuously from the parent are:—In the form of the cephalon, which is a broad ovate ball in the adult (the lateral walls encroaching upon the under surface and hiding both pairs of antennæ), while in the early form it is long and narrow, tapering to a point, near which, on the under surface, the superior antennæ are planted, while the inferior pair are a little posterior to these: though small, neither are covered by the lateral walls of the cephalon. The pereion in the parent is broad and flat, and the pleon considerably narrower, while in the larva they are both uniformly narrow throughout the entire length of the animal, tapering gradually towards the posterior extremity. The gnathopoda in the adult are complexly subchelate; while in the larva, if they can be said to assume ever so slightly the subchelate character, it is by the dilated form of the propodos, which, though broader at the distal extremity than the nearer, is not more in diameter than half the length of the dactylos, and therefore its prehensile capability must be feeble. The carpus, which in the adult is developed into a large projecting process that assists materially in perfecting the grasping power of the appendage, is in the larva rounded-off and not developed, the point of development being occupied by a solitary hair: a similar hair exists also upon the infero-anterior angle of the preceding joint. The first two pairs of pereiopoda, in the larva, may be recognized as the undeveloped future organs, differing as they do only in their more imperfect condition, being destitute merely of some of the adult armature. The two succeeding pairs of pereiopoda, which are developed upon one type, in the adult differ in their proportions, so as to appear to vary considerably in form, while in the larva they are uniform with each other in every respect; they differ from those of the parent in having their basa less developed, and the remaining joints considerably longer in relative proportion both to the size of the basos as well as to that of the animal. The fifth pair of pereiopoda in the adult are obsolete, being represented by a flexible membrane only, whilst in the young creature they are long, strong, and normally developed, like the previously described poda, except the peculiar and curious dactylos. In the adult, the three posterior pairs of pleopoda are membranous and foliaceous; but in the larva the rami are slender, sharp-pointed, and styliform. The telson, in the adult, is as broad at the base as the preceding segment of the pleon; in the larva it is much smaller.

Brachyscelus.

Cephalon anteriorly rounded. Eyes occupying the lateral walls, which encroach upon the inferior margin. Pereion not distended, nearly as deep as the cephalon, and not wider. Pleon nearly as broad as the pereion; fourth and fifth segments fused together. Antennæ obsolete or very rudimentary. Oral appendages membranous and rudimentary. Gnathopoda complexly subchelate. Pereiopoda having the basa of the three posterior pairs largely developed; fifth pair having the remaining joints not obsolete. Pleopoda biramous. Telson single.

Brachyscelus crusculum.

Female.—Animal round and smooth. Cephalon anteriorly depressed, rounded. Oral appendages consisting of two small, narrow, pointed foliaceous plates, having a quadrate membranous plate centrally placed behind them. First pair of gnathopoda short, having the carpus broader than long, inferior angle anteriorly produced, deeply serrated upon the anterior and inferior margins, teeth upon the inferior margin posteriorly serrated; propodos arcuate, inferior margin serrated; dactylos short, slender, and sharp. Second pair resembling the first, but slightly longer; carpus longer than broad, having the anterior margin directed obliquely forwards, and equal to the length of the carpus. First pair of pereiopoda simple, slender, finely serrated upon the posterior margin of the meros, carpus, and propodos. Second pair like the first, but longer, and serrated only upon the propodos. Third pair of pereiopoda having the basos long-quadrate, slightly tapering towards the distal margin, posterior margin slightly arcuate; ischium articulating at the extremity of the basos; remaining joints longer than the basos. Fourth pair having the basos broader than the preceding joint, posteriorly dilated, and tapering to the distal extremity, where it articulates with the ischium; remaining joints not quite as long as the basos; the anterior or flexible margin finely serrated, except the dactylos. Fifth pair having the basos ovate, not so broad as that of the fourth pair; remaining joints about half the length of the basos; carpus having the anterior or flexible margin finely crenulated; dactylos small, hooked, and sharp, apparently immobile. Antepenultimate and penultimate pairs of pleopoda articulating at the distal lateral extremity of the coalesced fourth and fifth segments: antepenultimate pair having the rami styliform, with the approximal margins serrated; penultimate having the rami subfoliaceous, lanceolate; ultimate having the rami foliaceous, ovate. Telson triangular, longer than broad, as broad at the base as the preceding segment, and as long as the posterior pair of pleopoda.

Length $\frac{3}{4}$ of an inch; young less than $\frac{1}{20}$ of an inch.

It was taken by M. Morrisse of Havre, but unfortunately the habitat has not been recorded.

The specimen from which the above description was taken was found upon examination to have within the incubatory pouch many young, which could not very long before have quitted the protection of the egg-case. The following is a description of one of them:—

Cephalon long, and tapering anteriorly to a point. Pereion not laterally compressed. Pleon having the fifth segment not developed, or fused with the preceding. Eyes not visible. Superior antennæ on the inferior surface approximating to the anterior margin of the cephalon, consisting of five joints, the second and third being each half the length of the first; fourth longer than the two preceding, and narrower; fifth short, narrow and tapering. Inferior antennæ obsolete*. Oral appendages rudimentary. First pair of gnathopoda well developed, tolerably robust, nearly chelate; carpus infero-anteriorly produced to a sharp point, reaching more than half the length of the propodos; propodos scarcely as broad as the carpus, having the inferior angle anteriorly produced to a sharp point, nearly as long as the dactylos; dactylos long, sharp, slender, curved. Second pair of gnathopoda like the first. First and second pairs of pereiopoda uniform, simple; dactylos long, curved, and powerful. Third pair long and slender; basos not dilated; ischium short; remaining joints rather long, subequal; dactylos slender, curved. Fourth pair as long as the preceding, but developed into a cheliform organ; propodos having the antero-distal angle produced into a long narrow process, nearly as long as the dactylos; dactylos long, slender, and slightly curved. Fifth pair of pereiopoda short; basos but little shorter than that of the preceding pair; ischium and meros subequal, short, not longer than broad; carpus as long again as the meros; propodos tapering, subapically tipped with a curved spine that represents the dactylos. Three anterior pairs of pleopoda consisting each of a peduncle and two rami, each ramus consisting of two articuli, one long, the second rudimentary, each articulus being tipped with two long hairs. Three posterior pairs of pleopoda likewise biramous, the rami being sharp, straight, styliform, and unequal, the inner ramus being the shorter: antepenultimate and penultimate pairs of pleopoda apparently attached to the latero-posterior extremity of the fourth segment of the pleon, the fifth segment being pro-

* I have not, with careful scrutiny, been able to make them out.

bably fused with the fourth: ultimate pair of pleopoda attached to the latero-posterior margin of the sixth segment. Telson small, round, being not more than one-third the diameter of the sixth segment of the pleon.

In comparing the young with the parent, we find the differences to be very considerable. The cephalon in the latter is rounded in front, and the walls encroach upon the inferior surface, whereas in the former it is produced anteriorly to a long point. The pereion of the adult is laterally compressed, and the first two segments are much shorter than the following; in the young the pereion is not laterally compressed, and all the segments are subequal. The pleon in the young resembles that of the adult, except that the telson, which in the latter is as broad at the base as the preceding segment, in the former is considerably narrower. In the adult, the eyes nearly fill the cephalon; in the young they are inconspicuous*. The antennæ in the adult are obsolete; in the young the anterior pair are largely developed, while the posterior alone are wanting. The organs of the mouth in both the adult and young are of a very rudimentary character. The gnathopoda in both old and young are well developed, but of a very different formation. In the adult they are developed upon the Hyperine type, a little exaggerated in feature, but strictly specific in character; the complexly subchelate condition of the organs could not be mistaken for that belonging to any other family; the carpus is large and inferiorly produced, the extremity forming the process against which the dactylos impinges; whilst the propodos is narrow, and appears to exist as a part of the mobile joint of the chelate organ, and is so described by most authors who have written on the *Hyperina*. In the young they do not assume the distinctly Hyperine type: although the carpus is inferiorly produced, the propodos is nearly as broad as the carpus, and has the inferior angle produced into a long and strong tooth, against which the dactylos impinges, and not against the inferior angle of the propodos, as is the uniform law in the *Hyperina* when they impinge at all. The first two pairs of pereiopoda differ only in the relatively imperfect condition of the former,—the small spines on the posterior margin of the carpus and propodos of the adult being wanting in the undeveloped organ, whilst in the latter the dactylos is proportionally much longer than in the former. The third pair of pereiopoda in the young are long and well-developed organs, being only distinguishable from the same in *Gammarina* by the absence of the squamiform distension of the posterior margin of the basos; whilst those in the adult

* This may partly arise from the animals having been long dead, and being preserved in spirits.

have the basos largely developed, and the remaining joints less so than the normal condition of these appendages generally. The fourth pair of pereiopoda in the young are developed in the character of a very perfect chela, bearing a very similar appearance to those of the preceding pair of pereiopoda in the genus *Phronima*; but in the adult *Brachyscelus* they approximate closely to the form and condition of the same organ in the genus *Platyscelus adult,* the basos being apparently monstrously developed at the expense of the rest of the appendage. The fifth pair of pereiopoda in the young are not half the length of the two preceding pairs, and, like them, have not the basos enlarged; the dactylos is represented by an immobile, curved, sharp spine: in the adult the same pair have the basos large, and the remaining joints very short and feeble, while the dactylos consists of a curved hook, apparently immobile. The three anterior pairs of pleopoda differ in the young from those of the adult by their immature and undeveloped character only; the three posterior, in the young, have the rami simply styliform, and unequal; in the adult the antepenultimate only exhibits inequality in the length and the styloid shape of the rami; the penultimate and ultimate are foliaceous and equal, the ultimate the more perfectly so. In the young the telson is small, whilst in the adult it is as broad at the base as the segment of the pleon immediately preceding, and extends as far as the terminal extremity of the ultimate pair of pleopoda.

Having noticed the changes which the young of these species pass through previously to attaining their final condition of maturity, it will be interesting to observe the relations which they bear to those of other genera and to the Amphipoda in general.

The great dissimilarity between the form of the adult and the young animal must strike the most casual observer. The great change in the two last-described forms is due to the immensely developed eyes of the adult compared with the almost invisible organs of the young, and to the monstrous growth of the basa of the third and fourth pairs of pereiopoda. The adult form that approximates the nearest to the young of these genera is that of the genus *Oxycephalus*, which bears so close a resemblance to the young of *Platyscelus* that they might readily be accepted as belonging to one genus. In *Oxycephalus* the cephalon is long, inferiorly concave, tapering anteriorly to a point; the pereion is not laterally compressed; the pleon has the first segment deeper than the two succeeding; the telson is long and tapering, and as broad at the base as the preceding segment. According to Milne-Edwards's figure in his 'Histoire des Crustacés,' pl. 30. fig. 10, and M. Guérin, "The eyes are large; the anterior antennæ situated upon the inferior surface and within the anterior margin; each consists of several joints and articuli, which fold, like the letter **z**, upon itself. The inferior pair are long, four-jointed, each joint being reflected upon the preceding." The gnathopoda are complexly chelate. The first two pairs of pereiopoda are long and simple; the three succeeding have the basa moderately developed; but the fifth pair are short, and in some species almost rudimentary. The three posterior pairs of pleopoda have the rami short, sharp, and styliform.

On a comparison of the species of this genus with those of the young animals already described, the difference will be found to consist chiefly in the size of the eyes, the length of the antennæ, and the complexly chelate condition of the gnathopoda of *Oxycephalus.*

The young of *Oxycephalus* have not been observed; yet I cannot but suppose that they bear a considerable resemblance to the young of the genera described, seeing that these so closely approximate to the form of the adult animal. This idea appears to receive sanction from observation of the young of *Rhabdosoma.* The only female specimens of this genus that I have had the opportunity of examining carried the ova in an immature state in the pouch; but M. Guérin-Méneville has been more fortunate: when he was so obliging as to show me his valuable collection of Amphipoda, he drew my attention to the form of the young of *Rhabdosoma,* which he had figured among his drawings. His figure of the young of *Rhabdosoma* appeared to me to be a fair representation of an adult *Oxycephalus.* Without going into the details of its structure, I think we may conclude that the young of *Rhabdosoma* bears a general resemblance to the young of *Platyscelus.* Thus we may remark that the young of *Vibilia, Brachyscelus, Leptoscelus,* and *Rhabdosoma*—animals, in their adult condition, very unlike each other—bear a considerable resemblance to one another in their young state.

In speaking of the morphology of this group, it must not be confounded with that of the Decapod forms, where the young animal leaves the egg and the care of the parent in an embryonic condition, and where the organs that are obsolete or secondary in the adult are made subservient to the uses of the animal in its immature condition. The morphology of the Brachyura is due to the development of parts that in the early condition of the animal are not visible. The creature, starting upon its errand of life at too early a period for the true limbs to have been moulded to their useful form, makes use of others that can only be available to an animal in an immature or degraded state.

In the Amphipoda the young quit the egg with the permanent or adult features present, but in an imperfect state, the process of development being as yet incomplete; and, as I observed in the "Report on the British Edriophthalma," in the British Association Reports for 1855, p. 55, "Although the resemblance to the parent is very considerable, yet it is by no means complete; and it is probable that several moults are undergone before the perfect development of the animal is matured." And, arguing from this datum only, we could subscribe to Milne-Edwards's theory, that the condition of the young animal first exhibits the form of the *family* to which it belongs, next the *genus*, and lastly it betrays the *species* from which it sprang. But this doctrine appears to be at variance with the character of development in the present division, unless we are to assume that the type of the family is to be found in the genus *Oxycephalus*, and not in *Hyperia*.

The young animal, when it quits the ovum, does not leave it in a larval condition, but assumes the form consistent with the characters of an adult animal; that is, its permanent organs are not in an embryonic or larval condition, as is the case with the *Zoë* of the Decapoda, but are present in a more or less perfectly developed state. Thus, the anterior antennæ in *Vibilia* exhibit a character in the young animal more consistent with the normal condition of these organs than is to be found in the adult, while the reverse is to be seen in the posterior antennæ. The gnathopoda appear, in the young animal, to exhibit features of an immature condition; whilst the pereiopoda, with the exception of the fifth pair, exhibit the condition of fully-developed organs. That they differ from those of the adult is true; but, with the exception of a distinction in form, those of the young appear to be as efficiently developed organs as those of the parent. The fifth pair of pereiopoda, in the young, have not assumed the complete form of the parent; neither have the appendages attached to the pleon. As in *Vibilia*, so in *Platyscelus*, we find some parts of the animal more advanced in the young stage than in the adult, whilst others, again, show that they have not yet attained their fully-developed condition. In this species the eyes are developed, in the adult animal, to a monstrous size, encroaching upon, filling, and enlarging the entire cephalon, and changing its form from that of a narrow flat projection to one that is laterally broadly ovate and frontally circularly developed—a change of form that appears to have been produced in order to permit the visual organs to attain their greatest increase of dimension. Both pairs of antennæ exhibit a more developed condition in the adult than in the young; and in this they differ from *Vibilia*, where the posterior pair only are in an embryonic condition, and bear a close resemblance to those of the young of this genus.

The gnathopoda in the young of *Platyscelus* possess less of the embryonic condition than those in the young of *Vibilia*, but the form approximates to that of a mature animal; they do not resemble those of the parent, but approach more nearly to those of *Hyperia* or *Lestrigonus*. The first two pairs of pereiopoda, as in *Vibilia* and probably all the genera of the family, assume in the young the form of simple poda, and differ from those of their respective parents only in the relative proportion of parts and in the presence or absence of a few spines or teeth. Not so the third and fourth pairs. In the three genera to which this paper alludes, these assume a very different form in the young from that presented by the adult: in *Platyscelus* and *Brachyscelus* they exhibit a condition that would generally be accepted as more perfect than that of the adult; whilst in *Vibilia*, although the change is quite as great as in the preceding genera, their form in the parent appears adapted to fulfil similar conditions to those of that in the young, being apparently as complete for the purpose in the one as in the other, although bearing little or no resemblance. In *Platyscelus* and *Brachyscelus* their form and condition are altogether distinct, and must be different in kind as well as in degree. The fifth pair of pereiopoda, in the genera under consideration, exhibit altogether depauperized features; and it is curious to observe, with this condition constant in the adult state, how variable are their forms in the young animals of the several genera. In *Vibilia* they are, in the adult, well formed, but slender and feeble; in the young they are robust, but embryonic in appearance. In *Platyscelus* they are rudimentary in the adult, but in the young, with the exception of the dactylos, they are as well developed as the preceding pair, and only differ from them in having a narrower basos; and in *Brachyscelus*, where they approximate somewhat to the form of the preceding pair in the adult, in the young they assume a somewhat abnormal condition. Thus, singular to say, in that genus in which the appendages are most rudimentary in the adult, they are most perfectly developed in the young; and, on the other hand, in that genus in which their character in the adult is most consistent with that of the preceding pairs of appendages, they are, in the young, the most aberrant and immature.

In judging of the changes that these animals undergo, they appear to consist in something more than simple development. The morphology of some of the parts is certainly as complete a change of one form to another as is conceivable. Admitting that the change of the cephalon from the long, flat, tapering process to the short globular lobe is but the result of the development of the eyes and the consequent growth or enlargement of one part at the expense of another, it cannot be the same with regard to some of the appendages. For instance, the third and fourth pairs of pereiopoda in *Vibilia* are, in the adult, of the same form, their most remarkable feature being that the propodos is nearly one-half the length of the entire limb; it is armed with minute spines upon the anterior or flexible margin, and is capable of being doubled back against the preceding portion of the limb, being rendered more securely prehensile by the presence of two lateral, short, stiff spines at the antero-distal extremity of the carpus, between which the propodos closes against the carpus. In the young, these same organs, while differing from those of the parent, also differ from each other, but only in degree, so that a description of one will serve for both. The carpus is antero-distally produced nearly to the entire length of the propodos—in the third pair not so much as in the fourth; the propodos is anteriorly concave, the antero-distal angles being anteriorly produced (one on each side of the dactylos) to a sharp point,—the dactylos, closing between them, falling into the anterior concave groove, its apex antagonizing with the extremity of the carpus, and thus forming a tolerably perfect but complex chela. This change is still more complete in the morphology of the fourth pair of pereiopoda of *Brachyscelus*. In the adult the basos is broad and large, the remaining joints lying reflected against the basos being considerably the shorter; in the young the basos is long and narrow, consisting of but a normal portion of the limb, whilst the propodos is large, with the antero-distal angle produced to a considerable process, and forming a strong ramus against which the moveable dactylos is capable of striking,—thus forming a very perfect chela, and one assimilating to that of the third pair of pereiopoda in the genus *Phronima*. In *Platyscelus* the alteration is less striking, though still extremely great. The fourth pair of pereiopoda differ from the third in having the basos more largely developed; the five distal joints, which articulate near the centre of the basos, are scarcely one-third of its length, it being so monstrously enlarged as to equal the entire length of the pereion. In the young, the third and fourth pairs of pereiopoda resemble each other, and bear a moderate resemblance to those of the adult form of *Brachyscelus*; that is, they differ from those of the parent by the monstrous development of the basos only.

Observing that such considerable and eccentric changes occur in the progress of the animals from the earliest form to that of the adult, and knowing that the law among the Amphipoda, even including the aberrant forms of *Caprellæ*, is, that the normal progressive development is a variation of degree only, I am induced to think that the unimpoverished type of these genera is to be found nearer to the young than to the adult form, and that the latter is the result of development superinduced by peculiar conditions. Thus, several genera, the young of which start from a common type, undergo changes most opposite to each other in order to fulfil with advantage the conditions under which they are placed.

Our knowledge of the habits of the *Hyperina* is very limited. They have mostly been found dwelling in the gill-cavities of Medusæ; but the few specimens of *Rhabdosoma* of which the habitat has been recorded were taken swimming freely in the ocean. Whether or not this may be the habit of this very curious creature, I cannot say; but *Platyscelus, Brachyscelus,* and other allied genera are certainly animals which have undergone a deterioration of character, and the great alteration of parts is such as their permanent condition may have required. The small eyes of the type are produced into monstrous organs in order, we may assume, to make up for the depreciation of the light that reaches them through the transparent animals in the cavities of which they take up their adode. The basa of some of the pereiopoda are developed to a monstrous degree, and at the expense of the remaining joints, inasmuch as the walking appendages are not required by animals that are not in a position to use them; while the great squamiform basa of the third and fourth pairs protect the entire range of ventral organs, as well as the ova and young.

The adult animals having departed from the typical character of Amphipoda, we must look for their nearest allies in the order through the relation which their young may hold with the more aberrant forms. This link is certainly to be found to exist in *Phoxus* and other genera of the subfamily *Phoxides*—a circumstance that points out to us a necessary emendation in the classification of these animals.

EXPLANATION OF THE PLATES.

Plate I.

Fig. 1. *Vibilia Edwardsii,* female adult.
Fig. 2. Ditto, young.
b, anterior antennæ; *c,* posterior ditto; *h,* first pair of gnathopoda; *i,* second pair of ditto; *k, l,* first and second pairs of pereiopoda; *m,* third pair of ditto; *n,* fourth pair of ditto; *o,* fifth pair of ditto.
Fig. 3. *Oxycephalus piscator.*
Fig. 4. *Rhabdosoma Whitei*: *b,* anterior antennæ; *d,* mandible; *h,* first pair of gnathopoda; *i,* second pair of ditto.

Plate II.

Fig. 1. *Brachyscelus crusculum,* female adult.
Fig. 2. Ditto, young.
b, superior or anterior antennæ; *g,* maxillipedes; *h,* first pair

of gnathopoda; *i*, second pair of ditto; *k*, *l*, first and second pairs of pereiopoda; *m*, third pair of ditto; *n*, fourth pair of ditto; *o*, fifth pair of ditto; *s*, fourth pair of ditto; *t*, fifth pair of ditto; *u*, sixth pair of ditto; *z*, telson.

Fig. 3. *Platyscelus serratus*, female adult.

Fig. 4. Ditto, ditto, young.

b, anterior antennæ; *c*, posterior ditto; *h*, *i*, gnathopoda; *k*, *l*, first and second pairs of pereiopoda; *m*, *n*, third and fourth pairs of ditto; *o*, fifth pair of ditto; *p*, first pair of pleopoda; *s*, fourth pair of ditto; *t*, fifth pair of ditto; *u*, sixth pair of ditto; *z*, telson.

II.—*Notes on Cambridge Palæontology.* By Harry Seeley.

IV. *Some new Upper Greensand Echinoderms.*

Hemiaster M'Coyii.

Outline oblong, oval, slightly flattened at the anterior extremity, longer than wide; height two-thirds of the length. The most elevated part is a little behind the apex, the widest part a little anterior to the middle. The transverse section is oval. Upper side slightly convex, sloping down towards the anterior end. Under side slightly convex; the part anterior to the mouth depressed. Anal side nearly vertically truncated; anterior end round. Ambulacra straight, unequal, very slightly impressed. The odd ambulacrum is formed of straight zones, each composed of about a dozen pairs of round pores, which are placed obliquely and rather wide apart; the pores are close together. The anterior ambulacra consist of a similar number of pores, which are smaller and closer together. The posterior ambulacra are very short, the zones consisting of about four pairs of pores. Mouth transversely oval, bordered by a little groove, and placed in the anterior third of the shell. Anus oval. The fasciole is wide and 7-sided; it is angular posteriorly, with a short side anteriorly: the posterior and shorter pair of lateral sides is parallel; the granules of which it is formed are very dense, and only just visible to the naked eye. The shell is very thin, and covered with comparatively large tubercles.

This well-marked Urchin is so distinct as not to admit of comparison with any form with which I am acquainted. Its nearest relative is a more globular form which occurs with it.

Rare. Coll. University; J. Carter, Esq.

Salenia (? *Hyposalenia*) *Woodwardi.*

Round, greatly depressed. Ambulacral areas narrow and straight, furnished with two rows of rather small tubercles, which are placed close together and occupy the whole of the space between the pores. The poriferous zones are slightly sinuous, wide, united above and below, and consist of nearly twenty pairs of pores; the pairs are wide apart and oblique. The lower part of each plate is a little impressed, so that the upper part projects below the pair of pores of the plate above. Plates nearly quadrate. Interambulacral areas about three times the width of the ambulacral, furnished with two rows of large tubercles of three in a row, of which the top or middle one is largest. The boss is greatly elevated, hemispherical, and crenulated on the top. The areolæ are surrounded, except towards the poriferous zones on which they abut, by a closely-placed row of secondary tubercles. The small interspaces between the double zigzag rows which these form are granulated. The mouth is very slightly pentagonal. The apical disk appears to have been but slightly elevated; its marginal plates scarcely projected above those of the test. The ocular plates have a rather deep spoon-shaped hollow on each side of the ambulacral area. The other plates are not sufficiently preserved for description, but appear to have been ornamented.

Lat. $\frac{5}{16}$ inch, alt. $\frac{2}{16}$ inch; oral opening nearly $\frac{3}{16}$ inch; apical opening nearly $\frac{4}{16}$.

This remarkable little Urchin is so distinct as not to admit of comparison with any known form.

Rare. Coll. Univ. Mus.; Ashwell.

Hyposalenia may be regarded as a section of *Peltastes*, and *Peltastes* and *Goniophorus* as subgenera of *Salenia*.

Goniophorus lunatus, Ag., var. *minutus*.

A minute inflated Urchin with an elevated disk. Base flattened and slightly concave. Apical disk a regular pentagon, broad; its margin considerably elevated: it is divided into six pits, of which the central one is the anus; it is square. The pit immediately in front is also square; all the rest are pentagonal. Each of the five pits is margined by a strong elevated ridge: the three anterior are transversely divided by a septum rather less elevated than the marginal cordon. The genital openings are in the middle of the sides of the pentagon, at the point where the ridges meet. The madreporic tubercle is visible, and occupies the right half of the right anterior pentagon. The ambulacra are narrow and furnished with two rows of tubercles, which occupy the whole space, except towards the base, where a few others are introduced. From them descend short transverse ridges, forming pits, in which the pores are placed. The pairs of pores are in single file throughout. The interambulacra are furnished with two rows of tubercles of four each; the uppermost of the left row is very large. The bosses are hemispherical and crenulated. The scrobiculæ are surrounded by a row of granules. The peristome is rather pentagonal.

Lat. $\frac{8}{48}$ inch, alt. $\frac{6}{48}$ inch; oral opening $\frac{3}{48}$ inch; apical disk $\frac{7}{48}$ inch.

This form is easily distinguished by the characters of the apical disk, the narrower ambulacral areas, larger interambulacral tubercles, small size, &c.

It is one of the many unique treasures contained in the cabinet of my friend Mr. Carter.

A single specimen has been found in which the following characters may be generic:—

Poles opposite. Apical opening moderate [cordate]. Oral opening entire, circular. Tubercles imperforate, crenulated. The ambulacral areas are half the width of the interambulacra. In them large tubercles are developed on one row of plates, and small tubercles on the other; in the interambulacral areas are two primary rows. Pores bigeminal. The poriferous zones are wide, and much impressed above.

Should the characters presumed to be generic prove constant, the name *Caseolus* might perhaps be used to indicate them.

[?*Cyphosoma*] *impressa*.

Pentagonal, greatly depressed, flattened above, concave below. Oral opening deeply sunk, circular. Apical aperture heart-shaped, extending into the odd interambulacrum. Ambulacra narrow, furnished with one row of about seven tubercles, which are as large as those of the interambulacra. On the other series of plates is a row of small granules, about three or four to each large plate: near the apex two or three small tubercles are developed. The poriferous zones are impressed on the upper part. The pores are placed in a straight line between elevated transverse ridges. There are two primary rows, and two secondary rows between these. In the interambulacra are two rows of tubercles of seven or eight each. Areolæ large, radiated, scarcely impressed, nearly circular, and margined by a row of granules, which separates them one from another. On the upper part of the test, the suture between the interambulacral rows of plates is impressed.

Lat. $\frac{11}{16}$ inch; oral apert. $\frac{4}{16}$ inch; apical apert. $\frac{4}{16}$ by $\frac{3}{16}$ inch.

Coll. University Museum.

I cannot conceal from myself a suspicion that some of the characters here described are a monstrous development. Nothing, however, is wanting in the anatomy of the test, nor is anything unnatural superadded. The only really abnormal character is the unsymmetrical ambulacral ornament arising from the coalescence and development of granules into large tubercles. If this character is not generic, it can only be an individual variation: if it should prove to be the latter, the genus would have characters probably indicating its place to be among the Saleniadæ.

Diadema fungoideum.

Test circular; inflated on the lower part, obliquely depressed above, thus appearing rather subconical. Base rounded, on its inner part concave; oral aperture deeply sunk and larger than the apical disk. Ambulacral spaces two-thirds the width of the interambulacra; furnished with two rows of tubercles, which are very large round the circumference and become less elevated and rapidly smaller above, and regularly smaller below: those of the circumference and base are of the same size as the corresponding interambulacral tubercles; those of the upper surface much smaller. Each row consists of about eight. Round the circumference the rows are separated by a single zigzag line of granules. On the upper part the pairs of pores are close together, but in the middle they become wider apart, and are separated by a granule, which renders their detection difficult. The space between them and the tubercles is granulated. The interambulacral tubercles are very large and close together, in two straight rows of eleven each; on the upper part they are but slightly smaller than at the circumference; separated by wide spaces, which are occupied by two somewhat irregular rows of granules. On the outside of the tubercles round the bend of the base are two or three very small accessory tubercles. Each pair of pores is enclosed in a little, oblique, elevated, oval ring. On the base the interambulacral areas are noticeably inflated.

Lat. $\frac{13}{32}$ inch, alt. $\frac{8}{32}$ inch; apical disk $\frac{4}{32}$ inch.

This very distinct and remarkable little species is most nearly related to *D. Carteri* (Woodw.), from which it is distinguished by its subconical shape, absence of secondary tubercles, difference in size and number of primary tubercles and granulations, &c.

Very rare. Coll. University.

Diadema intertuberculatum.

Circular, tumid, flattened and slightly concave below, somewhat flattened above. The ambulacral and interambulacral areas have each two distinct rows of tubercles, of about eleven each; the tubercles are large and wide apart. Areolæ large, circular, and margined by circlets of granules; in the interambulacral area the borders just coalesce in the longitudinal direction. In the ambulacral area the tubercles are rather smaller, above much smaller, and the areolæ separated from each other by a granulated space. The rows of tubercles are very close together, so that the areolæ touch obliquely, and on the lower part of the shell are separated by a zigzag line of granules. The interambulacral rows are wide apart, and bordered externally on the base with short rows of about six secondary tubercles. Also, on the basal part, between the primary rows, are two rows of secondary tubercles, each formed of about five or six. On the upper part there is generally a row of granules between those margining the areolæ. Shell thin.

Width $\frac{12}{16}$ inch, height $\frac{7}{16}$ inch; width of mouth $\frac{4}{16}$ inch.

This species differs from *D. Carteri* in the presence of secondary tubercles between the interambulacral primary rows, in the more inflated form, smaller mouth, greater space between the tubercles, &c.

Rare. Cambridge and Ashwell. Coll. University.

Diadema (? *Tetragramma*) *scriptum.*

Depressed, very slightly pentagonal, inflated. Pores close together and in double series above, wide apart below. Ambulacral areas half the width of the interambulacra, furnished with two rows of about twenty or twenty-two tubercles, which are as large as those of the interambulacra, except on the upper part, where they become smaller and closer together: the rows are close together. As in *D. divergens*, the tubercles are semiradiate. On the lower part of the shell the areolæ are confluent, above they scarcely exist. Round the circumference the intermediate space is granulated; the granules partly surround the areolæ, and are for the most part in two rows. Interambulacral tubercles in two primary rows of sixteen or seventeen; each is flanked externally by a row of nine or ten secondary tubercles, of the same size as the primaries. Outside of each of these are two tertiary rows, of about twice the number. Areolæ on the lower part confluent; above circular, and commonly margined with a circle of granules, but for which the upper part of the space between the primary rows, which is concave, would be naked. Round the circumference, and below, the interspace is closely and irregularly granulated. Shell round the mouth inflected. Apical opening pentangular; width 6 lines.

Lat. $1\frac{1}{2}$ inch, alt. $\frac{5}{8}$ inch.

Most nearly related to *D. Malbosii* (Desor), but differs in the small size of the mouth, in having the rows of tertiary tubercles, in the greater number (especially of ambulacral) tubercles, &c.

Diadema (subg. *Pseudodiadema*) *inversum.*

Circular, depressed, flattened above, concave below. Apical opening pentangular. The greatest inflation is above the middle of the shell. Mouth very deeply sunk. Ambulacral tubercles arranged in two rows of about seventeen each, nearly as large as the interambulacrals, except on the upper surface, where they become much smaller, and are scarcely elevated: the rows are separated on the lower part of the shell by a single zigzag row of granules,—round the circumference by two rows; the space above naked. The areolæ are large circles, which are confluent; they are indistinctly radiated. On the outer side of the bosses, on the lower half of the shell, descend three wide deep grooves, each to a pair of pores, the inner one of which they almost obscure, thus giving the tubercles a remarkable semiradiated appearance. The zones are straight, and the pores in single file throughout. Except on the upper part, each pair of pores appears to be surrounded by a little ring, which is divided by the septum being also elevated. Interambulacral tubercles in two primary rows of about sixteen each; they are each flanked externally by a secondary row of about nine; outside of these, on each side, is a tertiary row of two or three times the number. The tubercles are radiated, and on the upper part of the shell surrounded by a row of granules; from the areolæ enlarging, these become, at the circumference, a double row of granules. The upper parts of the intermediate spaces are naked and rather hollow.

Lat. $1\frac{1}{4}$ inch, alt. $\frac{9}{16}$ inch; apical apert. $\frac{7}{16}$ inch; oral apert. $\frac{5}{16}$ inch.

Most nearly related to *D. Barretti* (Woodw.). It differs, however, in having the tertiary tubercles, two or three of which are placed on each plate, in the greater number of tubercles, the different inflation, small mouth, and in having but half as many rows of granules.

Rare. Coll. University.

From the oral opening being mostly filled with phosphate of lime, not more than fifteen tubercles in a row will commonly be visible.

Cidaris gradata.

Greatly inflated, flattened below, with the peristome circular; elevated above, with the periprocte pentagonal. Ambulacral areas nearly one-third of the width of the interambulacrals, sinuous, and divided into two parts by a deep mesial groove; furnished with four rows of rather large granules, which are not arranged in straight transverse lines. Poriferous zones deeply impressed on the base, furnished with a close row of granules, which are rather smaller than those of the intermediate spaces; they divide the pairs of pores. The ambulacra are narrow at the apex, so that the inner rows of granules are suppressed; they become a little narrower towards the mouth. Interambulacral area with two rows of rather convex plates, of three and four each. The tubercles are small on the base, and progressively increase in size, so that the scrobiculæ of the uppermost of the 'three-series' occupies half the width of the area. The uppermost plate of the 'four-series' is small and granulated, or has only a rudimentary tubercle. The areolæ are circular, moderately impressed, placed below the middle of the plates; margined by two rows of large granules of about thirteen each, an inner row forming the margin of the pit, and an outer row between these, which does not reach to the margin; thus both rows appear to form one irregular circle. The bosses are truncated cones, which are proportionally elevated inversely to their size. The tubercles are large depressed spheres. Miliary granulation coarse, on the upper part very large, so that a line of not more than twelve would be sufficient to reach across the widest part of the largest plate.

Nearly $\frac{1}{2}$ inch high, more than $\frac{3}{4}$ inch wide; oral aperture $\frac{3}{8}$ inch, apical aperture $\frac{7}{16}$ inch.

Differs from *C. Heberti* (Desor) in wanting the character "scrobicules petits et serrés;" from *C. dissimilis* (Forbes) in the more elevated form, four rows of ambulacral granules, wide ambulacra, &c.

It is common, perhaps commoner than *C. Sedgwickii*, but in general only occurs in detached plates. A single beautifully perfect example is preserved in the cabinet of J. Carter, Esq.

Cidaris Sedgwickii.

Inflated, elevated [rather subconical?]. The ambulacral areas are narrow and sinuous. The poriferous zones much impressed, and rather narrower than half the intermediate tapering space; they have a row of granules down the middle, separating the two rows of pores: towards the apex the granules become less distinct. The pairs of pores are oblique, and are separated by an oblique elevated ridge: it is between these ridges that the granules are placed, which, by nearly uniting their extremities, give the zones a zigzag ornamentation. The space between the zones is occupied by two marginal rows of granules, between which there are, round the wider part, six much smaller rows of granules, of twice the number in a row: at the extremities these are reduced to two rows. The interambulacral areas are about five times the width of the spaces between them. The plates are high, and only four in each row. The scrobiculæ are large, circular, moderately deep, and above the base separated longitudinally by interspaces of equal width. Excepting the uppermost one, each is placed below the middle of the plate; they are surrounded by a prominent row of seventeen or eighteen granules, which are wide apart; each is placed on an elevated oval base. The bosses are very moderately elevated and compressed round the middle, so that in section the sides would be concave; a few of them are sometimes crenulated. The tubercles are large, rather depressed spheres, which are placed close on to the bosses. The perforation is small and circular. The miliary granules are extremely small and dense on the base; they gradually become larger above. Oral and apical openings both small.

Loc. Cambridge and Ashwell. Coll. University; J. Carter, Esq.

Spines occur not to be distinguished from those of

Cidaris clavigera.
Cidaris Bowerbankii.
Cidaris, n. sp. (figured in Dixon, Geol. Sussex, t. 24. fig. 25).

There are also spines of at least three or four unnamed species. One is a large, compressed, club-shaped spine, obliquely placed on a short neck; it is beautifully marked with longitudinal striæ, which are knotted into distant tubercles. Another is extremely compressed and ornamented with fine longitudinal ridges, which are granulated; its margins finely serrated. A third is cylindrical and irregularly granulated.

Besides these, there are spines nearly resembling those of *C. sceptrifera,* but much smaller and with fewer ridges. Spines occur nearly resembling those of *C. sulcata,* but more cylindrical and having the ridges unserrated. Another form of spine may belong to this species; it is slender, has fewer and more elevated ridges and a similar coronated summit.

I abstain from attaching names to these spines, as the practice of naming species from appendages which give no clue to the major part of the organism is a custom which loads the nomenclature with synonyms, and, from the extreme variability of spines in the same species, can only bring with it very questionable advantages.

The largeness of the object can furnish no reason for conferring on it a name; and we might with as much propriety give names to the spines of *Micraster* or *Galerites*: those names would, when the test was found, be just as much entitled to priority; in a natural-history point of view they would be no more objectionable. The only argument for naming the larger object is convenience. But the circumstance of the test not having been found is an evidence of the rarity of the species, and therefore of the little inconvenience which would result from its not having a name.

The names already given to spines can only be considered as provisional,—to be adopted if the first discovery of the test shall be made with them *in situ*, but to become synonyms if the test shall be separately named.

One specimen of *Diadema Bonei* from Warminster, measuring more than an inch over, with the apical opening broken, has twelve or thirteen ambulacral tubercles. The interambulacrals number twelve, and have secondary rows of nine. It thus only differs from the diagnosis of *D. Barretti* in having in the areas respectively half the number of rows of intervening granules. Another and perfect specimen appears to have but eight tubercles in the interambulacral rows.

I have seen a single specimen of an internal cast of what was probably a large *Micraster*, nearly resembling *M. cor-anguinum*.

An elevated species of *Salenia* occurs.

One species of *Astrogonium* and

One species of *Pentacrinus*.

III.—*On Recent* Terebratulæ.

By T. Davidson, Esq., F.R.S., F.G.S. &c.

To the Editors of the Annals of Natural History.

Gentlemen,

The important researches as well as the discussions that have taken place, within the last few months, between Mr. L. Reeve, and Prof. Suess of Vienna, in connexion with the recent *Terebratulæ*, and in which my name has been so prominently brought forward, induce me to beg the insertion of the following observations in a forthcoming Number of your valuable Magazine. In the ninth volume, second series, of the 'Annals' (May 1852), was published "A Sketch of a Classification of recent Brachiopoda based upon Internal Organization," the result of investigations undertaken along with my distinguished friend Mr. S. P. Woodward of the British Museum.

For many years previous to that period (since 1835 or 1836) my serious attention had been given to the Brachiopoda in general, and at a later period more particularly to the fossil forms which had to be elaborated for the monograph published by the Palæontographical Society. From 1846 to 1852 some portion of my time was directed, under favourable circumstances, to the recent forms and their organization, from having duly estimated the great advantages to be derived from an attentive study of the animal and shell of the living forms, as well as from having noticed that a considerable number of species had been assembled, figured, and described in Parts vi. & vii. of G. B. Sowerby's 'Thesaurus Conchyliorum' (for 1846). It appeared to me therefore that some endeavour should be made to arrange those species according to their internal organization; and consequently, in May 1852, the 'Sketch' above mentioned, with its many imperfections, was published; but in so doing I distinctly intimated (p. 362) that it could not be expected that this first attempt to classify the recent species of living *Terebratulæ* should be entirely successful, but that such a classification had become not only desirable, but necessary, and that no good would be accomplished by delaying its publication. It is therefore a source of some gratification to perceive that the 'Sketch of a Classification' has been very generally adopted in principle, and with but few modifications in detail, by those naturalists who, subsequent to 1852, have devoted their attention to the subject, and especially by my learned friends Prof. Suess and Mr. L. Reeve, who have recently laid before the public their very valuable detailed revisions of the history, synonymy, and geographical distribution of the recent Brachiopoda.

Before referring to the publications of the last-named naturalists, which will form the chief purpose of the present communication, let us cast a rapid glance at what has been done since 1852 with reference to the recent species, leaving aside for the present the fossil ones, although no really comprehensive plan can be carried out without due regard to, as well as a thorough knowledge of, the fossil or extinct genera and species.

One of the first objects, and indeed the most important of all, was to study the animal; and I am truly happy in being able to assert that this portion of the work has been considerably and very successfully elaborated, during the last ten years, by several anatomists of high celebrity. In 1853, Prof. Owen published his views and important observations upon the anatomy of *Terebratula* in the first chapter of my 'General Introduction;' but it was not to be expected that, in such delicate and difficult dissections (mostly conducted upon individuals that had been immersed for many months or years in some preserving liquid not always of a suitable composition), the operator should have been entirely successful on a first or even second examination; and we must therefore not feel surprised if anatomists of such acknowledged repute as Professors Owen and Huxley, Mr. A. Hancock and Dr. Gratiolet have not yet entirely agreed upon certain delicate questions in connexion with this very difficult inquiry. In 1854, Prof. Huxley published, in the 'Proceedings of the Royal Society,' some excellent contributions to the anatomy of the Brachiopoda, which will be read with much interest; and in 1856 Mr. A. Hancock undertook to re-examine with all possible attention the animal of *Terebratula*, *Rhynchonella*, and *Lingula*, from some excellent materials which Prof. Huxley, Mr. Woodward, myself, and some others had been able to furnish him with; and on the 14th of May, 1857, he presented to the Royal Society the most remarkable and elaborate memoir that has been hitherto produced upon the anatomy of the Brachiopoda, and for which the Society awarded him the well-deserved honour of the Royal medal. At the same time, but perfectly independently, Dr. Gratiolet of Paris was investigating the same subject; and his two admirable memoirs, "Recherches pour servir à l'Histoire des Brachiopodes," published in the 'Journal de Conchyliologie' for October 1857 and January and April 1860, are deserving of the highest praise, as well as of the study of every naturalist who may take an interest in this matter. It would lead me too far were I to notice the many important facts discovered and elucidated by these gentlemen, as well as those by Messrs. S. P. Woodward *, J. Müller †, Oscar Schmidt ‡, E. E. Deslongchamps §, and others; but I must not omit to mention, while upon the subject, that some naturalists have been and still are devoting their attention to the condition of the embryo of several living species of *Terebratula*. These important and difficult investigations are being carried on by Messrs. Lovén and Müller, while M. Lacaze Duthiers has had the advantage of being able to examine the fry, in the living state, of several Brachiopoda, and in particular of the *Thecidium mediterraneum*.

Unfortunately the opportunities for studying the animal in

* A Manual of the Mollusca, 1854.

† Reports of the Naturforschende Freunde of Berlin.

‡ Die neuesten Untersuchungen über die Brachiopoden, 1854; Comparative Anatomy, 1852; Manual of Zoology, 1854.

§ Bulletin Soc. Phil. Paris, 1860.

life have hitherto been few in number and of difficult attainment; still the thing is possible, and no doubt will be attended to more particularly in future by those scientific observers who may be dredging in favoured localities. Thus, to take a well-known instance, we may remind the reader that during a dredging tour with Mr. M'Andrew along the coast of Norway, in the summer of 1855, the then young and rising naturalist, Mr. Lucas Barrett, was enabled to make some important observations relative to the animals of *Terebratulina caput-serpentis, Rhynchonella psittacea,* and *Crania anomala,* observations which, although filling but two pages of the 'Annals' for 1855, cleared up some important contested points relative to the power or otherwise of the animal to protrude its cirrated so-termed oral arms. We are now much in want of some observations on the animal of *Lingula* in life, as anatomists have not agreed as to the function of some of its muscles, as I was able to show in pages 58 and 61 of my Monograph of Scottish Carboniferous Brachiopoda (1861).

Another question which has, during the last ten years, attracted much of the attention of several experienced observers is that which relates to the geographical distribution of the various species, as well as to the marine depths they inhabit or prefer; and this subject has been carefully considered and elaborated from existing information, in the recent publications of Prof. Suess* and Mr. L. Reeve†. It is an inquiry, however, that will demand much further investigation, and one which time and fortunate circumstances can alone satisfactorily accomplish; for Brachiopoda, though, no doubt, generally very abundant in their respective haunts, are often much localized and difficult to obtain, so that it was not until the last few years that great accuracy in this particular was considered absolutely necessary; and it is probable that some of the data in our possession cannot be implicitly relied upon, having been at times noted down from the simple recollections of Mr. Cuming: and we might requote what Mr. Reeve has already mentioned, viz. that Mr. Calvert has asserted having dredged *T. fibula* in Bass's Strait, at a depth of 200 fathoms, the Strait itself being ascertained not to be deeper in any part than from 70 to 75 fathoms! The great encouragement given to the "Dredging Committee" by the British Association is certain to secure much accuracy; and we cannot pass over in silence the very excellent "Report" on

* "Ueber die Wohnsitze der Brachiopoden," Proceedings of the Academy of Sciences of Vienna, pp. 185–248 (1859); also the excellent analysis of the above by M. Deshayes, Bulletin de la Soc. Géol. de France, Jan. 1861.

† "A Revision of the History, Synonymy, and Geographical Distribution of recent Terebratulæ," Annals, 1861, and Conchologia Iconica, 1861.

the marine testaceous Mollusca of the North-east Atlantic and neighbouring seas, by Robert M'Andrew, in 1856, wherein every requisite information in connexion with the habitats of nine species of Brachiopoda have been carefully registered.

The question relating to the intimate shell-structure has been admirably elaborated by Dr. Carpenter. In 1853 he treated the subject in the second chapter of my 'General Introduction,' as well as in several subsequent papers in the 'Annals' and in the 'Proceedings of the Royal Society'; while Dr. Gratiolet and M. S. Cloëz have also given us some little additional information, which will be found recorded in the memoirs already quoted.

We now arrive at the difficult question that relates to classification; and here I must humbly admit (nor need feel ashamed to confess it) that, although my own feeble efforts have for years been strenuously bent in that direction, and although many have been the observations that have been made and recorded both by myself and others, I am not yet entirely satisfied as to the perfect stability of our building. That we have proceeded in the right direction, there can exist, I think, but little doubt. It was necessary and unavoidable at first to divide and subdivide our groups, in order to be able to study and appreciate their characters more conveniently and accurately, as well as to extricate the species from the chaos in which they were involved by grouping them according to their resemblances and affinities; but the time will no doubt come when, masters of our subject from a hard-earned experience, we may put into action our philosophical tendencies, which will enable us to compare and value the analogies, so as to reunite or draw closer together those links which had for a time been necessarily parted.

The object and limits prescribed to the present communication will not, unfortunately, admit of my indulging in a review of the whole subject of classification, as I should have desired, or in a criticism of the many so-termed genera that have been fabricated since 1852. Some are, no doubt, good; but the larger number rest on what has appeared to me a very uncertain foundation, and are probably destined to an ephemeral existence. I will therefore content myself with casting a rapid glance at some of the divisions introduced among the recent *Terebratulidæ*, and am happy to observe that, with the exception of *Gwynia* and *Macandrevia*, King*, whose generic claims do not appear to me substantiated, and the abandonment of *Waltonia* by myself in 1853, very little innovation in this respect has taken place since the publication of my 'Sketch' in 1852, and

* Proceedings of the Dublin University Zool. and Bot. Assoc. vol. i. part 3, 1859.

'General Introduction' one year later. Prof. Suess has adopted my classification in principle, but does not distinguish the subgenera from the genera, as those two sorts of division have appeared to him to possess a similar value; and he may very possibly be correct, although it appears to be at present a matter of opinion, since many naturalists prefer the one to the other system. Mr. Reeve has to a certain extent made use of the subgeneric arrangement; and my reason for preferring the retention (at least provisionally) of subgenera is based on the in all probability erroneous idea that genera and subgenera are not of equal value. Our record in this respect (as Darwin would so justly observe) is very incomplete. To be able to divide and subdivide the species definitely (if such were possible), one would require to possess a knowledge of the animals of all the recent and fossil forms, or, in default of that impossibility, to be perfectly acquainted with at least the interior dispositions, calcareous processes, or imprints left by the animal in the various species we require to class; and then one would be able to estimate, with an approximate degree of certitude, the value of the interior characters upon which our subdivisions are founded; and it is probable, from the rapid march of discovery, that the day will arrive when the interior dispositions of the larger number of species will have been examined and placed in comparison one with the other. The result of this will in all probability be, that the differences we now think so much of will be singularly attenuated in their importance, so much so that all the so-termed genera, subgenera, and species will become very much, although never entirely, connected by a series of modifications, which would be even closer had the geological and palæontological record been more perfectly preserved; for many fossil forms or intermediate links are, no doubt (as Darwin has so beautifully explained in chapters ix. and x. of the third edition of his admirable work upon the 'Origin of Species'), irrecoverably lost to us*. Exceptions to a general rule in natural history are oftentimes awkward subjects to be dealt with, and these do, alas! very often occur in our superstructure. Thus, for example, the genus *Terebratella* of D'Orbigny was founded for the reception of those species of *Terebratula* in which the loop is *doubly attached*, first to the hinge-plate, and afterwards to the mesial

* "That the extinct forms of life help to fill up the wide intervals between existing genera, families, and orders, cannot be disputed. For if we confine our attention either to the living or to the extinct alone, the series is far less perfect than if we combine both into one general system......that in a perfectly natural classification many fossil species would have to stand between living species, and some extinct genera between living genera, even between genera belonging to extinct families" (pp. 356, 357).

septum, by processes given off at right angles near the centre of the valve, the remaining portion soon becoming reflected, as in the type, *Terebratella magellanica.* Now, in this species, as in very many others, the dispositions of the loop are exactly the same, the septum being but slightly raised above the surface of the valve where the second attachment takes place, and not extending above or beyond it. Such is *Terebratella* proper, which will include, besides many fossil forms, the recent *T. transversa, T. cruenta, T. Bouchardii, T. rubella, T. rubicunda, T. coreanica, T. labradorensis, T. spitzbergensis, T. frontalis,* and *T. caurina.* But was not the arrangement above described liable to certain modifications? I should say it was; for in some shells, such as *T. Valenciennesii = T. Evansii, T. crenulata, T. flexuosa,* the septum, after the second attachment of the loop, rises and extends more or less rapidly in the form of a narrow elevated plate, and in some examples reaches the centre of the perforated or ventral valve, as in *Magas,* while the loop and other dispositions are exactly similar to those of *Terebratella* proper. This extension of the septum cannot, in my opinion, be regarded as of any generic or even subgeneric importance; and I therefore considered Dr. J. E. Gray was not justified (in his 'Catalogue of the Terebratulæ of the British Museum') in removing the abovenamed species from *Terebratella* and placing them in *Magas*—an arrangement which Mr. S. P. Woodward did not adopt in his excellent Manual. In his first paper and monograph, Mr. Reeve had followed Dr. Gray, from not having "sufficiently understood the fossil type of *Magas;*" and while restoring *T. Valenciennesii* or *Evansii* and *T. crenulata* to *Terebratella* (to which they evidently belong), he has added that, while the loop is a little removed from the typical loop of *Terebratella,* as seen in *T. magellanica,* it is at least intermediate in its characters between that and *Magas.* This, however, would relate solely to the extension of the septum; for in *Magas* (not hitherto known in the recent condition, but of which there are several fossil species), what corresponds to the reflected portion of the loop is anchor-shaped and disunited*. *Magas* may be, and probably is, a modification of *Terebratella,* but sufficiently constant and distinct to be retained as a subgenus.

Before we leave the subject in connexion with the extension of the septum, as exemplified in *T. crenulata,* it must be observed that several authors, among whom we may quote Prof. Suess and Mr. Reeve, have considered *T. flexuosa* to be a synonym of *T. magellanica;* and if such is the case (and I am not prepared to deny the probable correctness of the view), they are admitting

* As described and illustrated by M. Bouchard and myself in the 'Bulletin Soc. Géol. de France,' vol. v. 2nd series, 1848.

that the prolongation of the septum, which in *T. flexuosa* is similar to that in *T. crenulata* or in *T. Valenciennesii*, is not only liable to vary in different species of *Terebratella*, but likewise in specimens of the same species. This subject will assuredly demand further examination; for if *T. flexuosa* is only a young or half-developed condition of *T. magellanica* in which the septum was prolonged, to be so no longer as the shell approached the adult state, then I am of opinion that *T. Valenciennesii* and its synonym *T. Evansii* should be considered in the same light with reference to *T. cruenta*, of which it would be, in that case, the young. The material at my disposal will not, however, enable me to express a decided opinion upon the question; but as *T. cruenta* does not appear to be rare in Cook's Straits, New Zealand, it will not be very difficult for some naturalist in that island to procure a series of specimens at all ages, so as to determine the question. Our difficulties do not end here; for the shell described by myself, with much reserve, as *Terebratella*? *Cumingii*, and which Dr. Gray subsequently located with *Magas*, and Mr. Reeve with *Bouchardia*, possesses a loop and septum similar to that of several species of *Terebratella*, but with the general external shape, prolonged beak, and terminal foramen of *Bouchardia*, from which last-named subgenus it differs, however, very materially in its interior details. In 1852, while describing this New Zealand species, I felt much puzzled; for, on the whole, it is evident that this shell is intermediate between *Terebratella*, *Trigonosemus*, *Bouchardia*, *Magas*, and another of those forms which, according to my possibly erroneous notions, radiate from or cluster round a common type, and which cannot be considered as distinct genera, but merely as subgenera of *Terebratella*, and to which they are certainly more or less intimately related.

Indeed, the differences of the interior dispositions in *T.*? *Cumingii* and *Bouchardia* appear to me greater than those which exist between it and *Terebratella*; and I should consequently still feel disposed provisionally to leave it under the last-named subgenus, although its position there may be somewhat abnormal.

We are now insensibly led on to inquire, what is the character of the loop of *Megerlia*? and here we find it to be three times attached, first by its crura to the hinge-plate, secondly to a median septum by means of horizontal processes, as in *Terebratella*, and from thence reflected to become attached for the third time, by the lateral portions of the loop being again fixed to the septum. In fact, were it not for this third attachment, which may not have existed in the fry or young state, we should at once, as far as the loop is concerned, consider *Megerlia* to be a synonym of *Terebratella*. My friend Mr. Reeve, who admits both *Terebratella* and *Megerlia*, must, I fear, have overlooked the fact that *T. sanguinea*, Chemnitz, possesses a trebly attached loop as in *Megerlia*, since he places it in *Terebratella*, and allows *T. truncata* to remain with *Megerlia*. It is evident to me that either *T. sanguinea* will require to be classed with *Megerlia*, or King's subgenus should be rejected and located among the synonyms of *Terebratella**; but from this, in my present opinion, no advantage would be gained. We must proceed further, if such is to be our plan; for it is highly probable that we should be obliged to include *Kraussia* among the modifications of *Terebratella*, and dispense with the subgenus, were we to allow such shells as *T. sanguinea* and *T. truncata* to be located in two different genera. I well remember how puzzled my friend Woodward and myself were, in 1851 and 1852, while studying several species and specimens of *Kraussia*; for we found that the apophysis in some of the species and specimens became at times branched, and indicated a decided tendency to attain the form of *Megerlia*! I can hardly credit, therefore, that all these modifications or intermediate conditions can claim the rank of independent genera, or, rather, to be of equal value with other genera, such as *Spirifer, Orthis*, &c.; but by allowing them the title of subgenera of *Terebratella*, we are at once enabled to keep closely grouped what should not be separate in our classification of the species†.

Before passing to other matters, let us cast a glance at another example. *Terebratula* proper, exemplified by *T. vitrea*, possesses a small, simple, unreflected loop, composed of two short riband-shaped lamellæ attached to the hinge-plate, and united in front by a transverse lamella bent upwards in the middle. This character is constant in two or three recent and in several fossil species; but in *Terebratulina* the loop is also similar to that of *Terebratula* in the young age, becoming annular in the adult by the union of the crural processes. It seems to me, therefore, that this last is a mere modification of *Terebratula*, not deserving

* In 1852, while working at my 'Sketch,' I had not made out the fact (for which we are indebted to Mr. Reeve) that *T. pulchella*, Sow., was a synonym of *T. sanguinea*, Chemnitz. At the period just mentioned I had not been able to examine a complete specimen of what I considered to represent *T. sanguinea* (enough of the septum remaining only to mislead me into the belief that it belonged to *Terebratella*), but, from finding the triple attachment in *T. pulchella*, I placed it with *Megerlia*, where I am now disposed to leave *T. sanguinea*.

† A great deal is still to be found out relative to the development of the loop by an attentive examination of shells in their various stages of growth; and the reader is referred to a paper by Mr. C. Moore, in the December number of 'The Geologist' for 1860, where certain modifications in the loop of the fossil *Terebratella Buckmani* have been described and illustrated.

more than a subgeneric distinction; but when we come to place it in comparison with *Terebratella* or any of its modifications, the difference is more apparent. It is not impossible, I admit that these extremes may be found to be far more nearly, connected than is at present supposed; and many observations in connexion with the fossil species would lead to that inference. In *Waldheimia,* where, like *Terebratula,* we have but a single attachment, the loop is long and reflected, and there exists a median septum; so that all that would be required for a *Waldheimia* to be converted into a *Terebratella,* so far as the shape of the loop is concerned, would be for the principal stems of the loop to effect a second attachment to the already existing septum by means of short shelly processes.

I have made these observations and given these few examples (taken from among many) in order to show how difficult it is to rest long on a single character; for we have seen what a tendency the loop possesses to become modified at different ages and in certain forms, and how it thus diminishes in value as a constant character; but still, for all that, and until a better mode of classification presents itself, I think there is an advantage in subdividing the *Terebratulidæ* as we have done, with the understanding that undue importance must not be attached to the divisions.

Several new species having likewise turned up during the last few years, a revision of the subject had become not only a desideratum but an absolute necessity; and this has been most ably accomplished by Prof. Suess and Mr. L. Reeve. It must be remembered that Prof. Suess's 'Wohnsitze' has for its subject the fossil as well as the recent species, from the conscientious study of which he has deduced certain interesting philosophical reflections: but the author does not pretend that his superstructure is faultless; on the contrary, he claims great indulgence from having been obliged to borrow information from several sources which he could not possibly verify; and I do not consider that the author has shown any disregard for details or want of acumen in the preparation of his work*. Prof. Suess's 'Wohnsitze' was not intended to take the place of a monograph of the recent Brachiopoda, as the author neither gives illustrations nor complete descriptions of the various species; so that Mr. Reeve's "Monograph of the Genus Terebratula," which forms a part of his valuable and beautiful 'Conchologia Iconica, really fills up one of the desiderata to which we have already

* We feel much pleasure in referring the reader to a very interesting analysis of Prof. Suess's memoir, from the pen of the distinguished French naturalist, M. Deshayes, which will be found in the Bulletin de la Soc. Géol. de France, 2 sér. vol. xviii. p. 163, 1861.

alluded; and I am able to attest that its author has spared no trouble in the endeavour to make his work as complete as the material and information in his possession would permit. It must also be mentioned that Mr. Reeve was far from considering his work to be faultless, and repaired to Paris as soon as his monograph and first paper in the 'Annals' had been published, and there obtained from M. Deshayes some additional information, which he added to the French edition of his "Révision," &c., recently published in the 'Journal de Conchyliologie.' On his return from Paris, I was likewise able to offer Mr. Reeve some further suggestions, which he was about to publish in the 'Annals,' when a controversy arose between himself and Prof. Suess touching four points, which have been discussed in the May and June Numbers of the 'Annals.'

A few words from myself on the subject will, I trust, be sufficient to settle the little matter in question, which is but of small importance when viewed in relation to the labours of my two distinguished friends. The first point refers to the so-called *Waltonia Valenciennesii*; and I am sorry indeed that my own blunder should have misled Prof. Suess into the belief that the shell in question was referable to the genus *Argiope*. As far back as the end of 1852, I had acquired the conviction that the shell upon which I had, with an inexcusable haste, fabricated a so-called genus, was an abnormal mutilated specimen of some species in which the loop was broken away, and hence I did not reproduce the so-termed genus in any of the editions of my 'General Introduction.' I was not aware, while publishing my description of *T. Evansii*, from a perfect specimen, in the Proc. Zool. Soc. 1852, that it might be the same as *W. Valenciennesii*; but a subsequent study of several New Zealand specimens had led me to concur with Mr. Reeve that the two shells might belong to a single species; and all I can do is to express to my excellent friend Prof. Suess the regret I feel that my incomplete figure of *Waltonia* should have misled him in this particular.

I must also clear Prof. Suess from any charge of neglect in connexion with the second and third points, since he followed me in his references. The second relates to a single larger valve of Sowerby's so-termed *T. algoensis*, which I was not certain about in 1852, and which I supposed might perhaps belong to *Terebratella*. Mr. Reeve subsequently determined it to be a bleached *Kraussia rubra*; and it is due to Prof. Suess to observe that he did not reproduce the statement I had made without a caution, for he observes that it is only known by one single larger valve, the generic position of which is therefore rather doubtful. It would have been better had Prof. Suess omitted to include this uncertain form in his geographical dissertations; still the mistake is of but small importance, and easily corrected, and might have occurred to any naturalist. The third point has reference to Prof. Suess having followed me while quoting Corea as the habitat of *Kraussia Deshayesii,* instead of the Cape of Good Hope, as given in the 'Moll. Voy. Samarang:' but here, again, I was misled by Mr. Cuming, just as Mr. Reeve was himself when doubting his own original statement relative to the habitat of *T. abyssicola*; for he, as well as myself, had been misled by a displacement of the labels in Mr. Cuming's collection.

The fourth and last point has reference to the supposition made by Prof. Suess that *T. frontalis* might perhaps be identical with *T. transversa,* which is in all probability a mistake, but a point to which Prof. Suess did not attach any importance, and could not be blamed for having stated that *T. frontalis* was "quasi the representant of *T. spitzbergensis* in the North Pacific," recognizing at the same time that both were specifically distinct.

Notwithstanding the high value of the monograph and revised lists of recent Terebratulæ recently published, the subject will still demand further attention and study, on account of the great difficulties connected with the classification of some of the species; it will therefore perhaps be as well for me to conclude by reproducing the list of species as determined by Prof. Suess, Mr. Reeve, and others, to which I will add some suggestions and alterations which have appeared to me desirable.

Family Terebratulidæ.

[An * is placed before those species of which I have not seen specimens, and a ? before those whose generic or specific claims have not been, to my mind, satisfactorily established. For all details and full descriptions the reader is referred to Prof. Suess's 'Wohnsitze' and to Mr. Reeve's 'Monograph' and other papers.]

Genus Terebratula, Lhwyd (restricted).

1. *Terebratula vitrea,* Born, sp. *Hab.* Mediterranean.

*2. *Terebratula minor,* Philippi and Suess. *Hab.* Mediterranean. I am not acquainted with this shell, which Prof. Suess assures me is distinct from *T. vitrea,* that it is smaller, with stronger valves and blunt margins, and that Philippi has pointed out the constant differences between the two, though he possessed only fossil specimens, while the Imperial Museum of Vienna has it both fossil and recent. *T. euthyra,* Philippi, as Prof. Suess has shown, is a *Waldheimia* with a long loop, as figured in pl. 1. fig. 5 of his German edition of my 'General Introduction;' and therefore Dr. Gray and Mr. Reeve were mistaken in supposing it a synonym of *T. vitrea. W. euthyra* is a fossil species, and not known in the recent condition.

3. *Terebratula uva,* Brod. *Hab.* Falkland Islands.

Subgenus Terebratulina, D'Orbigny.

4. *Terebratulina caput-serpentis*, Linn., sp. Syn. *Anomia pubescens* and *A. retusa*, Linn. = *T. nucleus*, Müller = *T. costata*, Lam. = *T. emarginata* and *quadrata*, Risso. *T. aurita*, Fleming = *T. striata*, Leach = *T. septentrionalis*, Couthouy = *T. conica*, D'Orb. = *Delthyris spatula*, Menke.
Hab. This species has probably a more extended range than is usually supposed, viz. the North and South European and North American seas.

?5. *Terebratulina cancellata*, Koch. *Hab*. West Australia.

?6. *Terebratulina abyssicola*, Adams & Reeve. *Hab*. Cape of Good Hope.
It is probable that these two so-termed species should be united, and it is also possible that they may be nothing more than varieties of *T. caput-serpentis*.

?7. *Terebratulina japonica*, Sow. *Hab*. Corea, Japan. Mr. Reeve justly observes that this species (?) is closely allied to *T. caput-serpentis*.

8. *Terebratulina radiata*, Reeve. *Hab*. Corea.

9. *Terebratulina Cumingii*, Dav. *Hab*. China Seas.
Dr. Gould describes and figures, in the 'United States Exploring Expedition, Mollusca,' under the name of *T. patagonica*, a shell which Prof. Suess believes to be perhaps a new *Terebratulina*; but to determine this point an examination of the specimen itself would be absolutely necessary. *Hab*. Coast of Patagonia.

Genus ? Waldheimia, King.

10. *Waldheimia venosa*, Solander, 1789. Syn. *T. globosa*, Val. apud Lam. 1819 = *T. californica*, Koch = *T. Kochii*, Küster = *T. eximia*, Philippi = *T. physema*, Val. apud Reeve. *Hab*. Falkland Islands; California; Coquimbo. First discovered about a century ago by Capt. Cook, this is the largest known among the recent species, and has received many names. It appears to me that the *T. physema*, Val., is only a slightly different shape of *T. venosa*; and I am somewhat inclined to look upon *T. dilatata* also as another modification. The term *venosa* has been known to M. Deshayes and myself for several years.

?11. *Waldheimia dilatata*, Val. apud Lam. Syn. *T. Gaudichaudi*, Blainv. *Hab*. Same locality as the preceding species.

12. *Waldheimia lenticularis*, Desh. 1839. *Hab*. New Zealand. The same species is found fossil in the neighbouring cliffs.

13. *Waldheimia picta*, Chemnitz. Syn. *T. erythroleuca*, Quoy = *T. sanguinea*, Sow., not Chemn. *Hab*. Java.

14. *Waldheimia cranium*, Müller. Syn. *T. subvitrea*, Leach = *Macandrevia cranium*, King. *Hab*. North European seas.

15. *Waldheimia septigera*, Lovén. *Hab*. Norway; Finmark.

We know but little about this species (?). I have seen but the single example in Mr. Cuming's collection.

?* 16. *Waldheimia pulvinata*, Gould. *Hab.* Puget Sound, Oregon. Might this be a young *W. venosa*? The specimen would require to be carefully compared prior to being definitively admitted as a distinct species.

17. *Waldheimia flavescens*, Val. apud Lam. Syn. *T. dentata*, Val. = *T. australis* and *T. recurva*, Quoy. *Hab.* South Australia.

18. *Waldheimia Grayi*, Dav. *Hab.* Corea.

Genus ? Terebratella, D'Orbigny.

A. *Typical Species.*

19. *Terebratella magellanica*, Chemnitz, 1785. Syn. *T. dorsata*, Val. = *T. bilobata* and *T. pectinata*, De Blainville = *T. Sowerbyi*, King = *T. chilensis*, Brod. = *T. dorsata*, Menke. *Hab.* Straits of Magellan and Valparaiso. This shell was figured by Grundler in 1774 and by Favanne in 1780.

? 20. *Terebratella transversa*, Sow. Mr. Reeve believes that it is perhaps only a monstrosity of *T. magellanica*.

21. *Terebratella cruenta*, Dillwyn, sp. Syn. *T. sanguinea*, Leach, Quoy, not Chemnitz = *T. rubra*, Sow. = *T. zelandica*, Deshayes. *Hab.* New Zealand.

? 22. *Terebratella labradorensis*, Sow. *Hab.* Labrador. I have not seen its interior, and therefore cannot say whether it agrees with the typical species of *Terebratella*, or whether it is similar to those species (?) which have the septum extended. Again, it is possible that *T. labradorensis* might be only a young and abnormal state of *T. magellanica*?

* 23. *Terebratella caurina*, Gould, 'United States Expedition.' *Hab.* Puget's Sound, Oregon. From the description and figure, this appears to me a distinct species.

24. *Terebratella rubicunda*, Sow. Syn. *T. inconspicua*, Sow. *Hab.* New Zealand.

25. *Terebratella rubella*, Sow. *Hab.* Bass's Straits, South Australia. It has been quoted from Japan?

26. *Terebratella coreanica*, Adams & Reeve. *Hab.* Corean Archipelago.

* 27. *Terebratella frontalis*, Middendorf. *Hab.* South coast of the Sea of Ochotsk.

? 28. *Terebratella Bouchardii*, Dav. *Hab.* ——? This species (?) requires further examination, the material in hand being insufficient.

?* 29. *Terebratella suffusa*, Reeve. *Hab.* ——? This, like the preceding one, requires further examination prior to being definitively admitted, for the same reason as given with reference to *T. Bouchardii*.

?* 30. *Terebratella miniata*, Gould, MS. Described in Suess's 'Wohnsitze.' I am not acquainted with this large *Tere-*

bratella, which Prof. Suess considers to be a distinct species.

31. *Terebratella spitzbergensis,* Dav. *Hab.* Spitzbergen. This shell and its interior has been recently found and figured by Otto Torell, in his 'Bidrag till Spitsbergens Molluskfauna,' taf. 1. fig. 1, 1859.

B. *Species? in which the septum is more or less prolonged above and beyond the second attachment of the loop, and which certainly belong to* Terebratella.

?32. *Terebratella flexuosa,* King. *Hab.* Straits of Magellan and vicinity of Port Famine. This has been considered by many authors a synonym or variety of *T. magellanica,* which is probably a correct view; but as the interior dispositions are somewhat different from those of the last-named shell, further research will be desirable before King's species is united to that of Chemnitz.

?33. *Terebratella crenulata,* Sow. *Hab.* Santa Cruz?; Canaries. I quite agree with Mr. Reeve in the idea that this shell has much the appearance of *T. labradorensis,* and may be also a young condition of *T. magellanica?*

34. *Terebratella Valenciennesii,* Dav. Syn. *T. Evansii,* Dav.? *Hab.* New Zealand. May not this be a young state of *T. cruenta?*

C. *Species whose exact generic position is uncertain, but which possess a loop very similar to that of* Terebratella.

?35. *Terebratella? Cumingii,* Dav. *Hab.* New Zealand.

?36. *Terebratella? fibula,* Reeve. *Hab.* Bass's Strait. I have already alluded to the difficulties attending the proper classification of these two species, which have been placed by Mr. Reeve with *Bouchardia.*

Subgenus Bouchardia, Dav.

37. *Bouchardia tulipa,* De Blainville. Syn. *T. rosea,* Humphreys $=$ *T. roseus,* King $=$ *T. unguis,* Küster. *Hab.* Brazil.

Subgenus Megerlia, King.

38. *Megerlia truncata,* Linn., sp. $=$ *Anomia disculus,* Pallas $=$ *T. scobinata,* Gmelin $=$ *T. decussata* and *T. irregularis,* De Blainville $=$ *T. monstrosa,* Scacchi $=$ *T. oblita,* Michelotti, *Hab.* Mediterranean; Cape Finisterre; Canaries.

39. *Megerlia sanguinea,* Chemnitz. Syn. *T. pulchella,* Sow. *Hab.* Philippine and Sandwich Islands; was also recently dredged at Tahiti by M. Déplanche.

Another species?, *Megerlia transversa,* Gould, MS., is described by Prof. Suess in his 'Wohnsitze;' but I know so little about the shell, that I cannot venture to add it to the present list.

Subgenus Kraussina, Dav.

(The term *Kraussia* having already been made use of for some other animal, the termination *ina* has been substituted for that of the original designation.)

40. *Kraussina rubra,* Pallas. Syn. *Anomia promontorii bonæ spei,* Chemnitz = *T. algoensis,* Sow. = *T. rubra* and *T. rotundata,* De Blainville. *Hab.* South Africa.

?41. *Kraussina cognata,* Chemnitz. *Hab.* South Africa.

42. *Kraussina pisum,* Val. apud Lam. Syn. *T. natalensis,* Krauss. *Hab.* South Africa.

43. *Kraussina Deshayesii,* Dav. Syn. *T. capensis,* Adams and Reeve (not Gmelin). *Hab.* Cape of Good Hope.

44. *Kraussina Lamarckiana,* Dav. *Hab.* Sydney and New Zealand.

Subgenus? uncertain (*Gwynia,* King).

45. *Terebratula? capsula,* Jeffreys. *Hab.* Belfast Lough, and Etretat, Normandy. I can add nothing to what has been stated by Messrs. Jeffreys, King, and Reeve with reference to this microscopic so-termed species; and it appears to me that its generic and specific claims have not yet been sufficiently determined.

Genus? Morrisia, Dav.

(The arrangement of the oral arms appears to me so different from what we find in the other genera and subgenera of the class, that I propose, at least provisionally, to retain it as distinct.)

46. *Morrisia anomioides,* Scacchi. Syn. *Orthis anomioides,* Scacchi = *T. appressa,* Forbes. *Hab.* Mediterranean.

47. *Morrisia Davidsoni,* Deslongchamps. *Hab.* Mediterranean.

?48. *Morrisia lunifera,* Philippi. *Hab.* Mediterranean. I am not yet satisfied as to the value of this so-termed species.

Genus Argiope, Deslongchamps.

49. *Argiope decollata,* Chemnitz. Syn. *A. detruncata,* Chemn. = *T. aperta,* De Blainville = *T. dimidiata,* Scacchi = *T. cardita,* Risso = *T. urna-antiqua,* Risso. *Hab.* Mediterranean.

In 1793, Helmintholish figured two species of Mediterranean *Argiope,* of which one is no doubt intended for the *A. decollata* of Chemnitz. In pp. 18, 19 of his 'Oss. Zool.' (1833), Signor Scacchi describes two species of *Terebratula* (*Argiope*) which he states to be interiorly different from other *Terebratulæ.* In the one, his *T. dimidiata* (*A. decollata,* Chemn.), he describes five septa in the smaller valve, the three central ones being the largest; while in his *Terebratula* (*Argiope*) *neapolitana* he finds but one. This agrees with the two divisions I pointed out in Deslongchamps's excellent genus, the first being typified by *A. de-*

collata, the second by *A. neapolitana*, *A. cuneata*, and *A. cistellula*; and it is deserving of notice that, from the study of the interior, Scacchi had, as far back as 1833, perceived the differences which *Argiope* presents from *Terebratula*, and had thus indicated the probable necessity for the creation of a distinct genus for its reception.

50. *Argiope cuneata*, Risso. Syn. *Anomia pera*, Mühlfeldt = *T. Soldaniana*, Risso. *Hab.* Mediterranean.

51. *Argiope neapolitana*, Scacchi. Syn. *A. Forbesii*, Dav.

52. *Argiope cistellula*, S. Wood. *Hab.* Mediterranean and British Seas. The surface of this shell is smooth; and I regret that Sowerby's figure in Mr. Reeve's monograph does not convey a faithful representation of the species.

Genus Thecidium, Defrance.

53. *Thecidea mediterranea*, Risso. Syn. *Th. testudinaria*, Michelotti = *Th. spondylea*, Scacchi.

So that fifty-three so-termed species have been for the present catalogued; but of these a certain number will in all probability, when better known, have to be cast among the synonyms. In the mean time, we are greatly indebted to Prof. Suess and to Mr. L. Reeve for the additional information they have imparted.

I am, Gentlemen,

Your very obedient Servant,

Brighton, May 29, 1861. Thos. Davidson.

IV.—*Contributions to an Insect Fauna of the Amazon Valley.* Coleoptera: Longicornes. By H. W. Bates, Esq.

The number of species of Longicorn Coleoptera which I collected at different stations on the banks of the Amazons amounts to about 705. The collection appeared to me to contain so large a number of curious and interesting forms new to science, that I was anxious to make them known to the entomological public as soon as possible, first determining the already known species, and fixing upon a classification of the genera and groups. I then hoped to be able to give a complete view of the Amazonian productions in this department, incorporating a few general remarks on their natural history, instead of following the usual and much easier practice of giving merely a bare and unfruitful list of diagnoses of the new species.

It has been a difficult task, however, in the absence of a modern monograph on the family, to characterize the genera, and especially to group them into subtribes or groups subordinate to the four tribes of Latreille, which for a long time constituted the only received classification, but are now manifestly insufficient to give a lucid view of the contents of this greatly augmented family of insects. Within each of the tribes the diversity of forms is so great that it has become absolutely necessary to subdivide them, and ascertain at the same time the relations of the subdivisions to each other. I was therefore unwilling to publish descriptions of the new forms without first attempting to class the whole in natural groups, as well as to define better the already known genera. A mere succession of a multitude of genera treated in an isolated manner, without indications of the affinities which link them together (such, in fact, as has been given hitherto in works on the family), could lead to no useful scientific results.

No general treatise has appeared on this subject (until within the last few months) since the imperfect one of Audinet-Serville in 1832–4. In this work the genera are very insufficiently characterized, often from the examination of a single species. Shortly afterwards appeared the third edition of the Catalogue of Count Dejean, in which a great number of new genera were introduced without characters at all. On the uncertain foundation, however, of these two works, a vast number of new species and genera have been published, many of the former being referred, in a most loose and unsatisfactory manner, to the uncharacterized genera of Dejean. The want of a good monograph, such as exists on many other families of Coleoptera, has long been felt. Faunists, in treating of the family in their special works, and authors of the numerous works on the zoology of voyages, public and private, have been obliged to describe great numbers of new genera and species without reference to a reliable general classification; besides which, many Coleopterists to whom the family is attractive on account of the great beauty and variety of its forms, have continually published isolated descriptions of new species and genera, and this in every variety of natural-history periodical, and in almost every European language. In this way at length about 820 genera and 4500 species have been introduced into the science, a very large portion of them without proper indications of their place in the system.

The general treatise upon the Longicornes which I have alluded to above as having appeared very lately is by M. J. Thomson of Paris, and entitled 'Essai d'une Classification de la Famille des Cérambycides.' It is founded on a previous special work on the North American Longicornes published by Dr. Leconte in 1852, called 'An Attempt to classify the Longicorn Coleoptera of America north of Mexico.' The latter essay was a great step in advance, as it entirely remodelled the previous knowledge on the subject, and took into account many parts of the structure of these insects which were left unheeded by previous writers. Although a faunistic work, it comprehended here and there the results of the examination of genera found in other parts of the world. The treatise of M. Thomson consists of an application of Leconte's classification to the Longicornes in general. Both these essays, however, leave much to be desired, for reasons to be mentioned presently. The only other works which contain considerable modifications of the system of Latreille are Mulsant's 'Coléoptères de France (Longicornes),' 1839, and Blanchard's 'Histoire des Insectes,' 1845. The former, although containing an excellent analysis of the species and genera found in France, added little that could be applied to the family generally. The latter proposed a number of subtribes, but with insufficient and inapplicable characters, and without any review of the genera comprehended under them.

Leconte divided each of the tribes of Latreille into a number of subordinate groups, characterized after a searching examination of the whole external structure of the insects. It is doubtful, however, whether his groups can be all maintained: the classification is open to much objection, and, I think, will require considerable emendation before being applied generally. The important discovery of a very constant character for the tribe Lamiaires, viz. the existence of an oblique groove on the inner side of the fore tibiæ, is due to Zimmerman, who first called attention to it. The existence of a smaller similar groove surmounted by a tubercle on the outer side of the middle tibiæ, in most of the divisions of the same tribe, was not mentioned. The form of the anterior acetabula, or sockets of the fore haunches, is employed too rigorously: it is a constant character in some groups of Lamiaires, being a good guide, for instance, in distinguishing the Colobotheæ from the true Saperditæ, with which they had been confounded by all previous authors; but it separates *Acanthoderes* and its allies too widely from *Oreodera*, *Dryoctenes*, and similar genera, with which they are in all other characters closely connected. In fact, some of these genera are extremely variable in this character. The form of the anterior acetabula depends upon how far the suture which runs from their external rim to the line which separates the pronotum from the pectus is opened or closed. This suture seems to be that which separates the episternum from the epimera, and, according to the shape or manner of action of the fore haunches, it is either quite closed, more or less gaping near the rim of the socket, partly closed but not gaping at its commencement, or widely opened along its whole length. The shape of the acetabula in the Prionidæ was noticed long before the date of Leconte's treatise, viz. by the Marquis Maximilian Spinola, in a paper published in 1842. In this tribe, where the breast is very broad and the haunches cylindrical, the suture is long and widely gaping. When the suture is opened only a little at its commencement near the rim of the socket, the acetabula are termed by Leconte "angulated;" but it is often very difficult (for instance, in the genus *Acanthoderes*) to say when they should be considered angulated and when round.

This work, however, being almost confined to North American productions, could only be a stepping-stone to the desideratum of a sound general classification of the Longicorn family. M. Thomson, in his Essay, adopts the system of Leconte with some slight modifications, and applies it to the Cerambycides of the whole world, for doing which his very large private collection afforded great facilities. He institutes a great number of subtribes, groups, and divisions, arranged in order under the tribes of Latreille as modified by Leconte. This, therefore, is by far the most considerable work that has yet appeared on the subject, and might be expected to form the groundwork and guide which I have alluded to as being the great desideratum in this family. It is, however, disappointing in many respects, although containing much that is very valuable, and forming, upon the whole, a real advance in the science. The greatest objection that can be made to it is that, although there seems at first sight to be a just and well-digested classification, yet the diagnoses of his groups and genera, when examined into, are found not to apply, in most cases, to the majority of the insects they refer to. The characters very often are too general and random, and do not, in fact, serve to characterize at all. The more detailed characters of the numerous new genera, however, are given in a much more satisfactory manner. Part of this obscurity is owing to the innate difficulties that the study of the group presents, as will be mentioned presently. Very many of his groups are natural, and will doubtless stand their ground, but they will mostly still require to be defined. In his fifth group of Lamiaires, viz. the Onciderítæ, he gives as diagnosis, "Frons apud ♂ sæpissime armata. Tarsorum articulus ultimus longissimus." These two characters apply equally well to many of his thirteenth group, Hypsiomitæ—to several genera of the Apomecynitæ division of his Saperditæ (*Trestonia, Trachysomus,* &c.)—and partly to his fifteenth group, Hippopsitæ. Some features of his classification, however, are very good. Thus, by means of the system adopted, he has been able to ascertain that the curious South-east Asian group, Tmesisternitæ, are true Lamiaires, notwithstanding the porrect direction of the head—a superficial and erroneous guide, which has misled all previous authors. The Callidiitæ approximated to the Spondylidæ is also a good arrangement; and there are many others of the same nature. He has done great service, also, in characterizing most of the remaining genera and species of Dejean which still, as unmeaning names, encumbered the science. Moreover, the work, as bringing together, in something like order, a vast amount of hitherto scattered material, will be of great service.

A few more general remarks on these important works will perhaps not be out of place here, although they do not all strictly apply to the Amazonian fauna. The position of the Lepturitæ as a group subordinate to the Cerambycidæ seems to me untenable. The true Lepturitæ, by the structure of their fore haunches, the shape of the head, the insertion of the antennæ, and other features, appear to me better placed as an independent tribe, according to the system of Latreille. The Distenitæ, for similar reasons, namely the shape of the head and the insertion of the antennæ, I think should also be considered an independent tribe, instead of being intercalated between Rhopalophoritæ and Cerambycitæ. The Pseudolepturitæ of Thomson, as he justly remarks, require much further examination: they are in some respects the most curious forms of the whole family, and will require probably the institution of one or more distinct tribes. It is a merit of M. Thomson's system to have improved very much the constitution of the tribe Prionidæ, which previously was a most heterogeneous assemblage; but it has escaped him as well as other authors that the genera *Cheloderus* and *Oxypeltis*, singular Chilian forms, have a muzzle differently constructed from that of all other Longicornes. They also differ from all in the shortness of the third antennal joint. In the shape of the muzzle they resemble *Sagra* and allied genera in the family Phytophaga. They are especially ill-placed among the Prionidæ. Two Australian genera, viz. *Brachytria* and *Pytheus*, are closely allied to them; and the four, I believe, must be made to constitute another independent tribe.

In the following review of the Amazonian Coleoptera belonging to this family, I have thought it better, on the whole, to adopt the system of M. Thomson, introducing some modifications, and endeavouring to find more suitable characters for the genera, commencing with the tribe Lamiaires. It must not be urged too severely that the groups are not precisely characterized. It is a matter of great difficulty, perhaps impossibility, to find constant characters for the subordinate divisions. It is one of those groups of insects in which Nature, in striving after strong individuality in the species, seems to have changed or adapted those parts of structure on which we rely for characters of genera and groups of genera. The family, too, is found throughout all parts of the world where woody vegetation exists, and has endured probably, under the same laws of modification, throughout long geological epochs. The diversity of specific forms seems endless, running into infinite varieties of grotesque, ornamented, and extraordinary shapes; and nearly every species has structural peculiarities for its specific characters; so that in no family can genera be made so easily and so numerously as here. Analysis is too easy, and has already been pushed, perhaps, to too great an extent.

The Lamiaires, as far as they are represented in the Amazonian fauna, seem to present six different types of form: but in none are the characters quite constant; they can only be considered as very general, but seldom apply to the whole of the species or genera. I have taken into consideration most of the parts of structure employed by Messrs. Leconte and Thomson, and have brought into prominence others which were neglected or only considered subordinate by them, viz. the shape and relative length of the basal joint of the antennæ, the tubercle and groove of the middle tibiæ, and the claw-joint and claws of the tarsi. The parts of the mouth, which offer sure characters in most other families of Coleoptera, are here of scarcely any systematic value. The palpi only occasionally furnish generic characters. The ligula, otherwise a very important organ, varies greatly in species very closely allied in all other characters. Under each subtribe I have quoted such of M. Thomson's groups and divisions subordinate to it as are represented in the Amazon region.

Subtribe 1. Acanthoderitæ. Basal joint of the antennæ shorter than the third, forming an elongate-pyriform club, very slender at the base. Middle tibia with the tubercle and groove on its outer edge conspicuous. Anterior acetabula generally angulated externally, the suture more or less gaping, but sometimes (*Steirastoma*) entirely closed. Tarsi simple.

Acanthoderitæ, Acrocinitæ, Oreoderitæ, Dryoctenitæ, Polyrhaphitæ, and Anisoceritæ, *Thoms.*

Subtribe 2. Acanthocinitæ. Basal joint of the antennæ much elongated, as long as or longer than the third. Middle tibia almost always with the tubercle and groove conspicuous. Anterior acetabula circular, the suture being closed or nearly so. Head narrow. Tarsi simple.

Acanthocinitæ, Trypanidiitæ, Colobotheitæ, *Thoms.*

Subtribe 3. Lamiitæ. Basal joint of the antennæ moderate in size, forming an oblong club thickened from base to tip.

Middle tibia with the tubercle and groove always largely developed. Tarsi simple.
Monohammitæ, *Thoms.*

Subtribe 4. Onciderítæ. Basal joint of the antennæ thickened from base to tip; moderate in size (except in Hippopsitæ). Middle tibia with the tubercle and groove conspicuous. Anterior acetabula angular externally. Tarsi with the claw-joint almost always greatly elongated; claws simple. Body elongated.
Onciderítæ, Apomecynitæ, pt. (*Eudesmus, Trachysomus, Trestonia*), Hypsiomitæ, Onocephalitæ, Hippopsitæ, *Thoms.*

Subtribe 5. Desmiphoritæ. Basal joint of the antennæ very slender at the base, abruptly clavate. Middle tibia with the tubercle and groove frequently wanting. Anterior acetabula angulated externally. Tarsi simple. Antennæ filiform, rather short, pilose; muzzle generally very short, and occiput very large, prominent.
Compsosomitæ, Desmiphoritæ, Apomecynitæ, pt. (*Hebestola*), *Thoms.*

Subtribe 6. Saperditæ. Basal joint of the antennæ slender, generally thickened gradually from the base. Middle tibiæ in most of the genera wanting entirely the tubercle and groove. Anterior acetabula widely gaping externally. Tarsi always short; claws very frequently toothed or bifid. Body elongated; thorax very generally cylindric, simple.
Saperditæ, Amphionychitæ, Tapeinitæ, *Thoms.*

It is possible that this classification might be improved by withdrawing the Hippopsitæ from the Onciderítæ, and the Tapeinitæ from the Saperditæ, and instituting with them two additional tribes. I think it would be difficult, however, to form an arrangement which would meet all requirements. Each of the subtribes (except the third) will contain several natural groups, the definition of which I think it better to leave until the whole of the Lamiariæ have been passed under review. The geographical distribution of the six subtribes is interesting, in so far that the first (Acanthoderitæ) is almost peculiar to the New World, a few species of one genus only having yet been recorded from the eastern hemisphere. On the other hand, the third (Lamiitæ), which exist in great number and variety of genera and species in the Old World, is represented in South America, at least in the Amazon region, by one genus only, viz. *Tæniotes.*

Fam. LONGICORNES, Latr.

Tribe LAMIAIRES, Latr.

Subtribe ACANTHODERITÆ, Thoms. (pt.).

Group *Acanthoderinæ.*

Genus ACROCINUS, Illiger.

(Thoms. Class. des Cérambyc. p. 28.)

This genus, as revised by Thomson, is distinguished from *Oreodera* and all the allied genera by the simple femora. To this may be added that in *Oreodera* the basal joint of the antennæ is almost always relatively shorter and more abruptly clubbed than in *Acrocinus*; and the ♂ fore tarsi are naked in the latter, whilst they are always fringed with hairs in the former genus. The anterior acetabular sutures are widely gaping. The face in all the species is short, being nearly twice as broad as long (measuring the length from the top of the antenniferous tubercles); the muzzle is widened from the eyes downwards, and the lower angles are prominent. The eyes above nearly meet on the vertex, being separated only by the central line; below they reach the central line of the forehead only in one species (*A. longimanus*), in the others being widely separated. The fore and middle tibial grooves, with their accompanying tubercles, are removed to very near the apex of the tibiæ in *A. longimanus*; in *A. trochlearis* and *A. accentifer* they are largely developed, especially in the ♂. The fore legs are covered with granulations and elongated in the ♂ of the two species just named, and the tibiæ have a row of tooth-shaped projections along their under-surface. In *A. longimanus* the same legs are tuberculated in both sexes, the denticulations of the tibiæ are very large (extremely so and recurved in the ♀), whilst the fore legs of the ♂ reach an excessive length, the femora having also a strong tooth-shaped projection on the upper surface near the base, which does not exist in the ♂ of the other species. The thoracic lateral spines are long, acute, and retrocurved in *A. longimanus*; in the other species they exist only as points at the apices of the lateral tubercles. There are several other points of difference between *O. longimanus* and its congeners; but I think they are not of a nature to warrant the institution of a separate genus; the species must be viewed rather as a highly developed and exaggerated form of the generic type.

An erroneous statement has been made and repeated by authors with regard to the thoracic tubercles of *A. longimanus*, to the effect that they are moveable. Such a structure would be curious in the highest degree, but it does not seem to have excited attention sufficient to lead to further examination. It is, however, an error, the credit of pointing out which is due to M. Thomson in his recent work on the Cérambycides. A deep depression around the base of the tubercle seems to have given rise to the mistake; but in fact the depression, which is found also in great numbers of Lamiaires, is not continuous, as a slight examination will show.

1. *A. longimanus*, Linn. and authors.

The Amazonian examples of this insect are smaller than those found in other parts of South America. It is not a very common insect, and is not found, as its great size would lead one to suppose, on the larger trees of the forest; I have found it almost always on slender boughs, or on tree trunks of moderate dimensions. I have sometimes cut the insect out of the rather hard wood of such trees, near the centre of which it passes the larva and pupa states. The stridulation of the species is very loud, and can be heard at many yards' distance in the forest. It appears not to be confined to one kind of tree; I have found it on the Inga, a genus of Leguminosæ, and on the Jabutí-puhé, a wild fruit-tree of the order Anonaceæ, as well as other trees. On the Inga it is sometimes seen in company with *Oreodera glauca*,—the *Oreodera* being coloured in close imitation of the bark, and clinging very closely and flatly to it, thus eluding observation, whilst *A. longimanus* in its bright colours forms a very conspicuous object. It is very slow in motion, but has the habit of bending its long legs rigidly in self-defence on being disturbed. Thus, of two allied species, one has the means of defence and maintenance of existence in one way, and one in another.

2. *A. trochlearis*, Linn.

Cerambyx trochlearis, Linn. Syst. Nat. ii. 622.
Prionus trochlearis, Oliv. Col. iv. 7. 13. 49.

This elegant species seems to be peculiar to Guiana and the Amazon region. Its habits are similar to those of *A. longimanus*, in so far as it is found on the moderate-sized branches of trees blown down in the forest.

The allied *A. accentifer* I did not meet with; it is found in S.E. Brazil and in Venezuela, but not in the intermediate country of Amazonia.

Genus Oreodera.

Serville, Ann. Soc. Ent. Fr. iv. 19.

The body in this, as in the preceding genus, is elongated and flattened; the species, however, are of much smaller size. The prothorax has on its disk three prominent tubercles, arranged in a triangle; but the posterior one is sometimes wanting, and in some of the smaller species the whole are obsolete. The elytra are narrowed from the shoulders to the apex. The muzzle is very short, being prolonged very little beyond the lower margin of the eyes; but it is very broad, and the lower angles are prominent. The antennæ are much longer than the body in both sexes, fringed with hairs beneath; the third joint much the longest, the first being about two-thirds its length, and dilated (chiefly on its inner side), from near the base, into an elongate club. All the femora are strongly clavate; the fore tibiæ of the ♂, in those species which approach nearest the genus *Acrocinus*, are bent near the tip, the tubercle being very prominent, and the first joint of the tarsi much elongated. All the tarsi are remarkably narrow and elongated, especially the claw-joint, more so in some species than in others, a character which distinguishes *Oreodera* from *Acanthoderes* and the allied genera. The ♂ fore tarsi are elongated and fringed with hairs. The sterna are very broad, the anterior acetabula circular, but the sutures are slightly gaping along their whole length. The ligula (in *O. glauca*) is membranous, narrow, deeply and narrowly cleft, and its outer margins are regularly rounded. The lobes of the maxillæ are small and narrow; the mentum extremely short and broad.

The species of this genus are numerous in South America. Their habits are similar to those of *Acrocinus*, with the exception that they are generally found adhering very closely to the twigs or bark of the dead trees on which they are found; and their colours being assimilated to those of the wood or bark, they are with difficulty detected. The smaller species are exclusively confined to the slender branches, the length and slenderness of their tarsal joints and claws being specially adapted for clinging to them. The females deposit their eggs on the bark; and the larvæ, when hatched, penetrate into the wood.

§ Disk of thorax with three or two prominent tubercles: tips of the elytra truncated.

1. *Oreodera undulata*, n. sp.

O. elongata, depressa, tomento tenuissimo holosericeo griseo-olivaceo vestita: elytrorum apicibus oblique sinuato-truncatis, dimidio basali granulato-punctato, apicali lineis undulatis griseis et fuscis ornato. Long. 7 lin. ♂.

Head sooty-brown, opake: eyes nearly touching the central furrow on the vertex. Antennæ sooty-brown, the base of each joint from the third light grey. Thorax with large lateral tubercles and three discoidal ones—two transverse before, and one longitudinal behind. Elytra tapering slightly from base to apex, the tips rather obliquely and briefly truncated, the external angles of the truncature slightly produced; the basal half studded with acute granulations accompanied by punctures, and in the centre of each, near the base, is a large, obtuse, transverse elevation, dark brown in colour: they are clothed with fine silky changeable olive-grey pile, and are variegated from the middle to the apex with fine grey and fuscous strongly undulating lines, with a grey patch on each side near the middle spotted with black. Under-surface of the body clothed with golden-grey pile. Legs greyish olive, with paler rings.

One individual, taken at Ega. This and the following species resemble much in colour and design *Acrocinus trochlearis* and *accentifer*.

2. *Oreodera fluctuosa*, n. sp.

O. elongata, depressa, tomento tenuissimo holosericeo cinereo vestita: elytris apicibus oblique truncatis et spinosis, plaga laterali pone basin, strigisque undulatis numerosis fuscis. Long. 10 lin. ♀.

Head and thorax grey: eyes nearly touching the central furrow on the vertex. Antennæ grey, apex of each joint from the third dusky. Thorax with the two anterior discoidal tubercles very prominent, the posterior one nearly obsolete. Elytra slightly tapering, the tips rather obliquely truncated, the external angles produced, dentiform; in the middle, near the base, each has a large prominent dark-brown tubercle; the basal half is somewhat sparingly granulate-punctate: ashy grey in colour; across, near the base, is a broad yellowish-grey belt, and on the margins behind the shoulders a long oblique dark-brown patch; there are also two transverse, narrow, strongly undulated belts of the same dark-brown colour,—one behind the middle, the other near the apex. Legs grey, femora varied with dusky; two rings on the tibiæ and claw-joint of the tarsi black. Under-surface of the body densely clothed with a golden-grey pile.

One example, taken at Para. I believe it is also found at Cayenne.

3. *O. glauca*, Linn.

Cerambyx glaucus, Linn. Syst. Nat. ii. 626. 28.
Lamia glauca, Fab. Ent. Syst. ii. 274. 27.
—— *Spengleri*, Fab. Ent. Syst. ii. 291. 93.

This is a very common insect throughout the Amazon region as well as at Cayenne. It is found on the trunks of felled trees of one or more species of *Inga*, the bark of which it resembles in colour. The lateral tubercles of the thorax have indications of the same impressed line around them which is so strongly marked in the *Acrocini*. In the ♂ the fore legs are elongated; the tibiæ bent, rather hooked at the apex on the inner side.

The first joint of the tarsi is also much elongated in the same sex. The elytra are square at the tips, being truncated largely and transversely.

4. *O. bituberculata*, n. sp.

O. angustata, depressa, tomento tenuissimo holosericeo cinereo-brunneo vestita: elytris maculis tribus lateralibus violaceo-brunneis, quarum secunda striga undulata transversa emittente, tertiaque parva notatis. Long. 7–8 lin. ♂ ♀.

Head dusky: eyes nearly touching the central furrow on the vertex. Antennæ piceous, thinly clothed with grey pile; apices of the joints dusky. Thorax even, with two prominent discal tubercles, shining black, the third, posterior, totally wanting; punctured on the disk as well as on the fore and hind margins; lateral tubercles large, obtuse. Elytra very long, tapering from base to apex, the tips obliquely truncated, the external angles of the truncature much produced and acute; punctured throughout; two short rows of tubercles along the humeral elevations, two others on the disk near the base, and one of smaller tubercles along the suture; in some specimens the sutural row and one of the discal ones are nearly obsolete, in all they consist of a small number of tubercles: the sinuations between the purple-brown lateral spots are edged with white scales; the apical spot is very small, the other two large and semi-oval. The under-surface of the body and legs ashy; the femora varied with dusky; two rings round the tibiæ black.

I took this species at Ega and on the banks of the Tapajos. It is also found at Cayenne. I have received specimens from Paris labelled *obscurata* and *opaca*; but I cannot find any species published under those names.

5. *O. rufofasciata*, n. sp.

O. curta, depressa, tomento holosericeo argenteo-griseo vestita: elytris subtriangularibus, fascia basali rosacea postice late nigro marginata, prope apicem lineis vermicularibus argenteis et fuscis ornatis. Long. 6 lin. ♂.

Head dusky: eyes approximating on the vertex. Antennæ wholly clothed with silvery-grey pile. Thorax short and broad, dusky grey: lateral tubercles conical; anterior discal ones large, slightly elevated, transverse, clothed with pile; posterior one slightly elevated. Elytra wide at the shoulders, tapering to the tips, which are obliquely truncated, the external angles of the truncature slightly produced and directed outwards; closely granulate-punctate at the base; silvery-grey, the base with a rose-red fascia, behind which is a dusky-brown belt shading off posteriorly. Under-surface of body and legs clothed with grey pile.

At Ega, on felled Pamá (a wild fruit) trees in the forest.

6. *O. lacteo-strigata*, n. sp.

O. curta, tomento holosericeo rufo-brunneo vestita: elytris apicem versus attenuatis, pone medium fascia pallidiore strigis lacteis undulatis marginata, prope apicem linea transversa undulata lactea ornatis. Long. 6 lin. ♂.

Head brown: eyes rather distant from the central line on the vertex. Antennæ pitchy-brown, base of joints paler greyish. Thorax punctured on the disk as well as along the fore and hind margins: the anterior pair of tubercles prominent, conical, dusky; the posterior one slightly elevated; the lateral ones conical. Elytra rather thickly punctured from the base to three-fourths the length, punctures large, the basal ones accompanied by granulations, each near the base furnished with a longitudinal ridge-shaped tubercle, slightly hooked behind; the basal half is deep red-brown, deepening on the sides to violet-black; the space between the pale-brown median belt and the sub-apical transverse undulated line is lighter brown, streaked longitudinally with dark brown; the subapical milky belt emits short branches, and is edged posteriorly with dark brown; extreme apex light brown: the apex is obliquely truncated; the external angles of the truncature acute, but not produced. Legs and under-surface of the body clothed with silky-brown grey pile.

This species was rare on the Upper Amazons. In facies it resembles species of the genus *Alcidion* (group Acanthocinitæ); it is readily distinguished, however, by the short clavate basal joint of the antennæ.

[To be continued.]

V.—*Remarks on some novel Phases of Organic Life, and on the Boring Powers of minute Annelids, at great Depths in the Sea.* By G. C. Wallich, M.D., F.L.S. & F.G.S.

In the notice of the material obtained by the soundings taken on board H.M.S. 'Cyclops' in 1857, appended to the official report of Captain Dayman*, Professor Huxley mentions having met with a number of small rounded bodies, which he describes as consisting of several concentric layers surrounding a minute clear centre, and looking, at first sight, somewhat like single cells of the plant "Protococcus." To these bodies Professor Huxley provisionally applied the designation of *Coccoliths*.

In the deepest soundings taken during the recent expedition

* "Deep-Sea Soundings in the North Atlantic Ocean, between Ireland and Newfoundland, made in H.M.S. Cyclops, Lieutenant-Commander Joseph Dayman, in June and July 1857, published by order of the Admiralty."

to the North Atlantic, I detected these very curious bodies in great numbers,—occurring not only in the free state, noticed by Professor Huxley, but as adjuncts to minute spherical cells, upon the outer surface of which they were adherent in such a manner as to leave no doubt of that being their normal position. Whilst alluding to their occurrence, in my published "Notes on the Existence of Animal Life at vast depths in the Ocean," I ventured a surmise as to their being a larval condition of some of the Foraminifera,—first, in consequence of their being invariably present in greatest quantity in such of the deep-sea deposits as were most prolific of these organisms; secondly, because, in one or two instances, Coccoliths had been met with by me adherent to Foraminiferous shells in such a manner as to render it highly improbable that they could have attained their position by accident; and lastly, because the spherical cells, to which reference has been made, when entirely freed from their adherent Coccoliths, presented no discernible points of difference, save as regards somewhat inferior dimensions, from the minute and nearly hyaline solitary cells of the earliest stage of the Globigerinæ.

On reference to the annexed woodcut it will be seen that the composite bodies to which I allude, and to which I propose to give the name of *Coccospheres*, are minute spherical cells (figs. 1 & 2) having a defined limitary wall, and that upon their outer surface the Coccoliths of Professor Huxley are arranged at nearly regular intervals. The cells, when crushed, are seen to contain a homogeneous, gelatinous, and almost colourless matter, exhibiting no visible trace of organization, and, in all probability, consisting of sarcode. The wall of the cell may be distinctly seen under a high power; but from the minuteness of the entire structure, I have hitherto found it impossible to do more than attest its existence. Accordingly there is nothing visible to show whether the wall is formed of one or more than one layer. Cells are sometimes met with in a fractured condition; but I have never observed a collapsed specimen, or flattened-out fragment, such as would frequently occur were the basis of the wall formed of anything more yielding than calcareous matter. In like manner, I have hitherto failed to detect markings or apertures in the limitary wall of the Coccosphere. The solitary cells vary in diameter from $\frac{1}{1600}$th to $\frac{1}{1250}$th of an inch, when seen separately. Forming part of a series, as in the specimen of *Textularia* presently to be described, some cells, however, attain a much larger size.

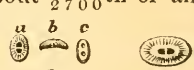
1 2

The Coccoliths, to which term I would restrict the minute bodies described by Professor Huxley, are of an oblong shape, concave on their internal aspect, namely that on which they are attached to the surface of the Coccosphere-cells, and convex externally; in short, they are spoon-shaped, only with a much less marked convexity and concavity. In some specimens, a single aperture, only, occurs at the central portion. In others the aperture appears to be double; or, rather, there are two perforations placed side by side, in the direction of the long axis of the body, and separated from each other by an extremely delicate transverse band; whilst the external marginal surface, which thus constitutes a quoit-like but oblong ring round the central perforated portion, is striated in a radiate manner. When the two perforations are present, the little mass closely resembles a miniature plate of *Synapta*. The Coccoliths, like the spheres upon which they rest, are transparent and devoid of colour. Their mode of attachment is undistinguishable, owing to their extreme minuteness. They appear, however, to be simply placed in contact with the surface of the Coccosphere-wall, and to be retained in position by the delicate gelatinous layer in which the entire organism is invested. We may thus account for the seeming facility with which the Coccoliths are detached, and the vast numbers of free Coccoliths which crowd many of the deposits.

It is necessary to state that a high magnifying power and very careful and brilliant illumination are requisite to enable us to see the structure of the Coccoliths to this extent. Their presence in the finer portion of the deposits may just be ascertained under a good $\frac{1}{2}$-inch lens; but in order to make out the apertures and striation, a $\frac{1}{6}$ or $\frac{1}{8}$, of first-rate construction, is indispensable,—the difficulty of obtaining clear definition being materially, and almost insurmountably, enhanced from the circumstance of its being necessary to mount the material in its normal state, inasmuch as subjection to acids at once annihilates all trace of the objects under notice.

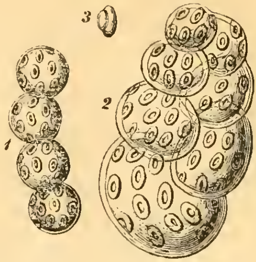
The average length of each Coccolith is about $\frac{1}{2700}$th of an inch. Fig. 3, *a, b, c,* represents these bodies as seen from their external, lateral, and inferior aspects. Fig. 4 gives a still more enlarged view of one, as seen from its external or convex aspect.

a b c



3 4

In the adjoining woodcut, fig. 1 exhibits a specimen in which four Coccospheres, with their adherent Coccoliths, are united together in a linear series similar to that of the chambers of the *Nodosariæ*. The cells are all, however, of uniform size, and smaller than the majority of the separate single specimens. Fig. 2 represents an unmistakeable *Textularia* (probably *T. variabilis*, Will.), the chambers of which apparently consist of several Coccospheres, in this instance of different sizes, arranged according to the double alternating order typical of the genus referred to. The chambers, as will be seen, are seven in number, the smallest and oldest measuring $\frac{1}{1250}$th of an inch, whilst the largest and last-developed measures $\frac{1}{450}$th of an inch. The entire specimen presents the transparency and delicacy of the normal Coccospheres. No septal apertures are visible; but this may arise in a great measure from the position of the specimen, which is preserved on a slide in balsam, and also from the imperfect manner in which it was necessary to clean the deposit before mounting it. On the exposed surface of each chamber the Coccoliths are distinctly visible. That their adherence in this fashion is not the result of accident is, I think, evident both from their disposition and the circumstance of numerous Foraminifera, present throughout the whole of the same slide, and of equal delicacy and transparency, not exhibiting a single Coccolith on their surfaces, although great numbers occur around them on every side.



During my earlier examinations of these remarkable objects, I repeatedly detected Coccoliths adherent to Globigerina-shells; but in no other instance than that just cited have I found the whole, or indeed more than one chamber of any Foraminiferous shell, so studded, and in other respects presenting appearances so identical with those seen in the free Coccospheres of which I have spoken.

It is certainly strange that, during the examination of a large series of slides exhibiting the lighter particles of the material in which the Coccospheres and Coccoliths abound, only one good example of a Foraminiferous shell should have been observed in the condition alluded to,—the four Coccospheres spoken of as occurring united in a linear series, although closely resembling the Nodosarian type in point of arrangement, presenting no positive evidence of their Foraminiferous origin. But it must be borne in mind, in investigating the lower organic forms of the animal and vegetable kingdoms, that instances are far from rare in which early phases of development are so ephemeral as to render the chances of their taking place under the eye of the observer extremely scanty. And again, for reasons already assigned, it is far from improbable that, although actually present in the material under analysis, the appearances are constantly overlooked.

These minute bodies, however, possess a high degree of interest apart from that arising from their association with the deep-sea deposits actually taking place in our own day, and this renders it particularly desirable that the attention of observers should be directed towards them. I allude to the discovery in the Chalk, by Mr. H. C. Sorby of Sheffield, of objects either identical with them or so nearly identical as to leave no doubt of their close affinity, and to the important additional evidence herein furnished regarding the identity in origin of some of the recent and more ancient oceanic deposits. It is not my wish at present to do more than point out these facts. Whether it be eventually shown that the association between these bodies and the Foraminifera is purely fortuitous or otherwise, there cannot be a doubt that they have some important office to perform in the history of the deep-sea deposits, and that the investigation of this office will materially assist us in clearing up the mystery that surrounds the occurrence of similar objects in the Chalk.

I have also to direct attention to some curious facts which have presented themselves to my notice whilst investigating the structure of certain Foraminiferous shells, and which illustrate, in a remarkable manner, the soundness of the views first propounded by Professor Carpenter with reference to the transmutation of many of the reputed species of these organisms.

Having selected some well-developed *Biloculina*-shells, I bisected them in various planes, and found that the innermost chamber of each individual—for segment it cannot in this case properly be termed—was in reality a minute and perfect *Miliola*,—this innermost chamber being, of course, the primordial chamber of the group. As is well known, *Biloculina* is a symmetrically-developed Foraminifer, the segments of which are arranged in alternating series, but with their margins in the same plane. In *Miliola*, on the other hand, the arrangement of the segments is asymmetrical, the plane of growth being a revolving one. Wide as the interval between the typical *Miliolidæ* and *Biloculinæ*, at first sight appears, the examples to which I refer show that there is no true line of demarcation between them, and that the one is neither more nor less than the primordial chamber of the other; whilst the future development of the primordial portion, into what has heretofore been considered a typical adult *Miliola* or a perfect *Biloculina*, depends wholly therefore on the conditions under which its further growth is regulated.

In the specimens under notice, the minute *Miliolæ* were found situated between the two earliest segments formed on the *Biloculina* type; and within the boundary so constituted it was placed, apparently, in an unattached state, but so closely pressed on as to indicate that the growth of the new segments took place upon the external surface of the primordial *Miliola*-chamber, and, as it were, on a mould. The minute *Miliola*, disposed with its long axis towards the axis of the septal orifices of the *Biloculina*-segments, is of sufficient size to be visible by the naked eye, and presents but one perfect revolution, as shown in fig. 3 of the last woodcut, there being no trace of a fractured margin of attachment at any portion of its surface.

Before concluding, I would also mention having met with several examples of Foraminiferous shells, brought up from the greatest depths, perforated, in all probability, by the minute boring Annelids that construct and inhabit the tubes of which I have made mention in my "Notes." The extreme delicacy of the inhabitants of these tubes has, as yet, completely baffled me in all my attempts to extract them and determine their character. In addition, however, to the tubes, formed in so singular a manner, of innumerable carefully selected Globigerina-shells cemented together, there also occur other tubes, in which the internal layer is a cylinder of tough membranous material with a rich sienna tint, whilst its outer surface is strengthened and protected partly by numerous Globigerina-shells, as in the previous case, and partly by a layer of silicious spicules, probably derived from some minute sponge. The perforations in the shells are invariably of one character, and consist of an aperture bored through and through, but having the entire thickness of the shell-wall, from the inner surface to the outer one, as it were countersunk. Accordingly, in section, such a perforation presents a truncated cone, the apex of which is directed inwards.

It has repeatedly been observed that, in the manufacture of telegraphic cables, it is a matter of vital importance to guard against the attacks of Annelids capable of thus penetrating hard substances at the greatest depths. Owing to the difficulty of boring into gutta percha, unless under the action of chemical solvents, I cannot conceive much danger is to be apprehended from its employment as the coating medium. If Annelids are able to drive their boring apparatus through gutta percha, it can only be when it has assumed the brittle, macaroni-like structure peculiar to it after long-continued exposure to heat, or in the case of impure and adulterated gutta percha. Pure caoutchouc, I do not hesitate to say, is impervious to a boring apparatus like that of the *Teredines*,—unless, as before mentioned, under the action of a chemical solvent, when, of course, no boring tool is necessary to render the mischief complete and fatal. And, lastly, there is this consolation for the advocates of gutta percha and caoutchouc coverings for submarine cables: —If their little hidden enemies at the bottom of the sea are so far advanced in civilization as to be able to discriminate when they ought to use their augers, or fall back upon their chemical laboratories for aid, neither glass, nor iron, nor hemp, nor adamant itself, will suffice to defy them. If any material exists, the characters of which are so thoroughly dissimilar from those of any substance known to occur at the bottom of the sea as to render it in the highest degree improbable that such creatures as live there could improvise means to pierce it, whilst, at the same time, it would secure perfect insulation of the telegraphic wire, *caoutchouc is that material.*

VI.—*Improved Method of making Microscopic Sections.* By G. C. Wallich, M.D., F.L.S.

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

Gentlemen,

Having devised a method of producing the finest sections of minute microscopic objects, such as Foraminifera, Diatomaceæ, and the like, which will, I think, prove of great service, I beg leave to lay it before your readers.

Hitherto, in making sections of any minute organized particles, the practice has been to mix the material with Canada balsam hardened over the spirit-lamp in the usual manner, and to grind down the balsam and its contents on a glass slide, until of the requisite degree of thinness,—a thin glass cover being placed on the ground surface, in order to complete the operation.

This plan, however, possesses the great disadvantage of affording only one ground side for microscopic examination, namely the one next to the observer's eye; whilst, the surface next the glass slide being in its natural state, not only is perfect definition prevented, but it is impossible to ensure anything like a uniform thickness of the various minute sections present.

To obviate this defect, I simply substitute, for the glass slide employed in the early stage of the process, a thin film of mica, mixing the material to be operated on with the balsam, and hardening it by heat in the usual mode. The slip of mica so prepared is now transferred to a glass slide, and secured by balsam as before, the mica being next to the glass. The operation of grinding down the exposed surface having been carried to the desired limit, and the surface carefully washed with water in order to carry off all loose particles, heat is applied to the under surface of the slide in order to drive off the last remnant of moisture left from the process of grinding-down. The slide is then heated just sufficiently to admit of the detachment of the mica-film and its burden *in situ.* A clean slide is now gently heated, and the mica-film, with its balsam-surface downwards, is made to adhere to it. The grinding-down of the remaining surface is now accomplished, the superincumbent film of mica yielding to the hone or grinding disk with the greatest readiness. After washing, as before, a thin glass cover is applied, and the operation is complete.

In order to ensure the non-displacement of the ground surfaces, and also the perfect parallelism of the minute ground objects to the surface upon which they rest (a matter of the highest importance wherever clear definition is demanded), great care is necessary in heating the balsam only to such a degree as to produce sufficient hardness, and permanently to secure the objects.

With due caution, the finest organic or inorganic particles of matter may in this manner be ground into sections, and their surfaces reduced so as entirely to obviate the diffraction of the rays of light attendant on the interposition of surfaces which are not parallel to one another.

I remain, Gentlemen,
Your most obedient Servant,
G. C. Wallich.

VII.—*Notice of a new Species of* Damaster *from Japan.* By Arthur Adams, F.L.S. &c.

Damaster Fortunei, A. Adams.

D. capite et thorace violascentibus nitidis, transversim ruguloso-punctatis; thoracis lateribus dilatatis; elytris triliratis, liris tuberculosis, interstitiis verrucis depressiusculis et punctis elevatis scabriusculis, apice angustato sed vix producto et non aculeato.

Hab. Awa-Sima, Japan.

In this species, which is of the same size as *D. blaptoides*, but of stouter build, the head and thorax are of a fine violet tint, the head is wider between the eyes than in the known species, the sides of the thorax are dilated, the body is considerably wider and more ovate, and the elytra, instead of being simply sulcate, are furnished with three slightly prominent tubercular ridges, with wart-like tubercles and elevated points filling up the interstices.

I have much pleasure in naming it after Mr. Fortune, who has just returned from Japan, and in conjunction with whom I compared it, at Shanghai, with a careful figure of *D. blaptoides* supplied to him by Mr. Adam White.

VIII.—*Zoological Notes on perusing* M. Du Chaillu's '*Adventures in Equatorial Africa.*' By Dr. J. E. Gray, F.R.S., V.P.Z.S.

[Continued from vol. vii. p. 470.]

I have been accused of carrying on a personal war—a "Gorilla war," as it is called—against M. Du Chaillu. Nothing can be further from the truth: we have only met twice, and then our interviews were friendly. I have merely taken up the question from its bearing on the science and literature of the country. I have no other purpose than to forewarn zoologists and geographers that all the natural-history observations, and the whole of the little geographical knowledge M. Du Chaillu's 'Travels' present, seem to me to rest on a very doubtful basis; and I feel that I am the more called upon to do this since the few geographers who seem inclined to believe in his travels place their faith, not in his geographical observations, but in what they regard as his zoological discoveries, which I do not think afford the slightest evidence in favour of his ever having been more than a few miles from the coast; and I find that this is the opinion of several travellers (as Dr. Daniel, Mr. Fraser, and others) who have been in the same locality. They say that he may have made a few excursions up the river in the canoes of the natives, but certainly not to any distance inland.

I believe, and have thought so from the commencement, that M. Du Chaillu is as much sinned against as sinning; for I presume that when he lent his name and, perhaps, furnished a few notes to the American publisher, neither he nor the author of the work (for it is generally allowed that M. Du Chaillu did not write it) intended it as more than a cheap popular book of travels, written to meet the taste of the American public; and hence they paid little attention to the chronology of the pretended journey, or the accuracy of the facts, as all they intended was to get up an amusing work, with sufficient interesting matter to make it sell among a community who are always seeking excitement and telling wonderful tales, and whose newspapers are so full of "sensation paragraphs." It is no fault of M. Du Chaillu that, to meet a supposed want of one or more of our scientific Societies, he was seized upon and put forth as a scientific traveller and zoologist—be it observed, before his book had seen the light, or his collections were unpacked; or that he, an "uneducated" collector of animal skins for sale, and an exhibitor of them in the Broadway, New York, was taken up and admitted as a visitor at one of our scientific and aristocratic clubs, and selected by the capricious world of fashion as the "lion of the season."

Nor is he answerable for an English publisher thinking that the book would be a good speculation—that he might sell here for a guinea what was intended to be sold in the United States for a much smaller sum.

The only excuse that can be made for these proceedings is the ignorance and credulity of what have been called the most fastidious and best-educated classes of the public, who rushed in crowds to see his specimens, though badly preserved and as badly exhibited, and to hear the wonderful tales he had to tell (and which he had already told the visitors to his show*); they seem to have swallowed all these tales as truth, and to have digested his book, illustrations and all, with equal facility, though it is full of contradictions and most evident exaggerations.

All these things are of little importance, except to make one regret that persons are not better instructed and more careful in what they give credit to and patronize. But they become important when the writer is put forward as an authority on subjects upon which I believe he is not qualified to speak; and it is only against the work being considered as what I conceive he himself never intended it to be when it was first compiled (that is, as a regular and veracious work of travels and natural history) that I have ever objected or desire to object.

I will now proceed to the regular zoological part of the work, which forms Appendix A., entitled "The Fauna of Equatorial Africa."

This list gives one an odd idea of M. Du Chaillu's zoological knowledge. It is divided under two heads, Mammalians and Birds. The first, "Mammalians," contains not only the Mammalia properly so called, but also "Turtles," "Serpents, and other Reptiles." We are there told, "*New species* I have, for convenience of reference, put by themselves: for details of the new animals the scientific reader is referred to the Proceedings of the Boston Society of Natural History for 1860." If the reader refers to them, he will find only the notices of sixteen Mammalia, and nothing respecting the Turtle, *Aspidonectes aspilus*, or the birds; for the birds are all described by Mr. Cassin, the Curator of the Museum of the Academy of Natural Sciences of Philadelphia, from specimens in that museum purchased of M. Du Chaillu, and are published in the Journal of that Academy. But, for some reason, neither Mr. Cassin's name, nor that of the Academy or its Journal, is mentioned in the 'Travels,' or even referred to in the preface or Appendix †.

On the Birds I will not make any observations, as only a very few authentically-named species have come under my hand, the typical specimens being in the museum of the Academy; and M. Du Chaillu appears to have brought only a very small proportion of the birds mentioned in the list to England ‡.

When I looked at the Mammalia, on the 13th of April, as carefully as I could under the then existing regulation that the specimens were not to be touched, and no visitor allowed to take notes or descriptions of them, I came to the conclusion that they were all old friends (even those named as new), and that they appeared to have

* See Berkeley, 'English Sportsman in the Western Prairies,' p. 417.

† See 'Saturday Review,' June 22, p. 634.

‡ M. Charles Bonaparte observes, "Nous profitons de cette occasion pour faire remarquer qu'en remettant simultanément en Europe et en Amérique les produits de ses chasses Africaines, M. du Chaillu a donné lieu à l'établissement de plusieurs espèces nominales; ainsi par exemple, *Barbatula Chaillui*? Cassin, ne diffère pas de *Barbatula formosa*, Verr., et a sur ce dernier la priorité tout aussi bien que *Barbatula fuliginosa*, Cassin, sur *Gymnobucco Bonapartii*."—*Comptes Rendus*, 1856.

been collected from the stations on the different parts of the west coast of Africa. A fuller examination has not altered my opinion. But one animal escaped me (or perhaps it was not exhibited when I was there); this is the one named *Cynogale velox*; for I now see that it is not the animal which I entered in my list as "*Lutra* species," and which is so named in the Appendix.

I have since had an opportunity of examining all the smaller species, and of comparing them with the specimens in the British Museum, and I subjoin the result of that examination, as challenged by M. Du Chaillu. I take the animals as they occur in the list of species discovered by M. F. B. Du Chaillu, in the Appendix, p. 471.

Troglodytes calvus,

Troglodytes kooloo kamba.—When I examined the skins of these two presumed new species, on the 13th of April, I was not able to discover any character by which they could be distinguished from the common *T. niger.* Dr. Sclater and my assistant Mr. Gerrard have each examined the skulls and skeletons, and they inform me that they have come to the same conclusion; and I observe that Prof. Owen speaks of them as interesting varieties only. I suspect the baldness is merely an individual peculiarity. I need only refer to my observations on the figure of *T. calvus* in the last Number of this Journal, p. 467.

Tragelaphus albovittatus.—This is evidently only a specimen of *Antilope euryceros* of Ogilby. It has unfortunately lost its hoofs, and the ears and tail are eaten. See observations in the last Number, p. 469.

Potamochœrus albifrons.—A mere variety of *P. penicillatus.* Specimens from the same locality differ in having the face black and white.

Genella Fieldiana.—This is *Genella pardina*, I. Geoffroy. M. Du Chaillu compares it with *G. poensis*, a distinct species.

Anomalurus Beldeni is only *Anomalurus Derbianus*, Gray (*A. Fraseri*, Waterhouse).

Anomalurus "not described yet" is *Anomalurus Beecrofti*, Fraser, Proc. Zool. Soc. 1853, p. 17, t. 32. It is the figure of this animal that is copied and given as the figure of the former presumed new species. The tail of the two specimens is short; but one is imperfect, and the other skinned, so as to make it look short.

Cercopithecus nigripes (a variety of *Cercopithecus Erxlebenii*, Dahlb. and Pucheran, Rev. Zool. 1856). M. Du Chaillu's specimen and the one we have in the British Museum have the sides blacker than in the figure above cited, which is said to be from a young specimen.

Otolicnus apicalis.—This appears to be *Galago crassicaudatus*; but the ears of the specimen are entirely destroyed by rats or cockroaches. The white end of the tail seems to be accidental.

Cynogale velox.—The specimen is in a bad state: only a skin—skinned from the mouth,—wanting one foot, and without any skull.

M. Du Chaillu thinks that, as *Cynogale* is an Asiatic genus, the different shape and the proportions of the tail, and an African habitat, are sufficient to constitute this the representative of a distinct genus, for which he proposes the name of *Potamogale*, preferring, however, "to wait until he can procure the skull and skeleton; therefore he places it in the genus *Cynogale*, to which it certainly bears a close resemblance." He further says, "the teeth resemble those of the above genus of Gray."

I may state that the animal does not appear to me to bear any relation to the genus *Cynogale*; and, from the form of the feet and tail, I suspect that it is a Glirine animal, and much more nearly allied to *Fiber*, *Hydromys*, or *Castor* than to any ferine genus. As M. Du Chaillu has not characterized his genus *Potamogale*, and has given such an erroneous description of the feet of the specimen that no one could recognize it, I do not think that his name has any claim to be retained, especially as it implies what appears to me to be a very doubtful affinity to the Musteline animal.

I therefore propose, as the feet differ essentially from any other genus that has come under my observation (though the peculiarity has escaped M. Du Chaillu and the naturalist that helped him in the preparation of his maiden zoological paper), and as I believe that it is necessary to form a genus for it, to call it *Mystomys*; and it may be thus characterized until the skull and teeth are discovered:—

Whiskers elongate, rigid. Feet small, rather slender; toes 5·5, compressed, elongate, not webbed, free, except the two middle toes of the hind feet, which are united together to the claws; claws compressed, curved. Tail short, stout, thick, compressed, covered with short adpressed hairs, except at the base and along the middle of the upper edge, where it is covered with close, soft, erect fur. The fur is soft, with flattened, elongated, striated hair, which is produced beyond the under-fur as in *Castor* and *Fiber*.

Mystomys velox=*Cynogale velox*, Du Chaillu.

M. Du Chaillu describes the feet and tail as follows; and this is a good specimen of his qualifications as a scientific zoologist:—"The extremities small, the first joint enclosed within the skin of the body (!); feet five-toed, plantigrade behind; soles bare; claws curved and sharp; fore *claws* (!) very slightly, if at all, webbed; hind claws (!) partially webbed, and the external border of the tarsus fringed with a membrane; tail stout, compressed laterally, and terminal three-fourths sharp above, and at the end below terminating in a point."

Sciurus Nordhoffii and *Sciurus eborivorus*.—These are only slight varieties of *Sciurus Stangeri* of Waterhouse; they both have the characteristic black streak behind the ear. I may observe that the Common Rat eats ivory.

Sciurus Wilsonii.—This appears to be *Sciurus mutabilis* of Peters; it is very nearly allied to *Sciurus Stangeri*, if indeed it be distinct from that species, only wanting the black streak above referred to; but Squirrels are exceedingly variable in colour, even when collected at the same time from the same locality.

Sciurus subalbidus is *Sciurus rufobrachium*, Waterhouse.

Sciurus rubripes is *Sciurus pyrrhopus*, F. Cuvier. M. Du Chaillu's specimens are brighter-bay on the head and legs than the specimen described by Mr. Waterhouse ; but this is just the character of a more adult animal.

Sciurus minutus is *Sciurus palliatus,* Peters, 1852.

Manatus Owenii is only *Manatus senegalensis.* The skull is exactly like M. De Blainville's figure of the skull of that species in the French Museum.

The African species is known from the American one by having the malar bone produced below into a more or less broad rounded lobe, instead of being straight and without any such lobe, as is the case in the American skull. The lobe appears to increase in size as the animal increases in age.

It would thus appear that there is only one new animal out of the sixteen, and that is referred to a wrong genus, and so described that it could not be recognized.

A true naturalist—an accurate observer and recorder—may add much to our knowledge, without procuring any new species, if he bring information about the habits, manners, and localities of the animals he observes. Unfortunately, nothing can be more uninteresting and unsatisfactory than the information on this head in M. Du Chaillu's paper on "the new Mammalia," or in the 'Adventures,' except as to the Gorilla ; and there the author has given his imagination full swing, and the specimens he brings contradict his statements. Thus, in his book the Gorilla is represented as advancing on its hind legs to meet its foes, and it is stated that it was always shot in the breast ; but the skins and skeletons show that they were shot in the back or the neck, as the animal was retreating on all-fours, or else in the trees,—which is more consistent with our knowledge of its habits, as those who have seen them alive inform me that they never willingly leave the trees ; and I am sorry to say that the observations on the other animals appear to me equally apocryphal. The habitat given in the essay as of a most general kind, such as the head-waters of such or such a river, and the habitat given in the description of the beast or bird, is often not consistent with that given in the 'Adventures.' Thus, we are told that *Barbatula Duchaillu* is found on the Moonda River ; and in the 'Adventures' it is said to be found in *Ikoi* Creek, which is on the Gaboon.

The number of animals collected by M. Du Chaillu, as given in his list, is very small compared with those collected by Messrs. Rendell, Whitfield, Thompson, Stanger, and Fraser, at different stations on the west coast of Africa. Each of these naturalists brought sundry new species of Mammalia, as well as many new birds, from a much more limited district than M. Du Chaillu professes to have examined ; and some of them were only amateur collectors : Mr. Rendell sent skins of birds in such abundance as to render them quite a drug in the market for years.

M. Du Chaillu is not a good preserver of skins. As soon as the skin was taken off the larger animals, even the Gorillas, it was stuffed, as full as it could hold, with straw, dried leaves, and other substances, and then sewn up : the outer surface dried, but there being no means by which the internal moisture could escape, many of the skins have rotted internally, are as tender as blotting-paper, and will scarcely bear damping without the hair and epidermis peeling off. Skins so stuffed are very liable to injury in carriage from place to place. It is this style of stuffing that makes me feel certain they could not have been prepared far inland; for no one would have adopted such an inconvenient and dangerous practice if the skins had to be carried for many miles on the backs of men; and even near the coast it would have been better if the skins had been spread out flat and allowed to dry on both sides, and then had been packed in a small space, as is usual with good collectors. The plan adopted, and the want of sufficient attention afterwards, render his specimens of the larger Mammalia of little value for a museum. Thus the beautiful Antelope (*Tragelaphus euryceros*) has no hoofs, and only remnants of ears and tail. The Buffalo skins want hoofs and tail, and one has no horns; and many of the other skins are equally imperfect, and cannot be stuffed.

The smaller specimens of the Mammalia are in a better state; but many of these, from constant handling and want of care, are without one or more limbs, &c. And I may observe that the *Galago*, smaller monkeys, and some of the squirrels are preserved just as they are usually sent from the native collector, with a stick up their tail, and not as if they had been preserved by a collector who had received instructions in taxidermy from M. Verreaux at Paris.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

March 21, 1861.—Major-General Sabine, Treasurer and Vice-President, in the Chair.

"On the Structure and Growth of the Tooth of *Echinus*," by S. James A. Salter, M.B. Lond., F.L.S., F.G.S.

The author commences his paper by stating that the researches upon which it is based were made more than four years since, and then without the knowledge that the structure had been previously investigated by others.

An abstract of the *literature* of the subject (contained in very narrow limits) is then given.

In 1841 Valentin, in Agassiz's Monograph on the Echinoderms (*Anatomie des Echinodermes*), published a description and many good figures of the minute anatomy and growth of the Echinus-tooth.

Professor Quekett, in his 'Lectures on Histology' (1854), referring to the minute *mature* anatomy of the organ, states its ultimate structure to resemble bone and dentine of vertebrata.

Dr. Carpenter, in his work 'On the Microscope,' speaks of the tissue of the tooth as essentially of the same nature as the shell of the Echinidæ generally (1856).

Lastly, Professor W.C. Williamson describes the subject more fully than his predecessors, entering into the question of the development of the tooth both generally and histologically (though apparently in ignorance of Valentin's Essay), in a paper on the "Histology of the Dermal Tissues," &c., in the British Journal of Dental Science, 1857.

The coarse anatomy and relations of the Echinus-tooth are then described, and the question is discussed as to how far the organ resembles and how far it does not resemble the incisor tooth of a Rodent mammal, to which it has constantly been likened.

Some remarks then follow on the method of investigation, which the peculiar physical characters of the structure render very difficult.

Before describing the histology of the mature tooth, the author premises some succinct remarks upon the several elementary parts that are formed at its growing extremity, and by which its complex structure is built up—showing how the shape and plan of these elements determine the microscopical appearances of the several regions of the tooth as seen in different sections.

These elementary parts are—(1st) the *Primary plates*, which consist of a double series of triangular sheets of calcareous matter, and which constitute the physiological axis of the tooth, about which, and connected with which, the four secondary elements are developed. These latter are (2nd) the *Secondary plates*, lappets of similar calcareous sheets attached to the outer edge of the primary plates; (3rd) the *Flabelliform processes*, elaborate reticulations of calcareous fibres ending in fan-shaped extremities; (4th) the *Keel fibres*, certain long cylindrical rods with club-shaped ends of the same chemical nature, which pass towards the enteric region of the tooth in their growth; and (5th) the *Enamel Rods*, which are minute very short developments of the same character, and which are formed in the opposite direction. Thus far a primary and secondary stage of formation are represented: a third stage, that of consolidation, now occurs in the development of (6th) the *Soldering particles*, multitudes of minute disks of carbonate of lime which appear over the whole surface of the previously-formed elementary parts, and by which they are soldered together, the intervals between these (in a certain sense) constituting the tubular character of the mature tissue.

The primary plates, secondary plates, and the proximal portion of the flabelliform processes are stated to constitute the body of the tooth; the distal extremities of the flabelliform processes the *skirtings* of the enteric region of the body of the tooth; the keel fibres wholly form the keel; while the short enamel rods compose the thin white layer on the dorsal surface of the tooth—the enamel.

The histology of the tooth is remarkable as exhibiting apparent inconsistencies in different lines of section. A vertical section of the tooth presents the appearance of vertebrate bone—lacunæ, canaliculi, and lamellæ; while a transverse section displays some regions resembling dentine (the body of the tooth), and others having the closest similitude to an oblique section of the shell of some Mollusca, such as *Pinna*.

The author then proceeds to describe in detail and with particularity the form and progressive growth of the several elements of the tooth as they are met with in examining the growing extremity and proceeding from it towards the mature structure, as long as the elements are susceptible of isolation and individual examination. The anatomy of the soldering particles, and their relation to the production of the cavitary structure of the tooth, is specially dwelt upon. The soldering particles are supposed to be isolated at first, but as they enlarge they become connected by a thin film from their upper and under faces. This occurs before the final consolidation of the tissue, and before the soldering particles are indissolubly connected with, and themselves indissolubly connect, the contiguous elements of the tooth. At this stage these particles are still susceptible of isolation, and they may be separated *en masse*, being held in relative position by the films that connect them. The soldering particles and the connecting films thus constitute a tubular system, which has an independent existence before the final consolidation of the tissue; and this tubular system is introduced between, and interpolated among the previously existing elementary parts of the tooth.

The author concludes by expressing a coincidence of opinion with Dr. Carpenter, that the minute structure of the tooth is essentially of the same nature as that of the shell of the Echinidæ generally.

ZOOLOGICAL SOCIETY.

February 12, 1861.—John Gould, Esq., F.R.S., V.P., in the Chair.

Observations on the Anatomy of the Echinoderms. By Thomas Howard Stewart, M.R.C.S., F.Z.S.

There are certain points connected with the anatomy of the Echinoderms which I am anxious to lay before the Society; and the more especially do I desire to do so, as I am not able to find any true and accurate description existing of the very wonderful apparatus for the prehension and division of food, which some of the higher groups of this class possess. I mean higher groups with regard to the class itself. The animals forming this class, from their organization, are placed low in the scale of creation, being just above the Polypifera and below the Annelida; yet we shall find, in the order *Echinoidea* of this class, animals possessing what may be called a *splanchnic* or oral skeleton, of so complicated and yet so efficient an arrangement, as cannot fail to make us wonder at the object of its sudden appearance in the anatomy of animals; nor can we help admiring the beauty, and wondering at the perfection of the work. Those who have not searched into the anatomy of these lower forms of life might be surprised to be told that a creature just above the common Sea-anemone, with an almost invisible nervous system, and otherwise very low organization, possesses jaws (or, as I prefer to call the apparatus, a splanchnic skeleton) of a more complicated arrangement than any other animal in existence, from a simple sponge or *Amœba* up to man himself. This splanchnic skeleton, in *Cidaris*, *Echinus*, and allied genera, is formed of forty separate calcareous portions, arranged in a conical form, and, as we shall see by description and inspection of the specimens on the table, beautifully and perfectly articulated together, and having forty separate muscles to move the teeth in various ways.

If we take up an *Echinus*, or Sea Urchin as it is commonly called, and look at the flattened under-side, we see in the centre a circular part which is membranous, and continued from the corona to the points of the five protruded teeth. This *peristomal* membrane is covered in most of the *Echini* (not in our beautiful *E. Flemingii*, however) with minute, oval, and somewhat irregularly scattered calcareous plates, not (as in the rest of the corona) articulated together, but with intervals between each other, leaving the membrane partly bare. On these calcareous particles are placed organs called *pedicellaria*, and also, on some, minute spines, the tubercles for which may be seen with a lens; these particles are of various sizes. Around the teeth, on the peristomal membrane, are situated, ambulacrally, five pairs of large oval plates, each with a pit excavated in the centre, and having a minute perforation, over which is placed externally a modified form of cirrus. Internally an exceedingly small vessel comes from each perforation and joins the large longitudinal ambulacral vessel: these plates are also covered with numerous tubercles for minute pedicellaria. To this series of plates succeeds a soft circular lip, containing excessively fine particles of lime in a radiating linear arrangement, not bearing either pedicellaria or spines, and immediately surrounding the protruded points of the sharp, hard, white, Rodent-like teeth.

Seeing these points of teeth in so humble an animal—and the first appearance of such, makes one, like a child with a new toy, long to see the interior—we set to work to open the shell, as erroneously called, of our *Echinus*. We there find, besides the intestines and other viscera, a complicated conical apparatus surrounding the first part of the alimentary canal, and enclosing the rest of the teeth (previously unseen), and having attached to it all the numerous muscles which act on it. Now it is to this that I principally wish to draw your attention.

In the first place, I will enumerate the parts which make up these curious jaws. There are ten triangular pieces, called *alveoli*, which when articulated together form five prismatic-shaped sockets for the five teeth, and all together constitute a conical mass, with the apex external, formed by the points of the teeth. The apices of the alveoli are firmly fixed to the peristomal membrane; but the lip is loose over the teeth. The bases of the alveolar pairs are united by wedge-like pieces called *falces*, five in number, on each of which is placed an arched portion, divided into two; there are ten pieces arching over the external surface of the alveoli at the base, which may be called the *epiphyses* of the alveoli,—making in all forty separate parts. The alveoli, when separated, are seen to be triangular in shape: they have a broad external rounded surface, presenting a deep hollow excavation; at the bottom of this is a groove in which is inserted a muscle. The surfaces opposed to the next pair of alveoli are finely striated; and these striæ may be seen to be continued as free points, forming a finely toothed margin on the œsophageal border; to each of these surfaces a muscle is attached, passing from one to that adjoining in the next pair. The remaining surface presents the half of the groove for the tooth, which is completed by the other alveolar piece, and also the symphysis that unites the two portions. The epiphyses arch over the upper or basal part of the alveoli on their outer borders, and serve as attachments for muscles. The *radii* are long, slender, arcuated portions, situated on the upper part of the oral skeleton between the pairs of epiphyses of the alveoli and above the falces: the œsophageal end of each is articulated with the centre of the inner end of the falces; this portion is rounded; but just above the point at which they are divided transversely they are laterally compressed, and here a muscle is inserted; they are then rounded again, and end by a flattened and bifurcated free extremity, forming points for the attachment of the tendons of slender muscles. The falces are somewhat square portions, which fit accurately between the pairs of alveoli, at their base; the œsophageal end has a deep notch, to the centre of which the radius is articulated, and on either side of this the œsophageal ligaments are attached. The teeth, five in number, are in shape somewhat like the incisor tooth of a Rodent; they have a hard, triangular, pointed prehensile end, and towards the root they become gradually soft and friable, and, when dry, split up easily into fine silky fibres; they are covered at their roots by a loose bag or pouch of the membrane of the perisome, which also connects the intervals between the muscles and the various parts of the splanchnic skeleton. The alveoli and teeth are, when in natural position, inter-ambulacral, the radii and falces being ambulacral.

With regard to the numerous muscles supplied to the apparatus, amounting to *forty* in number, there are first to be mentioned *five pairs* of what may be called *protractores*, arising from the inter-ambulacral region of the oral edge of the corona, and inserted into the upper and lateral borders of the epiphyses of the alveoli, and into a groove on the external surface of the alveoli themselves: their office is thus plainly seen, when acting together, to be to protrude the points of the teeth—or as protractors; and when acting singly, to draw the teeth to one side or another. There are *five pairs* of muscles arising from the inner surface of the auricular arches, and inserted into the oral ends or apices of the alveoli, on the inner side of these; they are obviously retractors (*retractores*), and antagonistic in their action to the preceding set. Another set of five pairs of slender muscles arises immediately in front of the protractor group, by a thin, narrow common origin, and terminates by two slender tendons which pass obliquely to be inserted into the bifurcated free ends of the radii. These are the radial muscles, or *radiales*: their action is to bring the points of the teeth together, and in opposition to the next group of five (not pairs), which pass from one radius to another internally and parallel with the epiphyses of the alveoli, and assume, when connected with the five radii, a pentagonal form on the upper part of the conical oral skeleton: these are the *interradiales*, and act so as to separate the points of the five teeth. But there are yet five more muscles, of great importance to the object of this paper: these pass from one alveolar pair to another, being attached to their serrated surfaces as short, coarse individual fibres: they are the *interalveolar* muscles, and their action is to move the points of the teeth on each other in cutting the food. When a muscle is fixed into a bone or hard substance, there is generally (I believe, always) a mark left of that attachment; and this is the cause of these alveoli being serrated as described. They are said by anatomists to be grinding-surfaces; but this cannot be, when the food cannot get near them, and they are covered by muscles. When we examine this oral apparatus in a fresh state, we find that the œsophagus is most firmly fixed around the apices of the alveoli internally, where they are themselves attached to the peristomal membrane; and when the teeth protrude, the œsophagus then takes its course through the centre of the conical oral apparatus, being borne up by the five pairs of ligaments, each of which passes as a broad band from the commencement of the œsophagus, and is attached to the bifurcated inner ends of the falces. Now, if the alveoli on their serrated surface or border were used to grind the food, how is the food to get to them? It must pass through the œsophagus, and thence to the rest of the alimentary canal; and for it to get near the alveoli, the alveoli must grind the œsophagus itself. We may as well call the muscular impression on the shell of an oyster or any other bivalve, or that caused by the impression of muscles on our own bones, a grinding-surface, as say that the alveoli of the *Echinus* are grinding-organs.

In the different genera that I have had the opportunity of examining, I find that there are certain peculiarities which might almost form generic characters.

Cidaris differs from *Echinus* in the form of the tooth: in transverse section the tooth of *Cidaris* is semicircular or boat-shaped; whilst the tooth of *Echinus* is somewhat T-shaped, having a ridge running down the inner surface; the alveoli in *Cidaris* are more obscurely serrated on their opposed surfaces and œsophageal border than in any other genus; and the epiphyses of the alveoli do not arch over and meet in *Cidaris*, as they do in *Echinus*; and in *Cidaris* the falces and radii are also shorter than in *Echinus*.

In *Diadema* the shape of the tooth is like that of *Cidaris*; the alveoli are serrated on the opposed surfaces as well as on the œsophageal border, and the serrations of the border are very long and fine; at the basal end of the symphysis on each individual alveolus is a long hamular process, enlarged slightly into a flat free end, and the basal border of the alveolus is long, which also necessitates the epiphyses being lengthened. These epiphyses do not arch over, but are like those of *Cidaris*; the falces and radii are more like those of *Echinus*. In the genus *Acrocladia* and *Echinometra*, at the end of the symphyses of the alveoli, there is a sharp, and in some a very long and delicate styliform process, and one also corresponding from the epiphyses; these support the teeth in position: they do not exist at all in *Cidaris*, and are very rudimentary in *Echinus*. The auriculæ of *Cidaris* do not form an arch, as they do in *Echinus, Diadema*, and other genera.

The oral skeleton of *Clypeaster* is a modification of that of *Echinus*, but more simple. The *Ophiuridæ* have also a decided oral apparatus, differentiated from the other calcareous portions of their skeleton; it is a decidedly modified form of the splanchnic skeleton of *Echinus*. They have alveoli somewhat like those of *Clypeaster*; a perforated oblong plate is situated perpendicularly at the symphyses of these alveoli; and here are situated a number of small, square, chisel-shaped teeth, translucent and sharp at their free end, and thick and opake at the attached end or root: there are five of these on each of the plates, and their points can meet so as to close the oral orifice. The Goniasters and the *Asterinæ* also, by means of their oral spines, can completely prevent the egress of food once taken into the stomachal cavity. The Solasters have beautiful fasciculated spines around the mouth; but they only partially or very slightly close the orifice, which in this Starfish is very capacious. The Urasters have five bundles, not quite closing the mouth.

There are some other points to be mentioned with regard to the antambulacral or anal ring of plates in the *Echinidæ*. This ring of plates is all in the *Echinus* that answers to the upper or antambulacral integument in the Star-fish.

The number of plates forming this part of the corona is ten,—five situated interambulacrally, *i. e.* one at the anal end of each interambulacrum; and five ambulacrally, or one at the end of each ambulacrum. The first are known as the genital plates; they are somewhat triangular in shape, with a semicircular border towards the peripygial membrane; these plates have a perforation for the exit of the generative products. Intermediately between these genital plates in the anal ring and at the anal end of the ambulacral series are much smaller triangular plates: these are called "ocular plates;" but as the *Echinus* has no eye, it is erroneous so to call them, and therefore I propose the name of "*inter-genital*" for them. At the point furthest from the anus they have a minute perforation; now to this perforation can be very readily traced the longitudinal ambulacral vessels that are placed on a raised edge in the centre of each ambulacrum, and terminate at this orifice in the *inter-genital* plates, which, no doubt, is the orifice of exit of the fluid used in the ambulatory system after it has circulated in the body and done its service and is no longer of any use. The anus in *Echinus* is excentric; in *Cidaris* it is centric.

In connexion with the position of the *Echinoidea* in the animal series, it is interesting to know that, as in the class of polyps below them, there are spicula scattered loosely through their tissues, as well as agglomerated ones forming their *corona*. I have found spicula in the fleshy tubes of the cirri, in the membranous madreporic canal, in the generative organs, in the fleshy part of the stem of the *pedicellaria*, and, very curiously, along the border of a spine that I have mounted in longitudinal section for microscopic observation. These spicula are much like those in some Sponges, except that in *Echinus* they are formed of carbonate of lime, whilst those of the Sponges are of silica.

In *Diadema* they take a somewhat triradiate form.

In *Comatula* also there are detached spicula in the internal membrane of the perisome, which, when mounted in Canada balsam, form beautiful polarizing objects.

The higher forms of Echinoderms, such as the *Holothuriadæ*, have their skeleton formed entirely of scattered spicula, except the oral ring; in each species the spicula are of a peculiar form: and all microscopists know the wonderful anchor-shaped spicula and plates in *Synapta*, and the curious wheels of *Myriotrochus* and *Chirodota*.

Feb. 26, 1861.—John Gould, Esq., V.P., in the Chair.

On some Points relating to the Habits and Anatomy of the Oceanic and of the Freshwater Ducks, and also of the Hare (Lepus timidus) and of the Rabbit (L. cuniculus), in relation to the Question of Hybridism. By Edwards Crisp, M.D., F.Z.S., etc.

This communication was suggested by the exhibition at our last meeting, by Mr. Bartlett, of four hybrid ducks between the Summer Duck (*A. sponsa*) of North America, the Pochard (*Fuligula ferina*), and the Ferruginous Duck (*Fuligula nyroca*). Mr. Bartlett thought that the progeny of these hybrids would be prolific. In the discussion which followed concerning these birds, I expressed my belief that the hybrid between the hare and the rabbit was a much more remarkable occurrence, taking the habits and the anatomy of the animals into account, than that of a cross between an oceanic and a freshwater duck. From this opinion several of the members dissented.

It will now be my object to make a fair investigation of this matter; and as the question of hybridism is one becoming daily of greater importance, I think that our time will not be unprofitably occupied, more especially as the comparisons I am about to institute will, I think, furnish some matters of physiological interest.

And first, of the Ducks; and I speak chiefly of British ducks. In this family of birds there is, for the most part, a great general resemblance, whether we look to their habits or to their anatomy. They have been divided into the Oceanic and Freshwater ducks; but it must be observed that they both frequent the sea, and also the freshwater rivers, although the first-named ducks are more limited to the ocean, to which their structural peculiarities render them better adapted. Their flesh, as regards flavour, has the same character, although modified somewhat by the nature of the food. In the sexual * differences of colour (excepting the genus *Tadorna*) there is a great general resemblance; and the same may be said, as far as we know, of the period of incubation. The eggs, comparatively speaking, both as regards number and appearance, are very uniform. Their nidification, too, including the abstraction of down from the body of

* I do not speak of the changes of plumage in the oceanic ducks, because we have yet much to learn respecting this matter.

the female, is nearly of the same kind; and the nature of their food, both animal and vegetable, is very similar. Of animal food the oceanic and diving ducks obtain a greater variety, including univalve and bivalve shells; but some of the freshwater ducks (so called), as the Shoveller (*Anas clypeata*), obtain a large quantity of these, as I have verified in several instances by dissection.

If we look to their internal organization, we have here likewise a great general resemblance. The lungs, heart, gullet, gizzard, intestines and their appendices—the pancreas, spleen, kidneys, and oil-glands—have nearly all the same character.

I have placed on the table the sterna of twenty-two different species of ducks, and likewise the tracheæ of nearly all the species of our British ducks; and it will be seen that, with the exception of the Common Scoter (*Anas nigra*) and the Surf Scoter (*A. perspicillata*), the lower part of the air-tube is furnished with a bony enlargement, more or less complete in the different species of oceanic ducks, and affording in these a greater variation as to form: thus, in the King Duck (*A. spectabilis*) and in the Eider (*A. mollissima*) this protuberance is without membranous divisions, as in the freshwater ducks; and the same may be said of the Velvet Scoter (*A. fusca*); but the enlargement in the air-tube of this bird is seated some distance above the bronchi.

In Yarrell's 'British Birds,' vol. iii. pp. 148, 202, descriptions are given of the freshwater and oceanic ducks. The characteristics of the former are said to be length of neck and wings, round tarsi, unlobated and free hind toe. "In habits they may be stated generally as frequenting fresh water, but passing much of their time on land, feeding in ditches and about the shallow margins of pools, on aquatic plants, insects, worms, and occasionally on small fish, taking their food at or near the surface, possessing great powers of flight, but seldom diving unless pursued. Of their internal parts, the stomach is in the greatest degree muscular, forming a true gizzard; the intestines long; the cæcal appendages from 6 to 9 inches in length in the larger birds, and decreasing only in proportion to the size of the species. Of the bones it may be observed that the ribs are short, the angle formed by the union of the first pair on each side extending but little beyond the line of the posterior edge of the sternum; the keel of the breast-bone is deep, affording great extent of surface for the attachment of large and powerful pectoral muscles; the enlargement at the bottom of the trachea in all of them is of bone only. The males of this species are further remarkable for becoming for a time during summer more or less like the females," &c.

At page 202, in speaking of the oceanic ducks, their food is said to be "fish, shelled mollusca, crustacea, and marine insects, but little or no vegetable production. Their powers of flight moderate, and their walk embarrassed, from the backward position of their legs. Of their soft parts, the œsophagus is capable of great dilation; the stomach is a muscular gizzard, but the internal cavity is large, and the sides comparatively thin. The ribs are elongated, and the keel of the breast-bone decreases in depth in those species which in their habits most resemble the *Merganser*."

In the above account there are several inaccuracies. Thus, the gizzard in many of the diving ducks, taking the weight of the bird into consideration, is quite as muscular as in the freshwater ducks; indeed the nature of their food requires this provision. I have not found either the above-mentioned difference in the œsophagus or in the length of the alimentary canal and appendices. The oceanic ducks, moreover, take a large amount of vegetable food; and the proportional size of the pectoral muscles in many of them is quite as great as in the freshwater ducks. The keel of the sternum, too, in some, is as deep; indeed the sterna of two of the ducks in question (the Summer Duck and the Ferruginous) bear in every respect a great resemblance; but to bring this matter to a more practical bearing, let me take eight ducks that I have recently dissected (four oceanic and four freshwater), by way of comparison of the length of the intestinal tubes. The appendices are included in the length of the canal.

Name.	Weight.	Length of alimentary canal.		Length of appendices.
	oz.	ft.	in	in.
Scaup (*Anas marila*)	27	7	9	13
Golden-eye (*A. clangula*)	31	5	8	10
Pochard (*A. ferina*)	37	5	0	4
Common Scoter (*A. nigra*)	38½	6	0	1½
Shoveller (*A. clypeata*)......................	20	5	7	6
Pintail (*A. acuta*)	36	5	3	12
Wild Duck (*A. boschas*)	42	7	2	10
Garganey Teal (*A. querquedula*)	13	5	8	3½

In twenty skeletons of different species of ducks that I have lately examined, I find that all have fourteen cervical vertebræ, seven caudal, and nine pairs of ribs, with the exception of the Summer Duck (*Anas sponsa*) and the *Anas cæruleata*: these have only eight ribs; but I scarcely need say that more than one specimen must be examined to ascertain whether this is the normal number.

Time will not allow me to touch upon the minor differences, external and internal, which apply more or less to all families of birds. Speaking generally, the short, thick-set, rounded form of the oceanic duck, its short wings and neck, shorter and flatter tarsi, lobated hind toe, more elastic breast-feathers, and the greater quantity * of grey down upon the skin, will serve at once to distinguish it. Internally the form of the lower part of the air-tube in the male, the wider and shorter sternum, in many instances with a less developed keel, and the form of the pelvis, are for the most part sufficiently characteristic; but they are none of them, I think, as regards the question at issue, of special importance.

* The Summer Duck (*A. sponsa*) has as complete a covering of grey down as any of the oceanic ducks that I have examined, and in this respect it differs from all the British freshwater ducks that have come under my notice.

One of my objects has been to point out some of the errors (as I believe) that generally prevail respecting portions of the anatomy of the oceanic ducks, and to show that several of the distinctions made are not well-founded. In my concluding paper * "On the Presence or Absence of Air in the Bones of Birds," I hope to exhibit other differences, not before recorded, respecting the absence of air in the *humeri*, and the muscular arrangement of the air-cells in some of the Sea-ducks (so called).

But lastly, as to the inquiry whether these hybrid ducks between the Summer Duck, the Pochard, and the Ferruginous Duck are likely to breed together as suggested by Mr. Bartlett, I have no hesitation, looking to their anatomy, in which there is a great general resemblance, to answer the question in the affirmative; but whether the progeny of these hybrids will also be prolific, is a matter that time only can determine.

I now come to the more interesting part of my subject, viz. that of the *Leporines*—hybrids, so called, between the hare and the rabbit. It has been stated that M. Rouy, of Angoulême, has bred for the market a thousand of these Leporines yearly—that they are fertile both with the hare and the rabbit, and with each other. I have written to M. Rouy, but up to the present time I have received no answer. It is reported that the cross is effected by keeping the animals together when very young. In the Society's Collection there are now several of these *Leporines*, and two of them have litters of young; but whether they are of the first cross it is difficult to determine. The adult animals have a hare-like character; they are large, weighing about 5 lbs., with long ears and long hind legs; but this description will equally apply to some varieties of the rabbit. I have, however, carefully examined the fur (microscopically and otherwise); and about the hare-like character of this *I think there cannot be a question*. The hair is long, and has the same party-coloured appearance (black and fawn) as in the hare—a peculiarity that I have not seen in any variety of the rabbit. The disinclination of the male for copulation is another feature very unlike the character of the rabbit. Of the two females mentioned, one has five young ones, and the other two: of the former litter two are black; of the latter both are grey: they are born blind, are wild, and, unlike the tame rabbit, shriek when handled. The female makes her nest of down, and covers her young. Mr. Bartlett has kindly given me one of his young Leporines, about three and a half months old, for examination. It was bred between the male Leporine from Paris and a common black rabbit. It weighed 3 lbs. 11 oz. Its fur and most of its external characters partook chiefly of those of the rabbit; and the same may be said of its visceral anatomy: the trachea, lungs, and heart are comparatively small; the length of the alimentary canal 17 feet $6\frac{1}{2}$ inches. The flesh was white, and in flavour like that of the rabbit.

With the above I have examined two hares and two wild rabbits, male and female, and I have weighed ten adult specimens of each; the average weight of the hares was 6 lbs. 11 oz., that of the rabbits

* See P. Z. S. 1857, pp. 9, 215.

3 lbs. ½ oz. By way of comparison I have taken a hare weighing 7 lbs. and a rabbit weighing 3 lbs. 5 oz. I have measured and weighed every part of importance, but I need only mention some of the comparisons:—Brain of hare 210 grains, eye 75 grains, lungs 684 grains, heart (bloodless) 655 grains, trachea very large, length of alimentary canal 18 feet. Brain of rabbit 125 grains, eye 35 grains, lungs 193 grains, heart (bloodless) 119 grains, trachea very small, alimentary canal 15 feet 1 inch. I may remark here that I have sometimes found the intestinal tube in the hare (probably in young specimens) much shorter than that before mentioned. I have compared the spermatozoa, the blood-corpuscles, and the various viscera not mentioned above, and I find no important difference in them.

As regards the skeleton, I have been unable to discover any appreciable difference, except in its size and in the length of the hind extremities; but in the Museum of the College of Surgeons there is a skeleton of the Lop-eared Rabbit (Preparation 1949); and if the posterior limbs are compared with those of the hare (Prep. 1914), the resemblance will be found to be very great.

In taking a retrospect of the anatomy of these animals we find a great similarity; the interesting and important differences are in the *heart*, *lungs*, and *trachea*. These I pointed out in 1854, in a paper read before the London Physiological Society, "*On the Weight, Form, Size of the Cavities, and Thickness of the Parietes of the Heart in the Vertebrate Animals**." On referring to the weights of the above-named organs, it will be seen that the proportions are *very remarkable*. Thus, the heart of the hare (and I speak from the examination of many specimens) is nearly five times the weight of that of the rabbit; the lungs are nearly four times as heavy; and the calibre of the trachea three or four times as great; the rings of the air-tube are about the same number in both.

But it must be remembered that these are differences in *degree*, and not in *kind*, and may be explained to some extent by the habits of the animal. The comparative swiftness and durability of speed of the hare require a larger and stronger circulating organ; and the same remark will apply to the respiratory apparatus. If, however, we have this similarity of structure, in many respects (as is well known) the habits of the animals are widely different. The period of gestation in the hare is said to be a month, that of the *wild* rabbit three weeks; but I am not acquainted with any reliable evidence upon this subject. The young of the rabbit are naked and blind; whilst those of the hare see, and have a hairy covering at birth; the number of young in the hare is from two to four, that of the rabbit from four to seven (early in the spring I have generally found four). The rabbit burrows, takes down from its body, covers its young and leaves them at night; whilst the hare (English) seldom, unless hard pressed, will go to earth. Without pointing out minor differences, I have said enough to lead some to suppose that my first impression was correct, viz. that the cross between the hare and the rabbit was a more extraordinary one than that between the ducks in question.

* Lancet, 1854.

But a closer investigation leads me at once to acknowledge my error; for, looking especially to the comparative anatomy, and believing, as I do, that time and circumstances may produce essential alterations in the habits and in the external form, colour, and size of animals, I think that there are more unstable and far-fetched theories in physiology than the belief that the hare and the rabbit may have been originally one and the same animal.

March 12, 1861.—John Gould, Esq., F.R.S., in the Chair.

DESCRIPTION OF ASTERONYX LOVENI, MÜLL. ET TROSCH., A NEW BRITISH STARFISH. BY JOHN A. STEWART, NEW COLLEGE, EDINBURGH.

This fine Starfish belongs to the *Euryaleæ*. It is the second species of this division of the *Ophiuridæ* which has been noticed in the British seas; and it is the more interesting as it is a form intermediate between the already known species (*Astrophyton scutatum*, Link) and the simple-rayed *Ophiuræ*, having the prehensile scaleless arms, and the radiating body-ribs of the other *Euryaleæ*, joined with the undivided arms of the *Ophiuræ*. As in *Astrophyton*, it wants the mouth-plates between the origin of the rays, but has instead a strong calcareous bar uniting the bases of the two neighbouring arms. The two genera have also the madreporiform tubercle on the *under* surface in one of the interbrachial angles nearest the mouth. The genus *Trichaster* is generally placed between *Astrophyton* and *Asteronyx*, but it has the interbrachial mouth-plates, and wants the madreporiform tubercle; indeed it seems scarcely separable from *Ophioscolex*, except in possessing prehensile divided arms, and would perhaps be more correctly placed by the side of this genus among the true *Ophiuræ*.

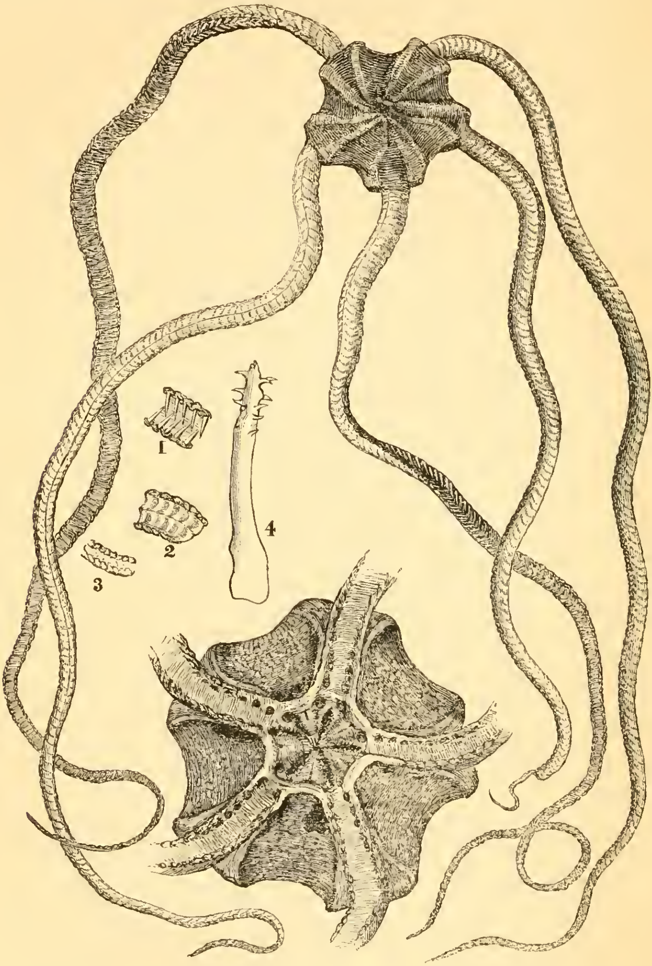
The specimen now exhibited was found in Loch Torridon in Ross-shire, in the summer of 1859. I took it from the deep-sea lines which had been set in a part of the loch 9 fathoms deep and having a rocky bottom. Koren records this species as occurring on the coasts of Norway at a depth of from 50 to 150 fathoms (Nyt Magazin für Naturvidenskaberne, vol. ix. p. 96).

The specimen from which Müller and Troschel's description was taken is in the Museum at Stockholm. It was found at Bohuslän, near Hammerfest, Norway.

Description of Asteronyx Loveni, *Müll. & Trosch.*

The body is pentangular. The skin, which covers the body and arms, is naked, without scales or granules. On the upper surface of the body, covered by the skin, are ten radiating ribs in subparallel pairs; they rise from the margin of the body, on either side of the arms, and, passing inwards, unite, leaving a small central portion of the disk free; they are cartilaginous and flat, with a slight depressed central groove: very much reduced in size, they are continued on the under surface of the body, along the margin of the arms, to the genital openings.

The mouth is five-radiate, and placed in the centre of the under-surface of the disk, in the midst of the origin of the arms; a strong osseous bar, taking the place of the interbrachial plate of the *Ophiuræ,* unites the bases of the arms, and forms a solid ring round the mouth; the five bars give origin to as many calcareous cones, which passing



inwards nearly meet in the centre; the intervening spaces form the five-radiate mouth. Articulated to the cones are a number of spines, which increase in number and length towards the apex; behind the base of the cone, in the angle of each interbrachial space, are placed two genital openings; the madreporiform tubercle also occupies the angle of one of these spaces.

The arms are convex above, and quite flat on the under surface; they are composed of narrow calcareous joints, each of which is furnished with appendages on the inferior angles; on the second joint from the base of the arm a single short spine appears on either side; before the arm leaves the disk, the number increases to three or four, the one on the inner side being longer than the others; these spines are articulated to calcareous processes, with socket depressions for the insertion of the ball-joint of the spines; the processes are scarcely visible at first, but increase in size, until, beyond the middle of the arm, their margin supplies space for the attachment of no fewer than twelve very short spines. The inner spine gradually increases in length from the base of the arm until it reaches its maximum about 2 inches from the disk; soon thereafter it begins to decrease, and continues until it becomes of the same size as the others. This long slender spine is directed inwards on the flat underside of the arm, and reaches at its greatest length fully two-thirds across; it is covered on its summit with a number of recurved spikelets. The second spine is slightly compressed towards the summit, where, on its inner margin, it is furnished with a few spikelets in a single series. When the animal is alive, a thin membrane covers the whole of the spines, as in other Echinodermata; but in dried specimens this is scarcely discernible.

Two series of tentacle-pores run along the sides of the arms—one pore to each joint, placed near to and in a line with the spines. They can be easily traced for 2 inches or so along the length of the arm; but whether they continue much further it is difficult to say from the dried specimen. Two of these pores occur at the origin of the arms within the calcareous ring surrounding the mouth.

The breadth of the body is $1\frac{5}{8}$ inch. The most perfect arm in the specimen is 12 inches long; but as this has been twice, perhaps more frequently, broken and repaired, it is probable that its true length would be at least 2 inches more. The relation of the body to the arms is thus as 1 to 9.

In the accompanying drawing (see woodcut, p. 78) the whole animal is represented at about half the natural size, and the upper surface of the disk at the size of life. Fig. 1 shows the under surface of a ray about 2 inches from the disk; fig. 2 the upper surface of the same ray; fig. 3 the under surface, towards the extremity of the ray; and fig. 4 one of the large inner spines magnified.

MISCELLANEOUS.

On the Pediculi *infesting the different Races of Man.*

Mr. Andrew Murray, the Secretary of the Horticultural Society, has lately read a paper before the Royal Society of Edinburgh on this subject. He confines himself to the study of the true *Pediculi*, including two species, viz. *P. capitis* and *P. vestimenti*, and proves that the pretended *P. tabescentium* is only *P. vestimenti*. He observes, "As to colour, I find that there is a considerable difference. The coloured races of man have correspondingly coloured parasites.., As to form, there is not so much scope for difference. . . Using these as characters, then, it is impossible to deny that there are tolerably well-marked differences between the parasites of different races; and as in several of these races I have had the benefit of a large series of specimens, I am able to add that these differences are constant."

"There remains the question, what is the value of these differences as bearing upon the unity of the human species? I am bound to confess that I think it leaves it exactly where it was before. I think I may say I have satisfactorily proved that there are differences, and that these differences are constant and permanent: that is, no doubt, something. But, unluckily, these differences are most singularly similar to the differences in the races whose unity is the question in dispute, and to solve which this evidence has been adduced. . . To attempt to draw any deduction from these differences in the *Pediculi* would therefore, as it appears to me, be something like begging the whole question."—*Trans. Royal Soc. Edinb.* 1861.

On a new Species of Fish belonging to the Genus Pagrus. By Dr. Albert Günther.

Pagrus Bocagii, Lowe.

D. $\frac{12}{10}$. A. $\frac{3}{8}$. L. lat. 65. L. transv. 7/17.

The greatest depth of the body is below the fourth dorsal spine, where it is one-third of the total length; the length of the head is one-fourth of it. The diameter of the eye equals the width of the interorbital space, is one-fourth of the length of the head, and two-thirds of that of the snout. The præorbital is longer than high, and higher than the orbit. There are six series of rather narrow scales between the præorbital and the angle of the præoperculum. Molar teeth in two series,—those of the outer series being conical, pointed, and much larger than those of the inner series. The third, fourth, and fifth dorsal spines are produced, flexible (in immature specimens); the second and third anal spines of nearly equal length and strength, one-third of the length of the head. The pectoral extends on to the vertical from the first soft anal ray, and its length is contained three and a half times in the total; the ventral reaches to the anal fin. Silvery, with red, shining golden stripes along the series of scales; a dark-claret spot on the back beneath the fifth, sixth, seventh, and eighth dorsal rays, extending on the membrane of the fin; a smaller spot on the upper part of the axil; the spinous dorsal, caudal, anal, and ventral fins with the margin blackish. Length $9\frac{1}{2}$ inches.

Hab. Sea of Lisbon.

This fish forms a new addition to the European fauna. It has been sent to the British Museum by the Rev. R. T. Lowe in a fine collection of fishes made at Lisbon. He proposes to call it after Dr. Bocage, of the Lisbon Museum, in case it should prove to be a new form, and writes:—"It grows very large; I saw one which was 2 feet 10 inches long, and was said to weigh more than 16 lbs. Its head was bright red or vermilion. The elongate dorsal spines are only a conspicuous character in young examples."—*Proc. Zool. Soc.* Nov. 13, 1860.

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IX.—*On the Sexual Life of Plants, and Parthenogenesis.* By Dr. H. Karsten, Lecturer on Botany at the University of Berlin*.

[Plates IX. A, X. & XI.]

The experience of past ages, that certain plants only produce fruit and fertile seed when two are grown together, laid the first ground for the doctrine of the sexuality of plants. The Arab writers, about 900 years after Christ, first drew particular attention to the phenomenon, and recognized its analogy to animal nature. The cultivation of the Date-palm, the Pistacio, of the *Carica Papaya*, &c., led observers to the knowledge of the purpose of the pollen and ovules in the development of seeds. But Clusius was the first botanist who pointed out distinctly that those plants of the *Carica Papaya* bearing stamens were the male, whilst, in accordance with the prevalent popular views, he called those which bore the fruit the female.

John Ray, who first remarked the fixed constancy in the number of the carpels (a fact employed at the present day, since the time of Jussieu, as the basis of the natural classification of the vegetable kingdom), arrived, after numerous experiments and observations, at the conclusion that the anthers of male plants were indispensable to the female in the production of germs.

The scientific foundation of the doctrine of the sexuality of plants was further advanced by our distinguished fellow-countryman, Rudolph Jacob Camerarius, Professor in Tübingen. Camerarius supplied by his researches the groundwork for that first logically-contrived system of plants which, thirty years later, Linnæus gave to his contemporaries.

* Translated by J. T. Arlidge, A.B., M.B. &c., from the original memoir communicated by the Author, to whose kindness we are likewise indebted for the use of the original plates.

By the labours of Burkard, Morland, C. J. Geoffroy, Bradley, Vaillant, Blair, and other observers, the sexual relations of plants were in various ways so elucidated, that, to the methodical mind of the great Swedish naturalist, and by means of his own numerous and accurate observations, their proofs were complete and multiplied. Indeed, he clearly proved that the female plants of *Cannabis sativa*, when carefully protected from the access of the pollen, produced no seeds.

The views of Tournefort and Pontedera, based upon some fallacious observations, respecting the importance and purpose of the anthers, failed to invalidate the antagonistic facts adduced by Linnæus and Dillenius.

The researches of Needham (1745) and Gleichen (1781) on the structural relations between the pollen and stigma, as well as the successful attempts of Kölreuter to generate bastard forms by scattering the pollen of other plants on the stigma, contributed most valuable support in favour of the doctrine of the sexuality of plants.

The inexact observations of F. J. Schelver and Henschel were insufficient to cast a suspicion upon the results obtained by Camerarius, Linnæus, Kölreuter, and others.

The hypothesis of the sexuality of plants entered on a new stage as a consequence of the labours of the distinguished anatomists of this century. The elongation of the pollen-cells was first observed by Amici in 1823; and Brongniart subsequently witnessed, in several plants, the prolongation of tubes from the pollen adherent to the stigma, and the extrusion of corresponding tubules from the orifice (mouth) of the ovules. The latter he presumed to be conducting tubes, through which the fructifying contents of the pollen-tubes (for, like Needham, he imagined that these tubes burst within the conducting tissue of the style) were conveyed to the embryonic sac, discovered by Malpighi to be present within the ovules. Amici followed the pollen-tubes, as is illustrated by the communication presented by Mirbel, from the pollen-corpuscle, through the conducting tissue (observed by Malpighi, as early as 1675, in Monocotyledons) of the canal of the style and of the embryo, to that little aperture in the seed (discovered by Grew in 1671), the mouth of the ovule (since named by Turpin the micropyle), into which this conscientious inquirer, moreover, saw it enter. This was confirmatory of the idea started by Samuel Morland (1703), that the pollen descended through the style into the ovary, and there entered the micropyle of the ovules. In this phenomenon we also find the true explanation of the fact recorded by Richard in 1811, that fibres grew from within the ovules of *Blyxa Auberti*.

Robert Brown, between 1831 and 1833, repeated and confirmed, to the fullest extent, the discovery of Amici in the case of the families of Orchidaceæ and Asclepiadaceæ. Amici, besides, very correctly showed that the elongation of the inner coat of the pollen-grains (usually regarded as simply an act of extension) was effected by a process of growth at the expense of the fluid supplied by the surrounding conducting cellular tissue. The end of the pollen-tube in contact with the ovule Schleiden followed and traced into its tissue, and came to the conviction that, in a large number of plants, the primary formation of the embryo takes place in the interior of this intruded sac of the pollen.

Horkel, Wydler, and, in part, Meyen, accepted Schleiden's views; and Schacht, in his extended prize essay sent to the Royal Netherlands Institute, contributed a large number of proofs in support of Schleiden's discovery. Repeated experiments and investigations that I undertook also caused me to side in general with this observer, although I held the opinion of Meyen and Brongniart to be generally true, that only the union of the contents of the two heterogeneous cells—viz. of the pollen-cell and of the embryonic sac—is necessary, according to the osmotic capacity of the membranes concerned (at one time of the pollen tube, at another of the embryonic sac) or through the union of these two histological elements, to give rise to the development of a new individual.

In the mean time, Griffith (in 1835, at Calcutta) saw, in *Santalum album* and in *Osyris,* the outgrowth of the embryonic sac, in the form of a tube of greater or less length, from the naked ovules as far outwards as the funiculus. The development of the plant-germ only proceeded when the pollen-tube entered within this open and freely-exposed cavity of the embryonic sac. On the other hand, in *Viscum* the germ appeared to him to take its origin in the pollen-tube itself.

In 1846, Amici, Mohl, and Hoffmeister pronounced themselves decidedly in favour of the opinion that the germ never originates within the pollen-tube, but by the enlargement of one of the cells floating freely in the fluid of the embryo-sac, after the pollen-tube has so extended itself as to reach to the vicinity of that sac.

Subsequently to these different interpretations as put forward by various able observers, Schleiden suggested the probability that the opinion first advanced by Brongniart might in many cases be true, and that the germ took its rise from the conjugation of the pollen-tube with a pre-existing embryo-vesicle. At the same time the last-named naturalist, and, at a later period, Radlkofer, and, last of all, Schacht, from his observations in

Madeira on *Gladiolus segetum,* advocated the opinion of Amici and Mohl with reference to the production of the embryo, as exclusively correct.

Not one of these anatomists called in question the theory of the sexual origin of plants put forward by Camerarius and Linnæus. Their views differed only on the question whether the rudiments of the new being were commenced exclusively within the embryo-sac, or exclusively within the pollen-tube, or by the united action of the two organs, after the manner of the conjugation of the Confervæ. The majority of botanists certainly incline towards the opinion that the basis of the young embryo is furnished solely by the germinal vesicles contained within the embryo-sac, and never by the pollen-cell, whose contents serve no other purpose than that of its fructification. Moreover, the plants which Linnæus cautiously named Cryptogamia have been of late years for the most part proved to be Phanerogamia; for, in 1848, Suminski, by observations first made on the thalli of Ferns, showed that those organs which Hedwig, in the case of Mosses, had rightly intimated to be anthers and pistils, actually performed the functions of such structures in Ferns; and since then, in 1850, I sent from Venezuela to Prof. Ehrenberg, as Secretary of the Berlin Academy, the first part of the history of the fructification of an Alga, which confirmed the idea of Nägeli respecting the sexual nature of the two sorts of stalked branches remarked by Vaucher. These two observations together made us acquainted with the extreme forms of the fructifying organs among the Cryptogamia: namely, in the one case the motory apparatus, which is to be compared to the extine of the pollen, is developed pre-eminently; in the other case the cell, which is comparable with the intine of the pollen, attains the maximum development. Still, in both cases, the latter is always present as the special fructifying organ—overlooked, it is true, by many observers, either because, in cellular Cryptogamia, they considered it to be an integral part of the spiral fibres producing the motions, or because, in the vascular Cryptogamia, they examined spiral fibres from which the fructifying cells were torn off.

The conjugation of *Spirogyra,* described by Vaucher as the simplest form of a reproductive process, is indeed still so regarded by the majority of botanists at the present day, and my researches on *Vaucheria* show it to be so in the clearest manner. In some cases, the impregnation of the naked archegonium takes place by means of a free spherical cell (Pl. IX. A. fig. 23 *a*), which escapes from the open extremity of the antheridium within which it was produced, adheres to the archegonium, and after a time coalesces with it, so that the two united lay the foundation for the new individual. However, I more frequently observed that "the apex of the archegonium ('separation-cell,' *Absonderungszelle*) is applied to the curved branch—the antheridium, and that the membrane of the latter becomes absorbed at the point of contact, and then the cells existing in it, filled with colourless muco-granular matter, discharge themselves into the 'separation-cell.' Once, indeed, I clearly witnessed (as I have represented in fig. 23 *c*) that in this process the membrane of the 'separation-cell' (archegonium) became thrust inwards, whilst the secreted matter existing in it decreased, to make room for the penetrating cell.

"Whilst it is easy to make out the whole process of fertilization, it is as difficult to answer the question respecting the condition of the membrane of the separation-cell (archegonium) in the natural condition of the plant, without preparation, as that respecting that of the embryo-sac in compound higher plants. I succeeded in making this point clear by allowing the cells found in actual union to dry up, whereby the coloured matters which lined the inner wall of the 'separation-cell' were withdrawn from the extremity which was occupied by the cell that had there penetrated it (Pl. IX. A. fig. 23 *b* & fig. 23 *c*).

"After the act of impregnation is accomplished, the 'separation-cell' (the archegonium) reassumes the same appearance as before, except that, by transmitted light, the newly produced cell appears of a brownish colour in the centre.

"The result of the two different forms of conjugation of the contents of the curved (antheridium) and of the ovate (archegonium) branch-cell is the formation of a similar product: this is the germ of a young plant, which forthwith, or so soon as the necessary conditions are furnished, developes itself into a simple or very slightly branched cylinder. If the plant, for instance, after impregnation has been accomplished, be moistened only just so much as is necessary to prevent its being quite dried up, the germs formed are not developed, its contents lose colour throughout, and at the same time its enveloping membrane grows thicker. I have kept such germs under observation for three months together. On the contrary, when placed in water, they become green again, and develope into long fibres."

I have here detailed my observations thus fully, in order that they may be compared with the quotations from them given by Pringsheim, through which various more recent authors, who have not given themselves the trouble to refer to the original statements, have been led into error. Pringsheim, who confessedly was unacquainted with the plants examined by me in the colony of Tovar, in Caracas, though he investigated other very similar plants, says, when citing my remarks:—

"In the first place, the extremities of the mother-spore-cells apply themselves laterally to the little protuberances (corniculi), whereupon the membrane of the latter at these lateral points becomes pierced through, and the 'Karsten'-cells are transferred through these apertures from the protuberances to the mother-spore-cells.

"This is the description of the process advanced by Karsten; and I can only express it as my opinion that the explanation given by that naturalist of this account rests upon a false interpretation of what he has seen.

"An aperture never exists on the sides of the projections*. In the instance figured by Karsten, the protuberance (little horn) is in contact, as happens perhaps as frequently as not, with the mother-spore-cell; but the protuberance is shown to be here quite entire and closed below, and nothing whatever is extruded from it; in fact, Karsten's figure represents it replete with contents, and conveys a more truthful impression than his explanation of it."

Pringsheim in this place copies my figure (23 *c*); but he prudently omits fig. 23 *b*, which exhibits the emptied antheridium, and would of itself furnish a contradiction to his denial of my statements †. It has been the fate of Pringsheim himself, who subsequently carried out some researches on the reproduction of *Œdogonium*, *Bulbochæte*, and *Saprolegnia*, to be compelled to confirm my views relative to *Vaucheria* by analogies which he discovered in *Saprolegnia*. He, moreover, discovered in *Saprolegnia* (supposing Pringsheim's account of his own researches to be more credible than his extracts from the writings of others) a similar double process of reproduction,—in the one case by the intermingling of the heterogeneous contents of two adjoining branches (compare the conjugation and the above delineation of the fertilization of *Vaucheria* and fig. 23), and, in the second case, a mode of fructification corresponding with that of the higher Cryptogamia, viz. by cells provided with locomotive cilia.

That the act of fertilization may be accomplished in other Algæ allied to *Vaucheria* by means of cells of larger size, instead of minute cells provided with vibratile cilia, is rendered highly probable from the accounts given by Pringsheim respecting the fructification of *Œdogonium*, and from what I myself have also repeatedly noticed. Pringsheim discovers, in these various modes of

* A pre-existing aperture is certainly never found in this organ, either on its side or at its extremity. No one has ever asserted its existence; and Pringsheim's denial of it is therefore altogether superfluous. If Pringsheim has not seen the absorption of the contiguous cell-walls, it is either because his investigations have not been continued long enough, or because the species of plants examined by him do not present this mode of fertilization.

† See *Botanische Zeitung* 1860, p. 385.

reproduction, evidences of generic difference: I satisfied myself (in 1850) that they are only different varieties of the same act, and may occur in one and the same species, the form being determined by certain relative conditions of nutrition.

The knowledge of the fructifying process which takes place in the Algæ has been pre-eminently promoted by Thuret and Cohn, and of that which occurs in the higher Cryptogamia by Mettenius and Hoffmeister. In short, by the careful labours of these and of many other naturalists, it has been incontrovertibly established that, besides the multiplication of individual plants by buds or offsets—whether it be a single cell detached from the general mass, or a complex cell-mass, still forming part of the parent plant and developed from it (germ-granules or buds)—there is throughout all classes of the vegetable kingdom, with the exception indeed, at the present day, of the Fungi and Lichens alone, a sexual method of reproduction calculated to maintain the typical form of the species.

In fact, indications of a process of impregnation were seen, and its reality conjectured, by Ehrenberg in the Lichens and Fungi; and more recently, Itzigsohn and Rabenhorst, in the case of the Lichens, and Tulasne in that of the Fungi, have detected corpuscles to which they would assign the function of antherozoids.

I moreover observed a process of fructification in a Lichen, which will serve to establish the opinion that even in these simplest organisms a sexual act is performed. Of this observation I shall have to speak hereafter more at large. These various researches respecting the fructifying processes in the Cryptogamia make it at the same time evident that the mechanism of the proceeding—*i. e.* the nature and manner of the approximation of two heterogeneous cells, the union of which brings about the production of a new individual of a younger generation—varies so much the more as the structure of the vegetative organs is simpler. Whether the cell containing the fructifying material (pollen, antherozoids, spermatozoids, &c.) be provided or not with a locomotive organ, is of no importance in connexion with the impregnating act.

The assertions advanced, in opposition to the Linnæan doctrine, by Spallanzani, Henschel, Schelver, Bernhardi, and others, that the ovules of plants, as a normal condition, are stimulated by the pollen-grains to set up a new development of cells as the foundation of a fresh germ, and that moreover, in like manner, a new germ may be produced without the fructifying influence of the pollen on the ovules, are founded on inaccurate observations, and constitute the framework of hypotheses completely set aside by exact investigations.

Still, the propensity to credit what is marvellous, and to excite an interest by taking up the defence of bold hypotheses at variance with hitherto acknowledged laws, did not allow the results arrived at by the united assiduous labours of so many naturalists to go unchallenged.

For instance, a report made by Smith, in 1841, that he had noticed in the *Cœlebogyne* grown in Kew Gardens no male flowers, and that, notwithstanding this, the plant produced fertile seeds, induced Naudin to repeat Spallanzani's experiments on *Cannabis* and *Mercurialis*; and from the origination of fertile seeds in isolated female specimens of those two plants, as well as in a female *Bryonia dioica* grown in the open air, he felt himself entitled to deny that the fructification of the ovules of plants is necessary to the development of normal germs.

Radlkofer, prompted by the observations of Siebold (1857–1858) respecting the capacity of development of the unimpregnated eggs of bees and moths, made use of these statements of Naudin to construct his hypothesis of the parthenogenesis of plants; but, at the same time, he omitted to notice that the normal formation of buds and the development of ovules, occurring in an abnormal manner analogous to the production of buds, are long- and well-known phenomena, corresponding likewise with the production of living progeny by the Aphides and Trematoda, and with that of barren eggs by insects.

Under the influence of his preconceived ideas he has failed to note that the researches of Naudin were instituted on polygamous plants,—a circumstance which naturally suggests to the mind that a concealed male flower, or an anther produced in the interior of a female flower, may have led the observer into error.

The observations of Smith on *Cœlebogyne* appeared to Radlkofer's mind to supply ample evidence in favour of his notion of vegetable parthenogenesis. Some examinations were undertaken by him on the *Cœlebogyne* and its embryos during a visit to Kew, in the course of which he once detected a pollen-cell on the stigma; this occurrence, however, failed to shake his faith in the conclusion he had already arrived at.

The same fortune that befell Radlkofer also attended Braun, who in the same year got Deeke to examine the embryos of the *Cœlebogyne* cultivated in the Botanical Gardens of Berlin. For although Deeke showed that there is a normal act of fertilization of the germ-vesicles in the embryo-sac of *Cœlebogyne*, yet Braun considered himself justified in propounding to the Berlin Academy his ideas of parthenogenesis in plants. Braun further supported this hypothesis by appealing to the before-quoted researches of Henschel and earlier inquirers, and to the circumstance of the much rarer existence of male specimens of *Chara crinita*, to which he thereupon attributes, without further research, a parthenogenetic mode of reproduction.

That the investigations, repeated by Naudin, of the development of unfertilized ovules in *Cannabis* and *Mercurialis*, and likewise the older experiments by Spallanzani, Lecoq, and others, asserting the same development to occur in the ovules of *Spinacia*, are untrustworthy, follows as a consequence of the researches undertaken by Regel and Schenk. On the one hand, Regel always detected male among the female flowers on the same plant; on the other, it follows (in accordance with the rule) from Schenk's admirable experiments, that the notion of the formation of fertile seeds without the operation of pollen upon the ovules of a plant, is not established. Both observers concur in saying that, of all the plants adduced as parthenogenetic, the *Cœlebogyne*, which was not accessible to them for investigation, forms the only exception to the general law, and that ovules become fertile seeds only after the act of fertilization. Schenk was led to believe in the existence of the exception mentioned, inasmuch as he relied upon the authority of Braun, who made it appear that he had for a long time examined the *Cœlebogyne* with the most scrupulous care in his room; but Regel formed a more unbiassed opinion, and gave to the unsupported statements of Braun and Radlkofer no such implicit belief.

Both these careful observers would have convinced themselves with ease of the groundlessness of the hypothesis of Radlkofer and Braun, if they had been enabled to examine a plant of *Cœlebogyne* in bloom.

The delusion of the two last-named observers, that they were able to make out, from among the structures of the normally-formed male flowers, the impossibility of the presence of a hermaphrodite flower in *Cœlebogyne*, rendered them blind to the existence of the comparatively large anthers, which, in fact, are often developed at the base of the calyx of the female flowers, as I have had opportunities of observing for two years in the specimens growing in the Berlin Botanic Garden.

That Radlkofer did not discover the hermaphrodite flowers of *Cœlebogyne* is attributable to the hasty character of his observations during his travels; but this, if in the least explicatory of the circumstance, is no apology for it. The finding of pollen on the stigma ought to have rendered him cautious, had he been only anxious for the discovery of the truth, and not, as is clearly the case, for the promotion of a literary work by the fallacious evidence of a preconceived interpretation. But that Braun, after several years' observation of the plant in question *, and after

* Whilst this sheet was passing through the press, I received from Prof. Braun his just-published "Supplement to the Treatise on Parthenogenesis

he had been shown by Deeke the fructifying pollen-tube in the embryo-sac, should not be acquainted with the fact that during the entire summer, from the beginning of May till the end of August, hermaphrodite flowers are not rarely met with on *Cœlebogyne,* is altogether incomprehensible.

Cœlebogyne (Smith).

The hermaphrodite flowers observed on the *C. ilicifolia* from May to August, in the Berlin Botanic Garden, were all monandrian. The single anther developed (Pl. X.) was situated on the periphery of the flower; it alternated on the outer aspect with the inferior first and with the adjoining fourth leaf of the calyx, and on the inner aspect with two of the carpels. Sometimes a second aborted anther is met with, also alternating with two carpels and situated opposite the third leaflet of the calyx. The stamens are attached to the bottom of the flower. The perfect one is equal to the sepals in length, and consists of a cylindrical, thick, fleshy filament, at first erect, but afterwards curved outwards; it gradually expands upwards to the 'connective,' which is free on the exterior; to this last is affixed an oval, reniform, orange-coloured anther-cell, having a discharging slit-like outlet prolonged to its apex. Though the anther has two parallel compartments when first formed, the septum breaks down between them at a very early period of development, when the entire stamen is still concealed within the calyx and the pollen is completely undeveloped.

Braun, who had the opportunity of examining some portions of a male flower which had been preserved in the Herbarium at Kew, as belonging to *Cœlebogyne,* describes the anther-cell to be "elongated, consisting of two halves, in contact above and below, but rather separated at the centre by the 'connective;' strongly curved on the outer aspect, where likewise the elongated slits for dehiscence are placed." This description of the anther of *Cœlebogyne* from Hooker's collection might raise the doubt whether the male organs described by Braun actually belonged to *C. ilicifolia,* were it not that, very fortunately, the most important contradictions in the account given by Braun to what I observed in the specimens obtained from the Botanic Garden of Berlin, particularly in respect to the variation in the form of the anthers, are removed by the illustrations that Braun has appended to his own essay. For instance, Braun says the anther-

in Plants—Polyembryony and Germination of *Cœlebogyne*" (extracted from the Transactions of the Berlin Academy for 1859, printed in 1860). In this work Braun adduces (p. 197) further evidence in illustration of parthenogenesis, without, however, assigning any great importance to it. But *Cœlebogyne* still constitutes, as heretofore, the mainstay of the doctrine of the parthenogenesis of plants.

cell is elongated, oblong, whilst I feel obliged to call it oval if I indicate its form according to the principles of nomenclature given by Linnæus and employed by the best authors, and as, moreover, it is in fact represented by Braun*. Moreover the mode of attachment of the anther to the filament, as described by Braun, differs from what I have found and represented; for he says the filament is very short, and affixed in a joint-like manner to the inner side of the connective. If this relation of the parts be true, and not an error in description, like that above noticed of "elongated, oblong," the cause of this assertion of Braun would in truth appear to be that the male organs examined could not have been those of *C. ilicifolia* of the Gardens of Kew and Berlin: for no example of a species is known to me having both those modes of attachment of the anther on the filament severally described by myself and Braun; in short, according to the prevailing notions of generic characters, plants so formed would belong to two distinct genera.

Since I have not had the opportunity of examining the male flowers of *Cœlebogyne* from Hooker's herbarium, I am unable to decide this point; we must therefore wait until Hooker, or some botanist familiar with the morphology of plants and with these particular inquiries, can give us an account of the true state of the case †.

This doubt, whether the male flowers of *Cœlebogyne* examined by Braun and myself were equivalent, would necessarily extend to the further account given by Braun of the female flowers of this plant, had I not thoroughly assured myself that I had the same individual specimens before me that Braun himself investigated, —a fact which does not appear, even in the case of the female flowers, from the descriptions of them given by Braun, but rather the contrary.

Thus, Braun describes the calyx of the female flower of the *Cœlebogyne* of the Berlin Botanic Garden to be deeply five-cleft (quinquepartitus), and rarely four-cleft (quadripartitus), whereas I, on the contrary, found the calyx to consist of five completely-separated, distinct sepals, imbricated in vernation; the leaflets never coalesced (gamosepalous), five-cleft (quinque-partitus), nor lobed, as Braun further terms it in his German description. Moreover in the same place he speaks of the

* The long diameter of the anther is not double its transverse diameter, and it is rounded, not pointed,—wherefore we must call it oval, according to Linnæus (Philosophia Bot. 1751, p. 42), Willdenow (Grundriss der Kräuterkunde, p. 78), and Bischoff (Handbuch der bot. Terminologie und Systemkunde, p. 74).

† I am, however, convinced that Braun's faulty description has alone given rise to this doubt; Decaisne (*Ann. des Sciences Naturelles*, vol. vii. 1857) has already corrected Braun's statement on this point.

leaflets of the calyx—a mode of expression not usual with botanists in the description of plants, except where the calyx consists of a whorl of free and non-united leaf-like organs or sepals.

Further, the form of the stigma is described in an anomalous way by Braun: the lobes are not "somewhat emarginate at their extremity (lobis expansis integris subemarginatis)," but each of them has several dentations along its upper edge, more or less deep, and three or four marginal teeth, or more seldom two such; and the edge is very rarely entire. This therefore is clear, that Braun selected an imperfectly developed bud, and described its condition as the rule, instead of a fully-developed flower,—a circumstance it is always necessary to have stated. The correctness of this conclusion is manifest from Braun's description of the position of the stigmas; for he says they arch over and are compressed against the capsule, whereas in the developed, full-blown flower the stigmata are horizontal and somewhat erect.

At the base of the external whorl of sepals, and partly adherent to the short axis of the flower, several glands are met with, usually one on each side of every sepal, of tolerably large size, hemispherical, and flattened at their apex. A fifth similar gland is also frequently found at the base of the free border of the third leaflet of the calyx.

Braun, again, is incorrect in his ideas respecting the attachment of the flowers, since he says, "Several female flowers grouped together at the extremities of the pedicels constitute strictly called few-flowered, apparently loose spikes. These are provided with a terminal flower, which is formed at an earlier period than the lateral blossoms, of which latter the upper slowly succeed the lower in the order of inflorescence."

The flowers, including the lateral ones, are, however, not sessile, as Braun implies, but shortly stalked, as Smith indeed rightly described them, and are situated in the axis of a bract; their pedicels are furnished with two bracts, similar to the leaflets of the calyx, and usually support a gland on each side of their base.

The presence of the bracts on the pedicels of the flowers, and the earlier expansion of the terminal than of the lateral flowers, afford unequivocal evidence that the mode of inflorescence we have here cannot be strictly named "a few-flowered spike," but is nothing else than a few-flowered "cyme" the lateral flowers of which are so shortly stalked that the whole inflorescence acquires a spike-like form, or constitutes a *cyma spiciformis*.

The description of *C. ilicifolia* given by Braun is not, indeed, sufficient to establish the identity between the species examined by him and by myself: however, I am thoroughly convinced of the fact of this being the case; for, as Braun himself states, only three flowering plants of *C. ilicifolia* existed in the Berlin Botanical Garden, and two of the self-same examined by him I also had the opportunity of investigating.

Thus it appears that the last insecure prop to the hypothesis of parthenogenesis in plants is thrust aside, and it is established beyond doubt that the production of a normal germ in the female organs is dependent upon the cooperation of the male organs of plants.

The Pollen.

The pollen escaped from the anthers of *Cœlebogyne* is spherical, and composed of a very delicate smooth integument enclosing fluid contents. The external coat is remarkable in having three symmetrically-disposed darker or clearer specks on its surface. The fluid contents have suspended in them a multitude of oval and rounded firm corpuscles, which are coloured partly blue and partly yellow by iodine.

The different transparency of the three points alluded to in the wall of the pollen is due either to the presence of small globular (collenchymatous) corpuscles, or to the detachment of such cells, and the consequent production, by the spaces left in the coat where they adhered, of clear circular specks with a dark outline. The internal very delicate pollen-coat, which cannot be distinguished from the outer tunic except after the application of chemical reagents, becomes evident at these clear spaces when the pollen-cell proceeds to elongate itself on the stigma (Pl. X.).

The pollen-grains (united in groups of four) contained within the half-developed anther-cell possess thicker coats, and on that account completely occupy the mother-cells in the parenchyma, of which four are formed in each anther-cell. The special mother-cells are very manifest, and are thickened during the whole period of the deliquescence of their parent-cell, and present the appearance of "imperfect" parenchyma-cells (collenchyma) (Pl. X.).

These cells enclose four others of a second generation, one of which, the intine of the future pollen-grain, at this period almost entirely fills up the parent-cell, and contains a uniformly thick mucoid fluid, whilst the other three grow to a very trifling extent, and are so compressed by their largely-developed fellow-corpuscle against the wall of the mother-cell, that they come to occupy a position between the two coats of the pollen-cell—the extine and the intine.

They are the "intermediate corpuscles," described by Fritsche as having a similar situation in the cell-structure of all varieties of pollen, and without doubt owe their origin to the same cause which gives rise to the circumstance that the vesicles* which cha-

* I frequently call the non-nucleated cells, which commonly perform a secretory function (H. Karsten, De Cella Vitali, 1843, p. 64), for brevity's

racterize porous parenchymatous cells and vessels always correspond to each other in the adjoining walls.

In the course of the further generation of the pollen-cells the soft mother-cell becomes progressively absorbed, until it is reduced to a most delicate and scarcely perceptible membrane, as we find it to be in the mature pollen-cell at the time of impregnation, and when at length it is broken through by the agency of the three vesicles distended by the absorption of fluid. In this way the openings (pores) originate, in the vicinity of which the intine begins to extrude.

At the time of the separation of the little-cells from the mother-cells of the *Cœlebogyne* (which in their origin stand related, like the dotted cells of wood, to the peculiar porous cells, and which ought therefore rightly to be called, not porous, but dotted cells), they can scarcely be recognized as such; for their walls are so thick, that their cavities are, like those of starch-grains, extremely contracted. Since Fritsche's observations on pollen, we know that the "intermediate corpuscles" existing in fully-developed pollen may not rarely be recognized as actual cells. I represented, in my 'Flora Columbiæ,' vol. i. pl. 44, the pollen of *Schachtea*, which also displays very clearly this same relative structure. The intermediate corpuscles, distinctly recognizable as vesicles, occupy, as do those in *Cœlebogyne*, the same position as the "opercula" of Fritsche, and are thrust aside by the expanding intine: until this period they constituted the "porous canal" in the wall of the extine.

The length of this canal necessarily depends in part upon the thickness of the extine of the pollen, and in part on the dimensions of the cell which constitutes the intermediate body. In *Cœlebogyne* the canal is exceedingly short; in *Œnothera* and *Clarkia** its development is very considerable, and both the cell concerned in its formation is very large, and the outer portion of the distinct canal hollowed out in the highly thickened extine of considerable length.

How essential the developmental history of organic bodies is to the correct apprehension of structural relations is exemplified by Schacht's most recent work on this subject of pollen-structure; for, notwithstanding his marvellous skill in the representation

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sake, vesicles. A superfluous and incorrect designation for these structures is the expression '*vacuoles*.'

* In *Clarkia pulchella* the wall of the intermediate cell is intimately united with the intine and extine on either side of it, whilst these two membranes are not in union, so that on a transverse section a fissure appears between them, as Schacht has figured ('Physiologie,' pl. 10. fig. 17), and as he states may be demonstrated very clearly in half-developed pollen-granules of this species.

of the transverse section of the mature pollen of *Clarkia*, as well as, indeed, of *Cucurbita* and other plants whose pollen is provided with intermediate corpuscles, he is so entirely mistaken with respect to its nature that he attributes the condition to thickening of the inner pollen-coat.

That these "dot-cells" of *Cœlebogyne* and allied forms, together with the cells containing the fovilla, are, in relation to the extine, cells of the second generation, can be made out only by their developmental history. For, in fact, they mostly retain within the pollen-cell, during the first stage of development, the appearance of secretory cells; still it is rare that they contain secretions, as happens in *Onagraria* and *Geranium*.

Their function evidently is, either by means of the osmotic action of their contents, or by the transformation into mucus and the consequent swelling-up of their enveloping membrane, to cause the rupture of the extine, which is always very thin above them. Then they in their turn are thrust out or absorbed by the outgrowing intine, to make way for its extrusion.

Without doubt similar cells are in requisition in all cases (as Fritsche indeed surmised) to effect the perforation of the extine, when the ripe pollen comes into contact with the moisture of the stigma or any other appropriate fluid.

Besides these cells, which originally held the same genetic position as the "intine," there exist very frequently, within the fluid contents of the pre-formed (parental) sac of the *extine*, some actually secreting-cells, containing volatile oils and other secreted matters. These vesicles especially contribute to produce the great varieties in the external aspect of pollen, either being so modified in growth as to constitute warts or spines on the surface of the extine, which is usually in part simultaneously absorbed, and in part transformed into lignine, or so spread out uniformly over the whole surface of the pollen-grains, except where these are in mutual contact, as to form a sort of epidermal covering over the intine.

In pollen-grains furnished with folds, the involutions of the extine have no such cellular membrane on their surface. Also in porous pollen-grains, where the pores of the extine are in part due to the presence of "dot-cells," there is not unfrequently an unusual number of them, developed by endogenous growth, which again by their manifold transformations still further multiply the varieties of pollen.

Mohl, indeed, in his standard work on Pollen (1834), expressed the opinion that "the outer integument of the pollen must be regarded as a structure composed of cells or of their rudiments and of a homogeneous connective tissue."

Unfortunately this distinguished histologist, misled by the result (not entirely borne out by facts) of later investigations of the cuticle, has, in a new exposition of the structural relations of the pollen, expressed himself somewhat ambiguously respecting them, and in such a way that his description has tended to strengthen the prevailing erroneous hypothesis, that the outer lamina of the epidermis (the cuticle) is produced from the subjacent layer by a process of secretion or exudation.

This theory of the growth of the cell by a simple act of deposition or exudation, after having prevailed during the last generation, must certainly be exploded; for it is contradicted by the progress of physiology. For though I was not able to disprove it by the facts presented in my dissertation (De Cella Vitali, 1843) and in other works, yet my repeatedly adduced demonstrations respecting the origin of resin and of the wax-like cuticular lamina of plants must convince every thinking person that organization is not a mechanical but a dynamical or vital act. (See 'Botanische Zeitung,' 1857, p. 313, and Poggendorff's 'Annalen,' 1860, p. 640.)

That the "dot-cells" which lie on the inner wall of the extine, and at a later period effect its perforation, may produce a secondary generation of cells, has just been remarked; and the same phenomenon is also sometimes observed in the case of the porous ligneous cells of the Coniferæ. This circumstance is very clearly illustrated by me, in the fourth plate of the 'Flora Columbiæ,' in the figure of the pollen of a *Bignonia*, the membrane of which is occupied by a large number of small, not quite flat, oval cells, not in contact with each other. Further, each of these contains a third generation of smaller cells, about sixteen in number, and together form an envelope around the smooth enclosed intine. After being macerated for a time in dilute sulphuric acid, the cells of the second generation detach themselves from their parent-cell, to the inner surface of which they were affixed, and are seen floating freely about under the object-glass. The membranes of these different generations of cells are in this case not thickened: were they so, we should have such forms produced as are met with in Synanthereæ, Nyctagineæ, Convolvulaceæ, &c., except that, in these, the cells of the second and subsequent generations become frequently converted into setæ, which project from the whole external surface of the extine, and are therein analogous to what is so clearly demonstrable in the hairs of the epidermis. Moreover, the structure of the spores of Cryptogamia, so thoroughly investigated by Mohl, teaches us very distinctly the signification of the reticulated surface of these bodies, so nearly allied to pollen-grains, in all that relates to their mode of development. This assertion is especially corroborated in the case of the spores of Acrostichaceæ, Aspleniaceæ, and Aspidiaceæ, some of which I figured in my 'Flora Columbiæ' (I beg to refer particularly to plates 52 and 57). The endogenous cells, which here clothe the extine as a completely closed membranous layer, are in these spores, as also in almost all others, not entirely flattened, but resemble the "dot-cells" (the intermediate corpuscles of Fritsche), and are, in the groups named, polyhedral, and in many others globular in form. When they contain no younger generation of cells, it is so much the more a problem whether they belong to the series of "dot-cells" or of "pore-vesicles;" but this is a matter of no consequence for the understanding of their anatomical structure. Those spores enveloped by cells are particularly interesting on account of the subsequent development of a sort of setæ, which, as their age increases, cover their surface, and entirely differ from those which derive their origin from a peripheral elongation of the porous vesicles. Further development takes place only in those walls of the cells forming the outer surface of the spores which lie next the intine and are in contact with each other (being in this respect somewhat similar to the cells of the sporangial ring and to the parenchyma-cells enveloping the vascular bundle of the Fern),—mostly, indeed, only where the three cells touch; for they are not completely in apposition. The extine itself and the superposed peripheral wall of endogenous cells are not thickened, but on the contrary are destroyed, in the older spores, so that only the thickened angles and walls are left behind, setiform and spike-like.

Similar structures are also found among the pollen of Phanerogamia, *i. e.* in *Cobæa scandens,* as Mohl has tolerably well pointed out. On the contrary, Fritsche and Schacht question whether the cellular reticulated envelope of the exterior of these pollen-grains is composed of actual cells; for, according to their views respecting the growth of the cell-wall, this external wall originates from the exudation and deposit of matters which, from some inconceivable reason, take on this wonderful reticulation. The study of the progressive development of these pollen-grains at once overturns this fantastic idea, and renders it easy to understand that the cells which are formed between the extine and intine, and construct a complete layer between the two, become lignified in the same manner as has been described in the spores of the Polypodiaceæ; only that, in addition, those cells in mutual contact become thickened and porous, and combine to form a series of radiating pores.

This cellular external tunic of Fern-spores often breaks up into its three component portions, which are divided from each other by stronger, thicker walls; and from all this we gather that the cellular envelope of the smooth intine of the Ferns is composed of three cells coating the very delicate, transient extine of the spores: these cells entirely occupy the intermediate space between the two membranes, and each of them contains numerous endogenous cells.

This fact of the breaking up of the integument of the Fern-spores into three segments recalls our attention to similarly constructed pollen-grains, namely, to those in which the openings in the extine are furnished with opercula, which are either simple or cellular, smooth or setaceous.

Three cell-like opercula, which occupy the whole circumference of the pollen, are found in many Passifloreæ; smaller ones, in greater number, beset with setæ, belong to many other species of this family, as well as to many Cucurbitaceæ, &c. In the Cucurbitaceæ, the opercula, besides being covered with setaceous enlarged secretory cells belonging to the extine, are in their formation evidently dependent on the "dot-cell" (intermediate corpuscle) adjoining each operculum; and in the Passifloreæ it is most probable that the very large "intermediate corpuscle" actually constitutes the operculum.

In the 51st plate of my 'Flora Columbiæ,' I figured the pollen of *Passiflora servitensis,* with its three very large opercula, attached to the stigma in the act of protruding the intine. This pollen shows that the different layers which Fritsche first observed on the intine are not always laminæ of one and the same cell-membrane, and that the actual intine is not always a cell of the second generation, but may, in fact, be one of the third.

Betwixt the two laminæ which hitherto have been together regarded as the intine, a small "dot-cell" is observed, as in the pollen of many Monocotylæ, whilst three such are met with in the pollen of *Cœlebogyne* and of most Dicotylæ. Two sorts of cells are thus formed in the extine, from one of which the fovilla is separated, whilst the other appears intended to facilitate the expulsion of the sister-cell from the mother-cell. From the researches of Meyen and Schacht it also seems evident that the pollen of Coniferæ belongs to this category.

It remains for future investigators to consider this relation of the parts of pollen, and to decide, with regard to the different forms of pollen, whether the opercula are immediately derived from the "dot-cells," or from a portion of the extine as a consequence of the contact of this with the "dot-cells." Both forms are met with. That the "porous vesicles," which are frequently charged with secretions, as well as the "dot-cells" may be transformed directly into opercula, is not improbable; nevertheless opercula do also originate independently of these cell-structures in the extine, the position and size of which are determined by the contiguous "dot-cells," as for example in the Cucurbitaceæ, where the "dot-cell" (the "intermediate corpuscle" of Fritsche) does not appertain to the intine as a thickened lamina, as Schacht implies, but from the first lies free between the two coats of the pollen, and at a later period becomes strongly attached to the extine. Consequently it clings to the extine when this is torn from the intine and gets so inverted that its setaceous outer surface is turned inwards.

The pollen-cells of *Thunbergia*, with their thickened extine disposed in spiral lines, remind us at once of the spiral-fibres of the vessels of Cryptogamia, and represent a modification of the spores of Equisetæ; whilst the pollen of *Ipomœa*, with its setaceous integument, may be considered like ligneous *Vaucheria* zoospores, as is proved by my history of the development of the latter (Botan. Zeitung, 1852, p. 95, pl. 2. fig. 12 *a*).

Each cilium of the vibratile epithelium of the zoospores of *Vaucheria*, and likewise the cilia of the cells of antherozoids and spiral fibres, are vesicles, which in the course of development assume a hair-like form, and it is most probable move the body to which they are attached, both by the agency of a great faculty of imbibition in their unequally thickened walls, and by great efforts in the diffusion of their contents with water—actions which proceed for some time with oscillating movements before an equilibrium is attained.

It can only be want of knowledge of the developmental history of these cells that can suggest the opinion that cilia are direct outgrowths of the primordial vesicle.

[To be continued.]

X.—*On Additions to the Madeiran Coleoptera.*

By T. Vernon Wollaston, M.A., F.L.S.

Fam. **Dytiscidæ.**

Genus Eunectes.

Erichson, Gen. Dytic. 23 (1832).

Eunectes subcoriaceus, n. sp.

E. oblongo-ovatus, subdiaphano-coriaceus, pallide diluto-testaceus, clypeo antice leviter emarginato; capite postice nigro et macula frontali magna distincta antice profunde bipartita ornato; prothorace vitta transversa parva fracta nebuloso, ad latera oblique subrecto, angulis posticis acutiusculis, subæquali, margine postico infra angulos leviter elevato; scutello subsemicirculari; elytris punctis magnis triplici serie et punctulis minoribus parvis (anterius minutis levioribus et magis remotis) nigris notatis, utroque macula (rarius duabus) parva sublaterali nigro-ornato; antennis pedibusque pallido-testaceis.

Fœm. elytro singulo fovea longitudinali sublaterali media breviuscula sat profunda impresso.

Long. corp. lin. 7.

Habitat Maderam australem: in cisterna quadam supra urbem Funchalensem tria specimina nuper deprehensit Dom. Bewicke.

The present *Eunectes* is closely related to a species* which I have taken in the south of Grand Canary; and *both* of them differ from all the varieties of the widely-distributed *E. sticticus* with which I am acquainted, in being larger and more oblong, in having their pale portions of a more pallid-testaceous hue, their surface more coriaceous and subdiaphanous, their elytral fasciæ (apparently) obsolete, and their prothorax straighter at the sides, as well as (in the female sex) a little more uneven, subsinuated at its base, and with its extreme posterior margin, within the hinder angles, more evidently raised. From its Canarian ally, the *E. subcoriaceus* may be known by, *inter alia*, its clypeus being more emarginated anteriorly, by the prothorax of the female being less uneven, with the hinder angles less produced, and the posterior margin (within the latter) less evidently raised, in its scutellum being perhaps rather more obtusely rounded behind, and in its elytral punctures being smaller and less dense —those on the anterior portion being especially *much* more minute and remote. The submarginal impression, also, on the elytra of its females is somewhat less deep and more abbreviated.

It was discovered by Mr. Bewicke, in his garden, above Funchal, where he captured three specimens, concerning which I have lately received from him the following note:—"They were taken in a deep tank; and, from their habit of clinging to the perpendicular walls of it, about two feet under water, they

* I subjoin the following comparative diagnosis of this Canarian species, which will sufficiently point out its distinctions from the Madeiran one. It may be characterized thus:—

Eunectes subdiaphanus, n. sp.

E. suboblongus, subdiaphano-coriaceus, pallide diluto-testaceus, clypeo antice subintegro; capite postice nigro et macula frontali magna antice profunde bipartita ornato; prothorace vitta transversa fracta nebuloso, ad latera oblique recto, angulis posticis obtusiusculis, subinæquali, margine postico infra angulos distincte elevato; scutello subtriangulari; elytris punctis magnis triplici serie et punctulis minoribus nigris notatis, utroque maculis duabus minutis sublateralibus nigro-ornato; antennis pedibusque pallido-testaceis.

Fœm. elytro singulo fovea longitudinali sublaterali media longiuscula valde profunda impresso.

Long. corp. lin. 7–7½.

Habitat Canariam Grandem australem, in aquis quietis ad El Charco mense Aprili A.D. 1858 a meipso repertus.

were difficult to secure. Now, in the event of their being some European species, I wish to remark that no water-plants, or anything likely to convey them, have been imported into Palmeira, so that in all probability they are distributed over a considerable area; and, further, that their habits, as far as observed, will account for their having been hitherto overlooked. The first one I took by chance; the others cost me many hours of search. They all occurred in the same tank; but had I not taken precautions to secure a moderate transparency in the water, I think I should hardly have found the last two."

Fam. **Ptiliadæ.**

Genus PTINELLA.

Motschulsky, Bull. Mosc. ii. (1845).

The little genus *Ptinella*, the external characters of which were enunciated by the Rev. A. Matthews in the 'Zoologist' for 1858, and the structural ones in the same Journal for 1860, may at once be known from the other groups of the *Ptiliadæ* by its posteriorly contracted prothorax (the hinder angles of which are not backwardly produced), its exceedingly short elytra, and by its very long, exposed, and somewhat robust abdomen. The species hitherto known are of a pallid hue; and in many of them the eyes have been supposed to be obsolete, but the more recent observations of Mr. Matthews have proved that this is not in reality the case. "It always appeared to me somewhat incomprehensible," says he, "how an animal unendued with sight could not only move with such surprising rapidity in any proposed direction, but also avoid the obstacles it met with in its path, as I have often seen these insects do. But the mystery is now solved; the many species comprised in the blind section of this genus (the "sans yeux" of the 'Faune Française') in reality possess as perfect visual organs as fall to the lot of any existing beetle; the only peculiarity of these organs being the fact that they are concolorous with the other parts of the head, and situated mainly on its lower surface, a small portion only being visible from above."

Ptinella aptera, Guér.

P. oblonga, testacea, subnitida et parce pubescens; oculis paulo prominentibus nigris; capite semicirculari; prothorace ad latera rotundato, basi leviter angustiore; elytris valde abbreviatis, apice singulatim sat rotundatis, versus humeros gradatim angustioribus; antennis pedibusque pallido-testaceis.

Long. corp. lin. vix $\frac{1}{2}$.

Habitat Maderam: sub cortice prope urbem Funchalensem mense Decembri A.D. 1860 detexit Dom. Bewicke.

Ptilium apterum, Guérin, Rev. Zool. 90 (1839).

Trichopteryx aptera, Gillm., St. Deutsch. Fna, xvii. 63. pl. 324. f. 4 (1845).
Ptilium apterum, L. Fairm., Faun. Franç. 339 (1854).

P. oblong, narrow, testaceous, very slightly shining, and sparingly clothed with rather coarse decumbent pile. *Eyes* blackish, and a little prominent. *Head* and *prothorax* delicately alutaceous; the *former* nearly semicircular; the *latter* a good deal rounded at the sides, but narrower behind than in front, and with the *extreme* hinder angles very minutely prominent, free from foveæ. *Elytra* very short, finely punctured, rather rounded at the sides, and gradually narrower towards the shoulders; each of them separately rounded-off behind. *Abdomen* largely uncovered, and apparently free from additional erect hairs. *Antennæ* and *legs* very pale.

For this important addition to the Madeiran Coleoptera we are indebted to the researches of Mr. Bewicke, who, during December 1860, detected several specimens of it "in a blue mould, under bark," near Funchal. The Rev. A. Matthews informs me that he believes it to be strictly identical with the *P. aptera* of more northern latitudes, the only appreciable difference being that in the examples from Madeira the eyes are blackish (instead of concolorous with the rest of the surface), and therefore more conspicuous than is usually the case. But as he likewise assures me that he has lately captured, even in England, specimens of the *aptera* in which the eyes are also dark, I conclude, with him, that this character is probably a variable one, and perhaps in some measure dependent on the greater or less intensity of the light under which the species may happen to have been bred.

Fam. **Lathridiadæ.**

Genus Monotoma.

Herbst, Natursyst. v. (1793).

Monotoma longicollis, Gyll.

M. angusta, picea, subnitida; oculis fere ad basin capitis sitis; capite prothoraceque leviter punctulatis, hoc ad latera subrecto, angulis anticis in spinam brevem obtusam productis, postice leviter bifoveolato; elytris leviter seriatim punctatis; antennis pedibusque rufo-testaceis.

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

Habitat Maderam, a Dom. Bewicke ad S. Antonio da Serra, æstate 1859, reperta.

Monotoma longicollis, Schönherr, in litt.
Cerylon longicolle, Gyll., Ins. Suec. iv. 635 (1827).
Monotoma longicollis, Aubé, Ann. de la Soc. Ent. de France, vi. 467. pl. 17. f. 8 (1837).
—— ——, Redt., Fna Austr. 203 (1849).

M. smaller, narrower, and less setose than any of the Madeiran

Monotomas hitherto detected, and rather more parallel in outline; piceous, and slightly shining. *Head* and *prothorax* lightly punctured, the punctures being small and with a tendency to be disposed in clusters (of twos and threes): the *former* with the *eyes* situated near the base, and with the hinder rim narrow and prominent; the *latter* with the sides a good deal straightened, and with the anterior angles produced into a very short but thickened and obtuse spine, and with the two basal foveæ rather distinct. *Elytra* hardly (if at all) diluted in colouring at the base, and finely seriate-punctate. *Limbs* rufo-testaceous.

Two specimens of the European *M. longicollis* were captured at S. Antonio da Serra (in Madeira proper) by Mr. Bewicke, during the summer of 1859. This gives us no less than five Monotomas for the island-fauna, viz. the *spinicollis*, Aubé, *congener*, Woll., *quadricollis*, Aubé, 4-*foveolata*, Aubé, and *longicollis*, Gyll.; and I may here mention that M. Aubé, to whom I lately transmitted an example of my *M. congener* for inspection, was scarcely able to detect sufficient differences in it to warrant its separation (in his opinion) from the common *M. picipes*, to which it certainly approaches very closely. It is possible, therefore, that it may be but a phasis of that insect, in which case the whole five species will be ordinary European ones. Nevertheless, having no longer in my possession the original types of the *M. congener*, from which I drew up my diagnosis, in 1857, I cannot now re-examine them, and so will not at present venture to amalgamate them with their more northern ally.

Fam. Corylophidæ.

Genus Microstagetus, nov. gen.

Corpus minutissimum, breviter ovali-obovatum antice obtusum, sericeo-pubescens, convexum: *capite* sub prothorace abscondito: *prothorace* subsemicirculari, angulis posticis acutiusculis sed vix productis: *scutello* sat magno, semicirculari-triangulari: *elytris* apice truncatis, pygidium vix tegentibus: *alis* amplissimis, longe ciliatis et punctulis dense irroratis. *Antennæ* distincte 11-articulatæ, graciles, clavatæ, articulis 1^{mo} et 2^{do} magnis robustis (illo longiore, hoc subrotundato-clavato), sex sequentibus (i. e. ad clavam) minutis sed inter se diversis, 3^{tio} intus versus basin oblique excavato, 4^{to} brevissimo (tertio quintoque paulo angustiore), 5^{to} quarto majore latiore intus obtuso rotundato, 6^{to} minutissimo angusto, 7^{mo} multo majore crassiore transverso-subquadrato latiusculo, 8^{vo} hoc multo angustiore minuto, 9^{no}, 10^{mo} et 11^{mo} maximis clavam magnam laxam triarticulatam efficientibus (9^{no} et 10^{mo} subpoculiformibus, 11^{mo} paulo angustiore ovali). *Pedes* ut in *Sericodero*, graciles, *postici* valde distantes: *tibiis* subrectis, apicem versus vix latioribus, ad apicem internum minutissime calcaratis: *tarsis* (nisi fallor) 4-articulatis, articulo 2^{do} subtus producto, 3^{tio} minuto, ultimo elongato clavato *unguiculis* simplicibus munito.

Obs. Genus corpore minutissimo pallido sericeo, prothorace antice semicirculari (caput totum tegente) alisque amplissimis ciliatis *Sericodero* affinitate proximum et prima facie illum simulans, sed species est minor, antice minus dilatata obtusa, prothoracis angulis posticis multo minus acutis (vix productis) et præcipue antennis 11- (nec 10-) articulatis, articulis inter se diversis. Cum *Moronillo*, Jacq. Duv., antennis 11-articulatis congruit, sed articuli sunt valde dissimiles, corpus minus est necnon pubescens pallidum alatum (haud glabrum apterum) et caput sub pronoto omnino absconditur. Ab *Orthopero* (cui aliquo modo approximat) antennarum 11- (nec 9-) articulatarum structura necnon capite toto sub prothorace recondito, præter cætera, differt.

A *μικρὸς*, parvus, et *σταγετὸς*, gutta.

The diminutive insect for which the present genus is established would appear, at first sight, to partake almost equally of *Sericoderus* and *Orthoperus*,—agreeing with the former in its pallid sericeous surface and anteriorly-semicircular prothorax (which entirely covers the head), and with the latter in its very minute, suboval body, and in its posterior prothoracic angles being almost unproduced. Nevertheless it is at once separated from them both by the structure of its antennæ, which are not only 11-articulate (instead of 10- and 9- respectively), but have the proportions of their intermediate joints also quite different. In minor details, *Microstagetus* recedes from *Sericoderus* in its smaller size, more oval (or less obovate) outline, and in its prothorax being less widened and with its hinder angles almost unproduced; whilst from *Orthoperus* its totally concealed head will, apart from the characters of its antennæ, immediately remove it. In the *number* of its antennal joints it is (judging from M. Jacquelin-Duval's description and figure) coincident with *Moronillus*, but in the shape and relative proportions of those joints it is perfectly distinct; whilst in its still smaller size, pallid hue, largely-developed wings, and pubescent surface it still further recedes from that genus, which (like the Madeiran *Glæosoma**) is stated to be both glabrous and apterous.

* Until it be demonstrated either that I was wrong in considering the antennæ of *Glœosoma* to be 10-articulate, or that M. Jacquelin-Duval was mistaken in regarding those of *Moronillus* as composed of 11 joints, it is difficult to conceive on what principle the latter has cited (*vide* 'Genera des Coléoptères d'Europe, ii. 234) my Madeiran genus as a synonym of his *Moronillus*, from the south of France; for not only have I *described* the antennæ of *Glœosoma* as merely 10-articulate, but have even given a *figure* of them; so that (if he had doubted my statement) he might surely have counted for himself! I admit that the two insects are very much alike in external *facies* and sculpture; nevertheless, on comparing lately a specimen of his *M. ruficollis*, in the collection of the British Museum, with the

The intermediate antennal joints, indeed (*i. e.* those between the second and the club), of this insect are very peculiar, and quite unlike (in their proportions) those of any other genus of the *Corylophidæ* with which I am acquainted. In fact, although the whole of them are in reality minute, they may be described as *alternately large and small.* The 1st, 3rd, and 5th, however (which belong to the larger set), gradually increase in size,—the 1st being obliquely scooped out towards its base internally, the third thick and blunt on its *inner* side, but narrower externally, and the 5th altogether much larger and thicker, being somewhat squarish-transverse, and very obtuse internally. The 2nd, 4th, and 6th (which constitute the smaller series) are, on the other hand, very diminutive, and also considerably narrower than the above-mentioned alternate three; nevertheless even *they* increase a little in dimensions, since the 2nd is so thin (or short) as to be scarcely traceable, whilst the 4th is more evident, and the 6th (although extremely minute) *comparatively* large. In the two greatly enlarged basal articulations, and the three which form the club, *Microstagetus* is coincident with the other known members of the *Corylophidæ.*

Up to the present date, therefore, we have eight genera which have already been made known in this small but interesting family, namely, *Sacium* (= *Clypeaster,* olim), *Moronillus,* and *Microstagetus,* in which the antennæ are composed of *eleven* joints; *Arthrolips, Sericoderus,* and *Glæosoma,* in which the number of these articulations is reduced to *ten*; and *Corylophus* and *Orthoperus,* in which it is only *nine.*

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unique example of my *G. velox,* they certainly did not appear to me to be absolutely identical; so that the recorded dissimilarity in the structure of their respective antennæ (not merely of the actual *number* of the joints, *but also of the relative proportions of the latter inter se*) should at least cause us to hesitate before concluding that the Madeiran and French insects are positively coincident. Yet, in spite of these important discrepancies (discrepancies at any rate *as yet on record,* whether in reality true or false), M. Duval, *without even alluding to them,* identifies *Glæosoma* with *Moronillus,* and refers to my details of the oral organs of the former in order to fill up his diagnosis of the latter. And, moreover, even assuming these two genera *to be* identical, it is at least a question whether M. Duval's name or mine has the priority, since they were both published in the same year,—mine, too, *accompanied by a figure* (both of the insect and dissections), and his without it. I may just add that, in my paper on "Madeiran Additions," given in the 'Annals of Natural History' for last year, I acted (without going further into the question) on the hypothesis that M. Duval was of course correct in his conclusion about *Glæosoma,* and consequently made, amongst others, the following observation: "for *Glæosoma velox,* Woll., read *Moronillus ruficollis,* Jacq.-Duval." But, after what has been said above, I need scarcely add that I must retract this remark *in toto,*—at least until further evidence shall settle the question, first as to coincidence of the two genera, and secondly as to their relative priority.

Microstagetus parvulus, n. sp.

M. ovali-obovatus, rufo-testaceus, sericeo-pubescens; prothorace nitidissimo, impunctato; elytris nitidis, vix obscurioribus et (oculo valde armato) minutissime et levissime punctulatis; antennis pedibusque vix pallidioribus.

Long. corp. lin. vix $\frac{1}{2}$.

Habitat Maderam, hinc inde sub quisquiliis degens.

M. like the *Sericoderus lateralis*, but shorter, smaller, and less widened anteriorly; rufo-testaceous (the elytra a trifle obscurer than the prothorax), and more or less clothed with a decumbent silken pubescence. *Prothorax* highly polished and quite impunctate. *Elytra* not quite so shining, and (under a very high magnifying power) beset with most minute and lightly impressed punctules, which, however, are less distinct than those on the *S. lateralis*, and with the single stria which exists alongside the suture less impressed than is the case in that insect. *Limbs* a little paler than the rest of the surface.

Twelve specimens only of this insignificant little insect have as yet come under my observation,—three of which were taken by myself (beneath vegetable refuse) near Funchal, and the rest by Mr. Bewicke at S. Antonio da Serra and the Praia Formosa.

Fam. Meloidæ.

Genus Zonitis.

Fabricius, Syst. Ent. 126 (1775).

Zonitis imperialis, n. sp.

Z. cylindrica, nigra, dense pubescens; capite prothoraceque profunde punctatis; scutello magno; elytris pallido-rufis, utroque maculis duabus (antica minore et interdum obsoleta) nigrescentibus ornato; antennis pedibusque longissimis robustis, unguiculis tibiarumque calcariis piceo-ferrugineis.

Long. corp. lin. 5–7.

Habitat Maderam et Portum Sanctum, inter flores in apricis inferioribus hinc inde sat vulgaris.

Zonitis 4-punctata, Woll. [nec Fab. 1792], Ins. Mad. 530 (1854).
—— ——, id., Cat. Mad. Col. 163 (1857).

Z. large and cylindrical, and densely clothed with pubescence, which is black, robust, and suberect on the black portions, and pale, silken, and decumbent on the elytra. *Beneath* black. *Head* and *prothorax* black, deeply and closely punctured: the *former* rather large and wide posteriorly, and flattened between the eyes; the *latter* somewhat uneven, and with the hinder disk convex, where, moreover, it has an abbreviated central channel. *Scutellum* large and black. *Elytra* pale rufous, and each of them ornamented with two blackish spots on its disk, the anterior of which is the smallest, and occasionally obsolete. *Antennæ* and *legs* very long, robust, and deep black, except the *tibial spurs* and *tarsal claws,* which are piceo-ferruginous.

Var. β. Elytra entirely immaculate, and usually of a slightly paler hue.

I have hitherto regarded this insect as identical with the *Zonitis 4-punctata* of the south of Europe; but a more accurate comparison of it lately with specimens from Lombardy has convinced me that it cannot be referred to that species (however much it may resemble it at first sight), presenting a combination of small structural characters essentially its own; and I have therefore given a fresh description of it, in which its peculiarities are more fully portrayed. It differs from the *Z. 4-punctata* in being a little larger, and in having its head proportionally a trifle broader and its scutellum somewhat longer, in the pubescence of its dark portions being rather more elongate and dark, and in its limbs being robuster, less abbreviated (which is particularly evident in the antennæ and tarsi), and of a much deeper black,—the last antennal joint, moreover, being cylindric, instead of gradually tapering as in that insect. Its elytra also are a shade darker and perhaps a trifle less pubescent, and their *extreme apex* (instead of being black) is concolorous with the rest of the surface.

Fam. Staphylinidæ.

Genus Leptacinus.

Erichson, Käf. der Mark Brand. i. 429 (1837).

Leptacinus parumpunctatus, Gyll.

L. niger, nitidus; capite utrinque parce sed valde profunde punctato, ad basin recte truncato; prothorace postice gradatim angustato, seriebus dorsalibus 5- (vel 6-) punctatis; elytris versus latera seriatim punctatis, angulo apicali externo testaceo; antennis fusco-piceis; pedibus piceo-testaceis.

Long. corp. lin. 2½.

Habitat Maderam, ad Palheiro prope Funchal a Dom. Bewicke detectus.

Staphylinus parumpunctatus, Gyll., Ins. Suec. iv. 481 (1827).
Gyrohypnus parumpunctatus, Mann., Brachel. 33 (1831).
Leptacinus parumpunctatus, Erich., Gen. et Spec. Staph. 353 (1838).

L. black and shining. *Head* and *prothorax* highly polished: the *former* straightly truncated behind, very deeply but sparingly punctured at the sides, and with the frontal sulci exceedingly deep and distinct; the *latter* gradually narrowed behind, with a longitudinal row of five (occasionally six) large punctures on either side of its disk, and with about five more arranged in a curve towards either edge. *Elytra* generally a little diluted in colouring posteriorly, but always with the outer apical angle testaceous, very sparingly seriate-punctate (more evidently so towards either side). *Antennæ* brownish piceous, but a little brighter at their base. *Legs* piceo-testaceous.

A single specimen of the common European *L. parumpunctatus* has lately been forwarded to me by Mr. Bewicke, by whom it was captured, amongst hay-stack refuse, at the Palheiro (in Madeira proper), during November 1860. Though probably an introduced insect from more northern latitudes, this is the second species of *Leptacinus* which the researches of Mr. Bewicke have added to the fauna,—the *L. linearis*, Grav., having been recorded by me last year, on the authority of five examples which he detected (under similar circumstances) at S. Antonio da Serra. I may add that I have also taken it in Lanzarote, Fuerteventura, Grand Canary, Teneriffe, and Palma, of the Canary Islands.

At the close of my last year's Papers (published in the 'Annals of Natural History') on "Additions to the Madeiran Coleoptera," I stated that the species which had been detected in those islands up to that date amounted to 642. Since, however, through not having the original type any longer in my possession, I had inadvertently re-described an insect (the *Rhyncolus capitulum*) which had been already characterized by me during the preceding year, the number should properly have been 641; so that, when the five * species here enumerated are taken into account, we shall have 646 as the total number which has hitherto been ascertained to occur at the Madeiras. I have still two or three doubtful forms which, from being represented by single specimens, I cannot safely pronounce upon until further material has been obtained ; nevertheless, from the slowness with which additions to the fauna are now brought to light—and that, too, despite the careful researches of Mr. Bewicke, Senhor Moniz, the Barão do Castello de Paiva, and Mr. E. Leacock (particularly, however, of Mr. Bewicke, to whose indefatigable labours the present novelties are due)—we may fairly conclude that we are fast approaching the maximum to which our list can be expected, *as limited by the existing fauna*, to reach. Fresh importations will almost certainly from time to time take place; for since it is an undoubted fact that minute Coleoptera are frequently naturalized in the island (which indeed *must* be the case so long as the gardens of the English residents are liable to be replenished, year after year, with various plants, whether for use or ornament, from more northern latitudes), it is evident

* I say "five," and not six, because the *Zonitis imperialis* is merely an old species under a new name.

that we may look hereafter for occasional additions from the ranks of the ordinary European Coleoptera (such as the smaller *Staphylinidæ,* and other more or less mundane forms) of easy diffusion. But, be this as it may, there seems good reason to believe that no considerable number of *truly indigenous* species can have now escaped our combined observations; and that consequently, if we choose (allowing a small margin for future introductions) to estimate the Madeiran Coleoptera at, *ore rotundo,* somewhere between 650 and 700 species, we shall probably advance a tolerably correct opinion as to the actual extent of that department of the fauna.

Before concluding this short paper, I may just call attention to the few following facts:—

1. My friend Dr. Schaum, of Berlin, thinks that the common Madeiran *Parnus* may *possibly* be distinct from the universal *P. prolifericornis,* as being "a trifle smaller and shorter, with its pubescence a little more brown, and its elytra more sparingly and coarsely punctured;" but, after comparing it very carefully with British specimens of that species, I must confess that I cannot detect any appreciable difference between the two, unless it be that the Madeiran one is perhaps, *on the average,* not quite so large.

2. *Acratrichis pumila* (Ins. Mad. 109).—The Rev. A. Matthews informs me that this insect cannot properly be referred to the *T. pumila* of Erichson, but that it is more akin to the European *T. brevipennis,* from which it nevertheless differs in being rather larger, more shining, and more coarsely punctured. In the dilated joints of its anterior tarsi it approaches both of those species; but, apart from other characters, the shape of the joints is, according to Mr. Matthews, quite different. I would propose for it, therefore (having already *described* it), the specific name of *insularis.*

3. *Microchondrus* (i. e. *Symbiotes*) *domuum* (Ins. Mad. 197).—This is clearly identical, as Mr. Janson has pointed out to me, with the *Symbiotes pygmæus,* Hampe.

4. The six *Ptini* (Nos. 200–206) which I indicated in the 'Ins. Mad.,' in 1854, under the subgeneric title of *Sphæricus,* and subsequently (in 1857), in my 'British Museum Catalogue,' under that of *Trigonogenius,* Solier (as being the older name), must be regarded as generically distinct from the *Ptini proper,* and be quoted as *Sphærici,* since M. Jacq.-Duval has lately informed us (*vide* 'Genera des Col. d'Europe,' iii. p. 211) that he has examined the true *Trigonogenii,* from Chili, and finds them structurally different from the Madeiran and Mediterranean insects. M. Duval, indeed, proposed last year (Glanures Ent. 137)

for these aberrant *Ptini* the title of *Tipnus* (even with the actual knowledge, moreover, that I had both previously separated them under that of *Sphæricus*, and *had given careful figures of no less than three* !); but, in spite of this, it is of course evident that *Sphæricus* has the priority, and must therefore be retained.

5. *Tomicus Dohrnii* (Ins. Mad. 290).—It seems likely, according to information which I have received from Mr. Janson (though I have not yet myself had an opportunity of comparing the two species), that this insect will prove to be identical with the *Bostrichus Saxesenii* of Ratzeburg.

6. *Phlœophthorus perfoliatus* (Ins. Mad. 301).—It is pretty nearly certain that this insect is coincident with the *Ptinus rhododactylus* of Marsham (Ent. Brit. 87, 1802); but the *genus* must certainly be retained; so that the species should be quoted as the *Phlœophthorus rhododactylus*, Marsham. In further confirmation of its being identical with the European insect, I may state that several specimens of it were taken by Mr. Bewicke, at S. Antonio da Serra, during the summer of 1859, out of decayed stems of the common Broom, under which circumstances it very frequently occurs in more northern latitudes.

7. *Rhyncolus capitulum* (Ann. Nat. Hist. 3rd ser. ii. 410, 1858). —As already stated, I inadvertently re-characterized this insect, in my last year's "Additions to the Madeiran Coleoptera," under the name of *Hexarthrum compressum*. The mistake arose, first, from the original type being no longer in my possession for comparison; and secondly, through my having failed to examine with sufficient care, whilst describing it, the structural features of the "*R. capitulum*,"—thus not perceiving at the time that it possessed but six joints to its funiculus, and that it was therefore no *Rhyncolus* at all. Hence, whilst the *genus Hexarthrum*, which I enunciated in 1860 (Ann. Nat. Hist. 3rd ser. v. 448), must be retained, the specific title of *compressum* should of course be cancelled; and the insect will stand as *Hexarthrum capitulum*.

8. *Rhyncolus tenax* and *calvus* (Ins. Mad. 307; and Ann. Nat. Hist. 3rd ser. v. 448).—In a memoir on the "Atlantic *Cossonides*," lately published in the 'Trans. of the Ent. Soc. of London' (*vide* new series, vol. v.), I stated that the two Madeiran insects which I have hitherto quoted as *Rhyncoli* will (from the shape of their rostra and the proportions of the joints of their comparatively elongate antennæ) be better referred to *Phlœophagus*; and the only doubt that now remains is, whether the *Caulophilus sculpturatus* of the 'Ins. Mad.' should not, consequently, be merged into *Rhyncolus*. As to this latter question, I will not at present, in the absence of my original type, attempt to solve it.

9. *Pentarthrum Monizianum* and *Bewickianum* (Ann. Nat. Hist. 3rd ser. v. 450, 451, 1860).—When describing these two insects last year, I stated the exact points of their structure in which they recede from *Pentarthrum proper*, as then represented by a single species (the *P. Huttoni*), discovered by my nephew eight years ago in the west of England; and I merely admitted them into that genus on account of their 5-jointed funiculus, and through a disinclination to multiply names more than was absolutely necessary amongst these small members of the ligni-vorous *Rhynchophora*. Since my diagnoses, however, were published, the detection of another *true Pentarthrum*, by Mr. Bewicke, in the Island of Ascension, has so completely confirmed my original formula of the group (*vide* Ann. Nat. Hist. 2nd ser. xiv. 129, 1854), that, as recently stated in my paper (above alluded to) on the Atlantic *Cossonides*, it can no longer be made to embrace these two (nearly blind) Madeiran Curculios; and I consequently proposed for them the generic title of *Mesoxenus*. They must therefore be quoted as the *Mesoxenus Monizianus* and *Bewickianus*. For the precise differential characters of the genus, I must refer to my last year's paper in the 'Annals of Natural History,' and to a recent memoir on the "Atlantic *Cossonides*" which has just been published in the 'Trans. of the Ent. Soc. of London.'

XI.—*Observations on the* Bignoniaceæ. By John Miers, F.R.S., F.L.S. &c.

[Continued from vol. vii. p. 396.]

In the herbarium of the British Museum I find a plant, in fruit, from the neighbourhood of Rio de Janeiro, the seeds of which differ from those last described: the specimen has no flower, so that it cannot be determined to be a species of *Adenocalymna**. The capsule is compressed, not cylindrical as in *A. scansile*, and the valves are proportionally thinner. The seeds are uniserial and much more compressed; the central disk is testudiniform, one of its sides, that of the hilum, being straight,

* I take this opportunity of confirming what I formerly stated (vol. vii. p. 266) concerning the little dependence to be placed on the calyx as a constant and unerring test for generic discrimination. Perhaps no genus in the family offers a more striking feature than *Adenocalymna*, in its peculiar calyx, which gave origin to its name; but I find in Gardner's collection a plant, allied to *Dolichandra*, with an entire, tubular, coriaceous, pulverulent calyx, marked with polished glands placed biserially below the margin, just as in *Adenocalymna*; and yet it is far removed from that genus on account of the difference of its habit, of its corolla, in the structure of its anthers, its ovary, its thick flat siliquose capsule, and its seeds.

the other rounded and emarginated, while the extremities are broadly expanded into a rather thin but opake wing, which is considerably narrower than the disk; the hilum, instead of being broad, is very narrow, linear, and marginal, corresponding with the cicatrices seen along the margins of the dissepiment. This appears to conform with the brief description by DeCandolle of his genus *Pachyptera*, no specimen of which I have seen. The internal structure of the seed is somewhat different, though approaching that I have given of *Adenocalymna* (vol. vii. pp. 156, 387): the discoid portion, although coriaceous, is not nearly so thick as in that genus; its internal space is rendered 2-celled by a very narrow septum, which extends from the hilum to the opposite emarginature of the disk; this septum is fenestrated in the middle (or, rather, interrupted) by a linear aperture for the reception of the radicle; the two cotyledons are compressed, each being divided by deep emarginatures at the apex and base extending to the radicle, which thus occupies a central position, united to the four cotyledonary lobes, the former filling the fenestrated space, the latter occupying the two cells of the disk formed by the narrow septum, as in *Adenocalymna*. The embryo is enveloped by a delicate inner integument, similar to it in form.

In one of my excursions near Tejuco, in a deep forest, I found the ground strewed with seeds of a similar shape and structure, which I still preserve: the plant from which they fell was at too great an elevation to be reached, and I could not find any remains of the capsules. These seeds evidently belong to a different species of the same genus, and are much larger, though resembling the former in every other respect, the discoid portion being 7 or 8 lines in diameter, the wing 5 lines broad, the total extent (including the wings) measuring 2 inches.

The plant in question hardly appears to be a true *Adenocalymna*, and I place it there with some hesitation. *Pachyptera*, in the absence of all knowledge of its floral structure, is still a doubtful genus; but its seminal characters seem to agree with this species. Will *Pachyptera* prove to be a subgenus or section of *Adenocalymna*? This appears probable, because the two species, *foveolata* and *umbelliformis*, which are associated with the type, *puberula*, have the many-foveolated punctures about the axils of the branches, which are almost peculiar to *Adenocalymna* and *Haplolophium*. The *P. dasyantha*, DC., which I have seen, belongs to the latter genus; while the two remaining species, *striata* and *Perrottetii*, appear foreign to the group.

Adenocalymna? *cæsium*, n. sp.;—ramulis teretibus, striatis, pallide glaucis, pilis articulatis dense velutinis, demum subglabris, ad nodos dilatatis; foliis 3-foliolatis aut conjugatis et ecirrhosis, foliolis ellipticis, imo obtusiusculis, aut subacutis, 3-nerviis, apice brevissime attenuatis, obtusis et emarginatis, coriaceis, supra pallide viridibus, opacis, costa mediana nervisque subimmersis cano-puberulis, subtus pallide glaucis, glaberrimis, nervis venisque valde reticulatis, prominentibus, nervo marginali cartilagineo, reflexo, dense poroso-punctulatis, glandulisque paucis immersis signatis; petiolo petiolulis paulo longiore cunctis apice tumidulis, teretibus, dense et sordide cano-tomentellis; racemis axillaribus fructiferis, petiolo dimidio longioribus, glauco-tomentosis; capsula compressa, siliquiformi, late lineari, glauca, subtomentosa, valvis convexiusculis subcrassis; seminibus plurimis, imbricatis, compressis, testudiniformibus, utrinque in alam opacam paulo latiorem expansis.—Prov. Rio de Janeiro, *v. s. in herb. Mus. Brit.* (Itaguahy, in sepibus, A. Cunningham).

Planta scandens, habitu *Adenocalymna comosum* aliquomodo simulans. Internodii $2\frac{1}{2}$–3 poll. dist.; petiolus crassiusculus, 9 lin. long., petioluli laterales 5 lin., terminalis 7 lin. long.; foliola 3 poll. long., $1\frac{5}{8}$ poll. lat., terminale paulo angustius et longius; foliola stipuloidea linearia, erecta, eglandulosa, 2 lin. long., 1 lin. lat.; racemi rachis crassiuscula; pedicellus valde incrassatus, 5 lin. long.; capsula $3\frac{1}{2}$–4 poll. long., 6–7 lin. lat., diam. transverso 4 lin.; valvæ convexiusculæ, lineis 3–4 abbreviatis sæpius evanescentibus, subcarinatæ tuberculisque paucis signatæ; replum compressum, utrinque liberum. Semina plurima, transversim elongata, utrinque 1-serialia, compressa, disco crasso-coriaceo, testudiniformia, 6 lin. diam., hilo lineari submarginali 6 lin. long., inclusis extremitatibus in alas opaco-membranaceas expansis 4 lin. lat., 2 poll. longa *.

Tanaecium.

This genus is remarkable for the extreme length and narrowness of the tube of its corolla, as well as for the peculiar structure of its fruit and seeds. From the evidence here adduced, it will be seen that its structure and affinities have been little understood. Dr. Seemann, in a recent monograph of the genus (Hook. Kew Journ. ix. 81), and again in his interesting Synopsis of the *Crescentiaceæ* (Linn. Trans. xxiii. 1), follows the example of DeCandolle in placing it in that order: he there adopts the mistake of preceding botanists in associating with the typical species the parasitical plant which Swartz had originally, and with much hesitation, conjoined with it; contrary, however, to the

* This plant, with the analysis of the seed, will be seen in the 'Contributions,' Plate 55.

diagnoses of DeCandolle, he has been led into the further misconception of ascribing to *Tanaecium* a unilocular ovary and fruit—a structure which I find quite foreign to it. I agree, however, with Dr. Seemann in his conclusion that the *Tanaecium parasiticum,* Sw., to which I have just alluded, is congeneric with the *Schlegelia lilacina,* Miq., a genus unquestionably belonging to *Crescentiaceæ.* Willdenow associated with *Tanaecium Jaroba,* Sw., not only *T. parasiticum,* Sw., but *Crescentia pinnata,* Jacq. As in these two plants the seeds are imbedded in pulp, it was then first incorrectly assumed that the fruit of *T. Jaroba* was also pulpy within; but Swartz, the only botanist who has described it from actual observation, nowhere hints at the existence of any pulp between the seeds, while he notices its presence distinctly in *Tanaecium* (*Schlegelia*) *parasiticum.* The fruit described by me in vol. vii. p. 167 sufficiently agrees with the well-detailed account of Swartz of his *Tanaecium Jaroba*; and there can be little doubt of its belonging to that species. It is therefore clear that the generic character given by Dr. Seemann (*loc. cit.* p. 82), excepting some misconception about the structure of the ovary, applies to *Schlegelia,* certainly not to *Tanaecium.* Endlicher, in his 'Genera Plantarum,' bases his diagnosis of *Tanaecium* (4172) entirely upon the *T. parasiticum,* Sw. (*Schlegelia*), and, in a note, points out its generic discordance with the *T. Jaroba,* Sw. (*T. albiflorum,* DC.), which he suggests may probably be a species of *Crescentia.*

I need not repeat here the description already given (vol. vii. p. 167) of the fruit of *Tanaecium albiflorum,* DC. Since that was written, I have seen the fruit of another species (*T. prælongum*), in which there is a somewhat different evolution of the placentæ, which explains the apparent anomaly of the development, so dissimilar in the former case from the usual structure of the order. These two examples are most instructive, and serve to confirm in the strongest manner the hypothesis of the normally 4-carpellary structure of the ovary. The dissepiment is here composed, as usual, of the two chartaceous lamellar plates, united together for the greater part of their breadth; but these plates divaricate when they approach the margins of the valves, and are thus respectively reflected away from each other upon them, as in *Pithecoctenium,* only for a much greater breadth, becoming agglutinated to the inner face of the valves; and the seeds are attached by their very large hilum, partly to the reflected margins and partly to the main portion of the dissepiment. In *T. albiflorum,* the attachment of the seeds is wholly upon the reflected margins of the dissepiment; and when the fruit opens, these four placentiferous portions remain confluent with the two valves, while the main body of the dissepiment breaks away from them, along the line of their inflexion, close to the sutural margins of the capsule; so that the seeds remain as if parietally attached to the valves, while the main body of the dissepiment, thus detached from its seminiferous portions, appears flat, smooth, and naked. The fruit of *T. prælongum* is of the same shape as that of *T. albiflorum*, only somewhat smaller; the ligneous valves are not quite so thick in substance, and they are covered with a closely adherent, coriaceous, rough epidermis, which can be scraped off the more ligneous shell. A similar coating exists upon the ligneous valves of *Adenocalymna, Memora*, and some other genera. In both these species of *Tanaecium* the valves split down the middle, as in *Distictis* and *Haplophium*, and a similar replum detaches itself on each side along the main sutural line of dehiscence. The hilum in *T. prælongum* is considerably curved, and broader, owing to the more thickened margin of the seed on that side, and it lies at a right angle with the axis of the fruit; in *T. albiflorum*, on the contrary, the hilum lies parallel with the axis, when the radicle is therefore centrifugal, while in *T. prælongum* it points a little outwards to the base of the fruit. There is, however, another essential difference to be noticed in these two developments: in the one, the seeds, from their mode of attachment, are pressed and twisted half round, in several series on each side beyond the dissepiment; in the other they are 2-serial, appearing almost uniserial, owing to their different direction and to the greater length and breadth of the hilum.

Tanaecium, therefore, fully corresponds with the conditions of the *Eubignonieæ*; and from the peculiar shape of its large handsome flowers, as well as of its capsule and seeds, it forms one of the most interesting genera of the family. Its place is certainly close to *Adenocalymna*. The generic diagnosis, in accordance with the facts stated, is therefore remodelled, entirely from my own observations, in the following manner:—

Tanaecium, Sw. (*in parte*).—*Calyx* tubulosus, margine integro, ciliolato, nervis extus in denticulos 5 excurrentibus. *Corolla* valde elongata, anguste tubulosa, apicem versus paulo ampliata et infundibuliformis, limbo expanso 5-fido, laciniis subæqualibus, 2 superioribus erectioribus, 3 inferioribus reflexis, æstivatione valde imbricatis. *Stamina* 4 didynama cum 5to sterili; *filamenta* filiformia, subulata, glabra, summum versus tubi inserta, inclusa; *antheræ* 2-lobæ, lobis linearibus, sagittato-distensis, aut divaricatissimis. *Ovarium* conico-oblongum, glabrum, *disco* carnoso cylindrico sulcato insidens, 2-loculare, pluri-ovulatum; *ovula* in extremis marginibus dissepimenti utrinque pluriseriata. *Stylus* filiformis, longitudine tubi corollæ. *Stigma* 2-lamellatum, lamellis oblongis, obtusis, membranaceis, glabris. *Capsula* magna, late cylindrica, botuliformis, 2-locularis, 2-valvis; *valvæ* lignosæ, medio longitudinaliter fissiles; *dissepimentum* (e lamellis 2 confluentibus) chartaceum, valvis parallelum, aut marginibus placentiferis ad parietem internum valvarum utrinque inflexis, ibi primum agglutinatis et demum solubilibus, vel marginibus seminigeris ad parietem valvarum permanenter conglutinatis et rima utrinque a dissepimento erumpentibus. *Semina* tunc e diversa evolutione placentarum, in uno casu ad dissepimentum, in altero ad valvarum margines affixa, utrinque 2–3-serialia, imbricata, magna, irregulariter sinuato-rotundata valde compressa, subplana, vel convexa, hinc ad latus hiliferum incrassata illinc gradatim tenuiora; *hilum* aut lineare et rectum, aut oblongum valde convexum et curvatum; *testa* dura, coriacea, brunnea, intus ab hilo usque ad centrum semisepto angusto donata, hinc 2-marsupiata; *integumentum internum* embryonem arcte vestiens, tenuissimum, pellucidum, in sinu superiori *chalaza* parva donatum; *embryo* exalbuminosus, 2-cotyledoneus, *cotyledonibus* orbicularibus, utrinque fere ad centrum 2-fissis, hinc fere 2-lobis, lobis plano-convexis, per paria adpressis, et imo in locellis testæ nidulatis, *radicula* centrali, brevissima, minuscula, horizontaliter centrifuga.

Frutices *scandentes, Antillani, Guianenses et Brasilienses, glabri:* folia *trifoliolata, vel cirrhoso-conjugata;* foliola *oblonga, petiolulata, integerrima*: paniculæ *terminales, pauciforæ:* corolla *alba.*

1. *Tanaecium albiflorum,* DC. Prodr. ix. 245; Seem. Kew Journ. ix. 83; Linn. Trans. xxiii. 15;—Tanaecium Jaroba, *Sw. Fl. Ind. Occid.* ii. 1050. tab. 20. f. 1;—Cucurbitifera, *Sloane, Jam.* ii. 175; *Browne, Jam.* 267;—glabrum, foliis 3-foliolatis, vel cirrhoso-conjugatis, foliolis late ovatis, breviter et abrupte apiculatis, imo rotundatis, supra nitidis, utrinque concoloribus, basi 3-nerviis, subtus nervis rufulis venisque transversis reticulatis prominentibus, petiolo longiusculo, petiolulis subbrevibus, striatis; paniculis terminalibus, trichotomis, paucifloris; calyce tubuloso, denticulis 5 e nervis excurrentibus; corolla alba, extus (in sicco) ochraceo-pruinosa, intus glabra; capsula magna, late cylindrica, botuliformi, seminibus crasso-coriaceis, exalatis, compressis.—Jamaica, *v. s. in herb. Mus. Brit.* (Robins).

Alte scandens; ramuli teretes, ad nodos compressi, striatuli, lenticellis parvis albidis crebris rugulosi; internodia 5 poll. dist.; foliola $3\frac{1}{2}$–$4\frac{1}{2}$ poll. long. (acumine 6 lin. long.), $2\frac{1}{4}$–$2\frac{3}{4}$ poll. lat. (sec. Swartz. inferiora 6 poll. long.); petiolus $1\frac{3}{4}$ poll. long., petiolulique striati supra canaliculati glabri, laterales impares æquales, 5 lin. long.; cirrhus simplex 3 poll. long.; panicula glabra (floribus exclusis) $2\frac{1}{2}$ poll. long., terque trichotome ramosa; pedicelli 5 lin. long.; calyx 6 lin. long., 3 lin. diam., coriaceus; corollæ tubus $4\frac{1}{2}$ poll. long., ad basin (pro longitudine 2 poll.) constrictus, hinc parallelim cylindricus et 2 lin. diam., dehinc ad os gradatim ampliatus, ore 6 lin. diam.; limbi lobi 9 lin. long., 2 superiores erectiores, alteri reflexi; stamina vidi paululo exserta, eorum locus insertionis, ob corollam insectis excisam, mihi invisus, sed filamenta ex icone Swartzii 3 poll. long., intra tubum $4\frac{1}{4}$ poll. long.; capsula cylindrica, 7 poll. long. (sec. Swartz. interdum 12 poll.), $3\frac{1}{4}$ poll. diam.; valvæ lignosæ, 2 lin. crassæ, imo apiceque rotundæ, medio rima longitudinali facile fissiles, interne in fundo flavidæ, nitentes, cum zona longitudinali et utrinque marginali, 12 lin. lat., cancellato-favosa e cicatricibus fuscis opacis linearibus 3–4-serialibus unde semina sessilia affixa sunt; dissepimentum planum, utrinque nitidum, e laminis 2 chartaceis confluentibus, coriaceum, læve, $\frac{1}{2}$ lin. crassum; replum compressum, crassitudine dissepimenti; semina dolabriformia, longitudine transversa 15 lin., latitudine verticali 14 lin., latere externo recte truncato hilifero 2 lin. crassa, dehinc ad latus alterum rotundatum sensim ancipitiformia, crasso-coriacea, dura; hilum cicatrizatum, fuscum, lineare, 13 lin. long., 2 lin. lat.; embryo orbicularis, 9 lin. diam., 1 lin. crassus, utrinque profundissime fissus; radicula brevissima, medio sita, vix 1 lin. long., ad hilum spectans, et ideo centrifuga*.

2. *Tanaecium prælongum*, n. sp.;—scandens, glaberrimum, ramulis teretibus; foliis 3-foliolatis, foliolis ovatis vel oblongo-ovatis, imo obtusis aut subrotundis, apice acute attenuatis, nitidis, nervis venisque transversis reticulatis supra immersis, subtus prominentibus, hinc pallidis; petiolo elongato, petiolulis lateralibus 3-plo, terminali 2-plo longiore; pedicellis longiusculis; calyce tubuloso, margine integro, ciliolato, obsolete 5-denticulato; corolla (sicca) ochraceo-pruinosa, intus glabra, longissime et anguste tubulosa, versus faucem paulo ampliata; genitalibus inclusis; capsula oblonga, cylindrica, dissepimento ad utramque faciem profunde cymbæformi, seminigero, seminibus crassis, coriaceis, imbricatis, adscendentibus, sub-sellæformibus, ala angustissima coriacea.—Guiana Britannica, *v. pl. s. in herb. Hook. et Lindl.* (Schomburgk, 829); *v. capsula in herb. Mus. Brit.*, Guiana (Schomb.).

Præcedente differt foliis 3-foliolatis, foliolis minoribus et angustioribus, petiolo petiolulisque longioribus, pedicellis 4-plo

* Full details of this structure, and also a drawing of the species, will be shown in Plates 56 and 57 of the 'Contributions.'

longioribus, corolla 4-plo longiore, tubo tenuiore, staminibus multo brevioribus. Ramuli striatuli, lenticellis parvis favosis sparsim rugulosi; internodia approximata, 6–15 lin. remota; foliola lateralia 3–3½ poll. long., 1½–2 poll. lat., terminali paulo majore; petioli valde divaricati, 2½–2¾ poll. long., petioluli laterales 8 lin., terminalis 16 lin. long.; pedicelli 18–20 lin. long.; calyx 5 lin. long., 4 lin. diam.; corollæ tubus 11¼ poll. long., pro majore parte parallelim angustatus, 2¼ lin. diam., ad insertionem staminum (15 lin. sub fauce) subito ampliatus, fauce 9 lin. diam.; limbi lobi 9 lin. long., obtuse sub-3-angulares, 2 superiores erectiores; stamina brevia, filamenta subulata, glabra, in paribus apice paululo incurvata, 2 longiora faucem non attingentia, 12 lin., 2 breviora 9 lin. long., sterile ultimis intermedium 6 lin. long., rectum, tenue, anantherum; antheræ lobi lineares, obtusi, glabri, angulo recto cum filamento divaricati et verticaliter positi, connectivum apicale obtusum prominulum; stylus tubo æquilongus; stigmatis lamellæ oblongæ, obtusæ, 3 lin. long., 1 lin. lat., glabræ. Capsula botuliformis, 5 poll. long., 2¼ poll. diam., dissepimentum cum marginibus bifurcatim reflexis et a valvis solutis (utrinque 6 lin. lat.), 3 poll. lat. Semina irregulariter suborbicularia, dorso convexa, 1¼ poll. diam., latere hilifero incrassata, hinc 3–4 lin. crassa, ad marginem oppositum gradatim attenuata, et fimbria coriacea illinc vix alata; hilum 10 lin. long., 4 lin. lat., convexum; structura interna iis *T. albifloræ* simillima*.

3. *Tanaecium brasiliense*, n. sp.;—scandens, ramis teretibus; foliis inferioribus 3-foliolatis, superioribus conjugatis, novellis longe cirrhosis; foliolis oblongo-ovatis, imo obtusis et ad petiolum breviter attenuatis aut rotundatis, utrinque glaberrimis et reticulatis, textura subtenui, imo 3-nerviis, subtus pallidioribus, nervis venisque transversis reticulatis delicatulis paulo prominulis; petiolo longiusculo, tenui, petiolulis 3-plo longiore; paniculis axillaribus, geminis, 3-chotomis, crebriter paucifloris; pedicellis calyce paulo longioribus; calyce parvo, tubuloso; corolla alba, sicca ochraceo-pruinosa, longe et anguste tubulosa; genitalibus inclusis.—Brasilia septentrionali, *v. s. in herb. Hook.* (Crato, Gardner, no. 1765).

Species a *T. prælongo* et *T. crucifero* valde distincta, ad *T. albifloro* propior: ab isto differt foliis minoribus et angustioribus, textura tenuiore, nervis tenuioribus et minus prominentibus, acumine obtusiusculo, paniculis axillaribus et brevioribus, calyce triplo breviore et angustiore, corollæ tubo longiore coarctato et

* A drawing of this species, with an analysis of its floral structure, and also of the fruit and seeds, will be given in Plates 58 and 59 of the 'Contributions.'

dimidio angustiore, staminibus multo brevioribus et inclusis. Rami glauci, tuberculis favosis rugosi, juniores læves, fusci; internodia distantia; foliola $2\frac{1}{2}$–$3\frac{1}{4}$ poll. long., $1\frac{1}{2}$–$1\frac{3}{4}$ poll. lat.; petiolus $1\frac{3}{4}$–2 poll., petioluli laterales 6 lin., terminalis 16 lin. long.; cirrhus citissime caducus; paniculæ geminæ (exclusis floribus) 8 lin. long.; pedicelli 2 lin. long.; calyx 2 lin. long., $1\frac{1}{2}$ lin. lat., margine integro ciliolato cum nervis extus in denticulos 5 excurrentibus; corollæ tubus 5 poll. long. (parte basali constricta 4 poll. long. 1 lin. diam., dehinc amplior et ad faucem 7 lin. diam.), limbi lobi 6 lin. long., oblongi, obtusi; filamenta longiora 9 lin. long., apice incurva, faucem attingentia, breviora 7 lin. long., inclusa, sterile 6 lin. long., gracile; stylus glaber, longitudine tubi corollæ; ovarium fusiformi-oblongum, 4-sulcatum, glabrum, disco carnoso solide cylindrico plurisulcato insitum, 2-loculare; ovula pluriseriata, versus extremos margines dissepimenti affixa*.

4. *Tanaecium crucigerum*, Seem. Bonplandia, iv. 27; Hook. Kew Journ. ix. 83; Linn. Trans. xxiii. 15;—Bignonia crucigera, *Linn. Sp.* 869; *DC. loc. cit.* p. 152; *Plum. Pl. Amer.* i. 48, tab. 58;—scandens, ramis teretibus, ad nodos dilatatis, lenticellis globosis tuberculatis; foliis inferioribus 3-foliolatis, superioribus conjugato-cirrhosis, foliolis oblongo-ovatis, acumine brevi acuto, imo obtusis, breviter cordatis et 3-nerviis, supra nitidis, subtus ochraceo-velutinis, nervis ramosis venisque transversis reticulatis nitidis prominentibus; petiolo longiusculo, petiolulis subbrevibus; paniculis geminis, terminalibus; ramis paucis, oppositis, 3-floris, aut abortu 1-floris; calyce tubuloso, margine integro 5-denticulato; corolla extus velutina (in sicco ochracea), intus glabra, genitalibus faucem attingentibus.—In Antillis: *v. s. in herb. Hook.*, Domenica (Imray), St. Vincent (Guilding).

Species a præcedentibus valde distincta. Foliola 5 poll. long., 3 poll. lat.; petiolus $2\frac{1}{4}$ poll., petiolulique crassiusculi, 6 lin. long.; cirrhus simplex, 5–6 poll. long.; paniculæ geminæ, glabræ, terminales, floribus exclusis 2 poll. long.; rami bijugi cum impari, singuli 3-flori, aut abortu 1-flori, pedunculorum articulationibus sursum gradatim dilatatis et compressis, nitidi et striatelli; pedicelli 3–4 lin. long.; calyx 6 lin. long., 3 lin. diam.; corollæ tubus $6\frac{1}{4}$ poll. long., pro majore parte ad diam. 2–3 lin. constrictus, dehinc sensim ampliatus, fauce 1 poll. diam., limbi lobi 9 lin. long., obtuse 3-angulares, 2 superiores erectiores, 3 alteri reflexi; insertio staminum 1 poll. infra faucem, filamenta subulata, in paribus, summo incurva, 2 longiora faucem attingentia, 2 altera paulo breviora, inter istas sterile dimi-

* This species will be shown in Plate 60 of the same work.

dio curtius, rectum, anantherum; antheræ per paria approximatæ, lobi lineares, obtusi, segregati, divaricatissimi, connectivo apicali obtuso breviter excurrente; ovarium conico-oblongum, glabrum, disco latiusculo carnoso impositum; stylus subtenuis, 5 poll. long.; stigmatis lamellæ cuneato-oblongæ, rotundatæ, 3 lin. long., glabræ; fructus vix notus, oblongus, verisimiliter ei *T. albifloræ* consimilis, ut dixit cl. Plum. (*loc. cit.*), "capsulam vulgi repræsentat, quam Tobacco replent, secumque portant."

With this will cease, for the present, my communications on the *Bignoniaceæ*, as I learn from Dr. Seemann that he has resumed his inquiries into that family, and is about to publish the results of his investigations. The respect I have for that zealous botanist, together with the desire on my part to avoid contravention, and the knowledge that he has long studied the subject, induce me to cede to him the priority. As he has the advantage of consulting collections to which I have no means of access, more may be anticipated from his exertions. I reserve to myself, however, the right of resuming the subject at a future time, and of carrying out my original plan of defining the limits of the genera and subgenera I have sought to establish upon features hitherto unobserved, and also of illustrating their characters by drawings of one or more species of each group, accompanied by analytical figures of the flower, fruit, and seed.

XII.—*Observations on British Protozoa and Zoophytes.* By T. Strethill Wright, M.D., F.R.C.P.E., Pres. Roy. Phys. Soc. Edin.

[Plates III. IV. & V.]

On the Reproduction of Ophryodendron *.

Ophryodendron abietinum, which I have figured in various attitudes in Pl. III., has been noticed elsewhere by Claparède and Lachmann † and myself ‡, several years since; but it was not until the spring of the present year that I was able to discover its mode of reproduction. The animal presents the appearance of an oblong sac filled with homogeneous and finely molecular matter, and is found attached to the corallum of *Sertularia pumila*. From one end of the body or sac arises a proboscis, generally appearing as a short and closely-wrinkled club, but

* Read to the Royal Physical Society of Edinburgh, April 24, 1861.

† Etudes sur les Infusoires et les Rhizopodes, par Edouard Claparède et Johannes Lachmann.

‡ Edinb. Phil. Journal, July 1859.

capable of being produced to a remarkable distance as a glassy ribbon surmounted by numerous twining tentacles. The sac usually shows no trace of a nucleus or contractile vesicle, nor are its contents differentiated into an external and internal tissue (ectosarc and endosarc), as in *Actinophrys* and others of the class ("Acinétiens") into which it has been introduced. The structure of the proboscis differs from that of the sac in the development within it of a clear and highly refractive tissue, corresponding to the muscular element in the branches of *Zoothamnium* and in the more directly contractile pedicle of *Zooteirea*. In the proboscis of *Ophryodendron*, as in the body of *Epistylis*, the contraction of the muscle throws its outer covering into close folds. The tentacles are formed of a continuation of the contractile tissue of the proboscis, and are covered to within a short distance of their tips by the integument. The proboscis, when extended, hangs suspended or floating in an erect position, or slowly swims about in large curves by the continuous and very active motion of its tentacles. This animal may be called the homomorph, amongst the Protozoa, of *Sipunculus Bernhardi*. I have never been able to satisfy myself as to its mode of feeding, though portions of matters are occasionally seen entangled amongst the tentacles, and apparently pressed in contact with the substance of the proboscis.

In the sketch of this animal appended to my notice of 1859, I figured several globular bodies within the sac, which my friend M. Claparède, to whom I showed it, had not observed; and on further observation I was led to consider the figure erroneous. In March last, however, the *Ophryodendra* (Pl. IV. fig. 1) again contained these bodies; and by a somewhat "meddlesome midwifery," I was enabled to force them from the sacs, and to find that they were living young, from four to nine in number.

The young thus obtained consist of ovoid bodies of higher refractive structure than the body of the parent, and contain olive-brown corpuscles, shaped like the chlorophyll-granules of *Hydra viridis*. At a later stage, when the wrinkled trunk of the parent hung lax and dead, the young larvæ assumed a pyriform shape, flattened on their inferior surface (Pl. IV. fig. 2). This surface was also marked with longitudinal striæ, carrying short, soft, slowly-moving cilia or processes. Their natural mode of extrusion was not observed; but several families of them were found, each enveloped in a soft gelatinous ball, and attached to the *Sertularia* and other bodies. Single individuals were seen slowly moving on the zoophyte; and others attached were putting forth the rudiments of the proboscis. The proboscis was at first finely molecular, like the contents of the sac, unwrinkled, and non-contractile. A few tentacles were presently put forth from its summit (fig. 3); and it gradually assumed the structure of that of the adult.

The body of *Ophryodendron* frequently bears fusiform bodies, from one to four in number, which I have already described, and which appear to be gemmæ.

EXPLANATION OF PLATES III. & IV. figs. 1–3.

Pl. III. Two cells of *Sertularia pumila* on which *Ophryodendra* are attached,—the figure on the left side of the centre with gemma and contracted proboscis, that on the right side of the centre with proboscis extended; the trunks of two others are shown in various states of extension.

Pl. IV. figs. 1–3. Young of *Ophryodendron* in various stages of development.

On Dendrophrya radiata *and* D. erecta (nov. gen. et sp.)*.

The Rhizopodous animals to which I have given the name of *Dendrophrya* are found plentifully on Sertularias, Flustras, Fuci, and stones, in low-water pools at Granton Quarry, near Edinburgh. There are two species, *D. radiata* and *D. erecta.*

D. radiata.

Its general appearance is that of a small shelly mass, from the borders of which radiates a system of branched membranous tubes, more or less coated with mud or other matters. In young specimens the central shell is absent, and the animal presents the appearance of an irregular system of branches radiating from a centre. The shape of the adults is very various, and depends on the surface to which they are attached; they attain sometimes a diameter of nearly a quarter of an inch, though generally much smaller. The shell is not acted on by acids, and is therefore silicious. The animal itself can seldom be detected, as it lies concealed within its central flinty stronghold and the complicated system of earthworks surrounding it.

D. erecta.

In this species, found on stones, the branched, membranous and mud-clothed tubes, instead of creeping over the surface to which the animal is attached, spring upwards and outwards, as in Pl. IV. fig. 4. Delicate pseudopodia, linear or forked (figs. 4 and 5), are readily observed to protrude themselves from the extremities of the branches, accompanied sometimes by lobular processes of the sarcode of the animal. The patelloid shell of *D. erecta* may be easily detached from its seat, and its tenant, a small patch of semitransparent sarcode, scooped out with a flat-pointed needle and transferred to the stage of the microscope. It differs from the sarcode of other Rhizopods in being filled

* Read to the Royal Physical Society of Edinburgh, April 24, 1861.

with delicate short fibres instead of the usual molecular matter, and contains, both within the shell and tubes, the highly refractive bodies I have mentioned in a former paper as ova.

EXPLANATION OF PLATE IV.

Fig. 4. *Dendrophrya erecta,* seated on a portion of stone, and showing pseudopodia projecting from summits of branches.

Fig. 5. Summit of one of the tubes of *D. erecta,* with projecting lobes of sarcode and pseudopodia.

On Lecythia elegans (nov. gen. et sp.).*

This animal, of which I give drawings in Pl. V. fig. 10, is found on *Sertularia pumila.* It is exceedingly minute, and requires high microscopic power and careful adjustment of light for its accurate definition. The body is flask- or carafe-shaped, mounted on a long, fine, rigid pedicle, and enclosed in a closely fitting envelope. The summit of the body is dilated, and furnished with a variable number of long, slender, divergent processes or tentacles, which appear to correspond with those of *Actinophrys.* When the tentacles are contracted, they become capitate, and assume the form of a bossed crown, as shown in the figure.

In the following part of this paper the term '*polypidom*' is used (with Johnston) to signify the chitinous envelope of zoophytes; the term '*polypary,*' the living communicating substance from which the polyps spring—the 'cœnosarc' of Allman; the term '*generative sac,*' the cavity, formed of the two constituent membranes of the zoophyte, which contains the 'generative elements'—ova or spermatozoa; and '*placenta,*' the layer of 'endoderm' in the generative sac, from which the generative elements are developed, and by which they are nourished.

Cionistes reticulata (nov. gen. et sp.)†.

Polypidom retiform; alimentary polyps sessile, minute, white, with a single row of short tentacles; reproductive polyps columnar, thickened towards the apex, not terminated by a cluster of thread-cells, bearing many generative capsules.

A male specimen of this zoophyte was found growing on an old shell at Granton, in May 1857. It differs from the *Eudendrium confertum* of Alder (the *Dicoryne* of Allman) in the absence of the dense clusters of large thread-cells which terminate the

* Read to the Royal Physical Society of Edinburgh, April 24, 1861.

† Read to the Royal Physical Society of Edinburgh, March 23, 1859; now rewritten.

summit of the reproductive polyp of the latter, and which are the last rudiments of tentacles. The polypidom consists of a close network of flattened tubes, from out of which the alimentary and reproductive polyps spring at distant intervals. The sperm-sacs (one of which is shown in the margin at fig. 1, attached to the reproductive polyp) differ from those of *Hydractinia* in having the endoderm attached to the ectoderm at their distal extremities, as I have figured elsewhere (Edin. Phil. Mag. Jan. 1859) in the sperm-sac of *Eudendrium rameum*. This zoophyte resembles the Sertulariadæ in the simple columnar form of its non-tentacled reproductive polyps, and forms the connecting link between these organs in the Tubulariadæ and Sertulariadæ. It exhibits the most degraded form of the reproductive polyp, previously to the latter being altogether dispensed with and the generative sacs being developed directly from the polypary. Thus we have, in the chain of degradation,—

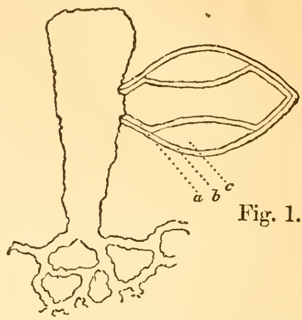


Fig. 1.

Reproductive polyp of *C. reticulata* with single sperm-sac: *a*, endoderm; *b*, ectoderm; *c*, cavity containing spermatozoa.

Generative sacs or medusoids attached to ordinary alimentary polyp, as in	*Clava, Coryne,* &c.
Generative sacs attached to reproductive alimentary polyp, which differs from ordinary alimentary polyp in having fewer tentacles	*Podocoryna fucicola* (Sars).
Generative sacs attached to reproductive polyp with rudimentary mouth and tentacles, as in	*Hydractinia echinata.*
Generative sacs attached to reproductive polyp without mouth or tentacles; summit of polyp surmounted by a cluster of large thread-cells, as in	*Eudendrium confertum* (Alder).
Generative sacs or medusoids attached to reproductive polyp without mouth, tentacles, or cluster of thread-cells, as in	*Cionistes, Sertularia, Campanularia.*
Reproductive polyp divided longitudinally into several portions, each surmounted by its cluster of large thread-cells; sperm-sacs formed, as in *Hydra*, by simple dilatation of the ectoderm; each division of polyp transformed into a 'moniliform' sperm-sac, as in	*Eudendrium arbusculum* (T. S. W.), *E. capillare*? (Alder).
Generative sacs or medusoids attached to the polypary, as in	*Atractylis* (T. S. W.), *Hydractinia* (Alder and T. S. W.), *Cordylophora* (Allman).

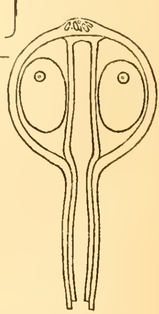
It will thus be seen that there is a very gradual transition from the alimentary polyp to the reproductive polyp, and from the latter to the simple generative sac. Prof. Allman's term 'blastostyle,' applied to the reproductive polyp, is apt to mislead, as it indicates that the alimentary and reproductive polyps are not homologous parts. Still more decidedly does that accomplished naturalist confuse the homology of these parts by applying the same term to the branched pedicle of the aggregated generative sacs of *Tubularia indivisa,* which is merely formed of the conjoined and elongated pedicles of the individual sacs.

It is impossible to construct any classification of the Hydroid Zoophytes on the form or position of their generative sacs or medusoids, as these vary not only in different species of the same genus, but also in males and females of the same species. Thus, in *Eudendrium rameum* the sperm-sacs are moniliform, the egg-sacs single; the former are attached to the alimentary polyp, the latter to the polyp and also to the polypary. In *Hydractinia,* although the generative sacs generally spring from the reproductive polyps, they are also found attached to the polypary; and in a most interesting species of this genus lately discovered by Mr. Alder, medusoids spring from the latter part of the zoophyte. In *Atractylis ramosa,* T. S. W. (*Eudendrium ramosum,* Van Ben.), the medusoids, the males and females of which differ in shape, spring from the polyps, from club-shaped bodies, and from the polypary; in other species of *Atractylis* they arise from the reticulated base of the zoophyte. In certain species of the genera *Sertularia* and *Campanularia,* marsupial forms occur which bear no homological relation to each other.

The gradual transition in the Hydroidæ from the simple generative sac to the perfect Medusa is exceedingly interesting. I attempt to indicate it in the following sketch :—

Generative elements (spermatozoa or ova) contained in a simple generative sac or dilatation of the ectoderm; *placenta* formed of endodermal floor of sac	*Hydra.*	Simple generative sac.
Placenta protruding into generative sac, and forming 'spadix' (Allman) surrounded by generative elements	*Coryne, Hydractinia.*	
— or branched and permeating them......	*Campanularia lacerata* (male).	
— or folding round single ovum	*Eudendrium rameum* (female).	

Placenta adherent to summit of generative sac; summit of sac furnished with cluster of large thread-cells; sac the equivalent of the peduncle of *Coryne gravata*	*Eudendrium arbusculum* (male). *E. confertum* (female*).	Generative sac become a peduncle ('manubrium,' Allman).
Summit of sperm-sac furnished with a row of tentacles indicating the presence of a non-differentiated subumbrella	*Laomedea Loveni* (male).	Subumbrella present, but not differentiated.
Generative sac transformed into a free walking medusoid; peduncle furnished with branched tentacles, as in *Bougainvillea*; subumbrella not differentiated, its presence indicated by eye-specks and otoliths; umbrella absent	*Eleutheria*, medusoid of *Clavatella* (Hincks).	
Ovisac fixed, enclosed in a differentiated subumbrella with lateral and circular canals and tentacles	*Laomedea Loveni* (female).	Subumbrella differentiated.
Sperm-sac surmounted with large thread-cells, and forming the peduncle of a fixed medusoid with differentiated subumbrella and umbrella	*Coryne gravata*.	Umbrella differentiated.
Imperfect free Medusa; peduncle with tubular mouth, and united with a single-cavitied generative sac	Medusa of *Coryne decipiens*, *Sarsia*.	Peduncle or alimentary polyp and generative sac not differentiated from each other (see *post*).
Perfect free Medusa of low type; peduncle four-tentacled or lipped, and containing eight generative sacs coalescing into four, which are situated alternately with the tentacles or lips	*Bougainvillea Britannica*, the Medusa of *Atractylis ramosa* (female). *Turris neglecta*, the Medusa of *Clavula Gossii* (female).	Generative sacs differentiated from alimentary polyp, but situated on it.
Perfect free Medusa of low type; peduncle four-lipped or tentacled, with eight distinct generative sacs, one placed on the side of each lip	*Oceania episcopalis*.	



* In the ovisac of *E. confertum* (see figure in margin), which I have had an opportunity of examining through the kindness of Mr. Alder, the endoderm and ectoderm at first adhere together at the summit of the sac, and at this point a few large thread-cells occur in the ectoderm. A similar occurrence of adhesion and thread-cells is found in the sperm-sac of *E. arbusculum*, and also in the false and mouthless peduncle of the medusoid of *Coryne gravata*.

Perfect free Medusa of higher type; peduncle four-lipped or tentacled; eight generative sacs, one on each side of lateral canals	Medusa of *Laomedea geniculata.*	Peduncle and generative sacs differentiated. Alimentary polyp taking no part in reproduction.
Medusa of highest type, with 4–6 lips and 8–12 lateral canals, each canal carrying a single generative sac	*Stomobrachium octocostatum.*	Generative sacs on separate canals; two canals corresponding to each lip.

Of the generation of *Stomobrachium* we know nothing. Claparède has shown that gymnophthalmatous Medusæ may produce Medusæ without the intervention of the polypoid phase; but it is impossible to draw any line of distinction between a Medusa and the medusoid phase of the Hydroid polyp. *Tubularia indivisa* produces its young as perfect polyps without the intervention of the planuloid phase, *Clava* with the intervention of that phase. In the life-history of the Hydroidæ any phase—planuloid, polypoid, or medusoid—may be absent.

The perfect several-lipped Medusa appears to be a symmetrical organism composed of eight or more elements, each element corresponding to the half of a lip. Each of these elements is composed of three subelements, the alimentary, reproductive, and prehensile, any of which may be suppressed, or unite with others of different value on the same element, or of the same value belonging to neighbouring elements. Thus, in *Sarsia* the peduncle appears to consist of a single alimentary subelement, and the single reproductive element or generative sac extends around and along the whole of it except the single trumpet-shaped lip. This lip is occasionally placed on one side and at some distance from the extremity of the peduncle, indicating the asymmetrical character of the latter organ in this genus. In *Euphysa* and *Eleutheria* the ovisacs coalesce, and are placed within and at the base of the peduncle. *Steenstrupia* and *Saphenia* furnish examples of the suppression of certain of the marginal tentacles or prehensile subelements, and the exaggeration of others.

The Polyp of the Hydroid Zoophyte must also be considered as composed of one or more elemental zooid. Thus we have the zooid of a single element in the 'tentacular polyp' of *Hydractinia*; the zooid of two elements in the two-tentacled and two-lipped *Lar Sabellarum* (Gosse) (Pl. V. fig. 8), and in the minute two-lipped and non-tentacled polyp which occurs on the Antennularias and others; the zooid of several elements in the five-lipped polyp of *Trichydra* (T. S. W.); that of many elements in the polyp of *Tubularia indivisa*, which I have elsewhere shown to be formed by the confluence of the several distinct tubes of which the polypary or cœnosarc is composed, each of which tubes may be traced, by its coloured endodermal ridges, to the mouth of the polyp, and bears its own system of tentacles and reproductive apparatus.

The compound character of the *polypary* is also seen in *Halecium* and *Antennularia*, and in a very beautiful manner in the very early state of *Sertularia pumila*, which (after it had been kept a few days in fresh water) I have figured with the camera in Pl. V. fig. 12. Its resemblance to Carus's figure of the Medusa, *Cunina globosa* (Esch.), which I have copied in fig. 11, is very striking.

As the Medusa is a multiplex organism, we must inquire how far it is homologous with the generative sac of the Hydroid Zoophyte.

Prof. Allman, in his paper on *Cordylophora* (Phil. Trans. vol. cxliii.), advanced the doctrine that the generative sac was homologous with the whole Medusa—a doctrine based upon an erroneous conception of the cavity in which the generative elements are contained. In a "Note on Diœcious Reproduction in Zoophytes" (Edin. New Phil. Journ. vol. iv. p. 88), I stated that "the reproductive buds [generative sacs] (of *Coryne*) were filled with ova developed from the exterior of a hollow central stalk, a diverticulum of the alimentary canal;" and further, "The *peduncle* of the Medusa-bud [or budded Medusa] appears to me to be homologous with the entire reproductive capsule [generative sac] (of *Coryne glandulosa*, &c.)." This view is now adopted by Prof. Allman, who writes, in this Journal (vol. vi. 3 ser. p. 4), "The manubrium is the whole of the 'peduncle,' 'stomach,' or by whatever other name it may be called, which depends from the centre of the umbrella in a Medusa or medusoid; and I apply the same term to what I consider the homologous part in a sporosac, namely the whole sporosac *minus* the ectotheca and mesotheca." Now, the 'sporosac,' less the 'ectotheca' and 'mesotheca,' is the simple generative sac, which therefore Prof. Allman has agreed with me in considering homologous with the peduncle.

But I would now very much modify the above view. We must keep in mind that each of the eight elements of a medusoid has three distinct functional subelements; that the single reproductive subelement of the Medusa exists, as in *Stomobrachium*, uncombined; that where the peduncle is the reproductive organ of a *free* Medusa, as in *Sarsia*, it consists of two subelements of different function combined, each exercising its separate function, alimentative or reproductive; that an organ composed of a single subelement (a generative one) having only one function cannot be homologous with one composed of two subelements (peduncle of *Sarsia*) each having its distinct function, or with an organ of sixteen subelements (peduncle of *Bougainvillea*), eight of which are alimentary and eight reproductive. I would therefore now state—

That the simple generative sac of *Coryne* is homologous with the reproductive subelement or single generative sac as it exists on the lateral canal of *Stomobrachium*.

That the peduncle-like sac of *Eudendrium confertum* is homologous with the *reproductive* subelement in the peduncle of *Sarsia*—not with the whole peduncle.

That where the generative sac evidently consists of many subelements, as in *Tubularia larynx* and *Sertularia fallax* (evidenced by the four summit-lips or lobes, the symmetrical character of each of which indicates it to be composed of two subelements), it is homologous with the *reproductive* subelements in the octopartite peduncle of *Bougainvillea*, or, rather, with the eight coalescing *reproductive* subelements of *Eleutheria*.

I consider that a four-lobed or branched state of the placenta or spadix indicates a multipartite constitution of the generative sac, and not a rudimentary medusoid form of that organ; for we have, in the fixed female medusoid of *Laomedea Loveni*, a four-lobed condition of the placenta in the peduncle-like ovisac, with the existence of a well-differentiated subumbrella and lateral and circular canals.

My space will not allow me to illustrate the homological relations which exist between the polypary (or cœnosarc) and the polypidom, on the one hand, and the subumbrella and umbrella on the other. This must be reserved for a future occasion, when I hope to fill up the gaps in this rough and incomplete sketch of some of the morphological relations of the Hydroidæ and their Medusæ.

Atractylis palliata, n. sp. Pl. IV. fig. 6.

Polypidom creeping, closely reticulate. Polyps fusiform, shortly stalked, minute, white, with eight alternating tentacles; body of polyp clothed with a thick layer of 'colletoderm.' Free medusoids springing from meshes of polypary, with four-lipped peduncle; four lateral canals; two long marginal tentacles and two tentacular tubercles alternately placed.

This zoophyte was found on a shell inhabited by *Pagurus Bernhardus*, at Granton. When first observed, its closely-set and dense white polyps, surrounded by their gelatinous envelopes, were mistaken for a mass of minute ova. These envelopes cover the whole of the body of the polyps up to the border of the mouth, and consist of an exaggerated development of the gelatinous coat which probably exists on the polypidom and body of all the Hydroidæ, in some as a delicate epidermis, in others (as in *Bimeria vestita* and the subject of this notice) as a thick, imputrescible coat—the "colletoderm."

The Medusoids (Pl. IV. fig. 7) are of great size when compared with the very minute polyp, and resemble exactly those of *Atractylis repens.* I have not witnessed any further development in them after their separation from the zoophyte. In those of *A. repens,* when kept alive for some time, the two tentacular tubercles put forth short tentacles, and four other tubercles appear on the marginal canal, as shown in fig. 8,—a change analogous to that undergone in *Bougainvillea Britannica.*

Atractylis coccinea, n. sp.*

Polypidom creeping, widely reticulate. Polyp fusiform, set at an obtuse angle to its stalk, rich crimson or pink, with eight alternating tentacles, four long and four short.

This zoophyte was found at Inch Garvie in August last, growing on the roots of *Laminaria saccharina.* The polypary consists of an open network of milk-white fibres, which closely invests the branches of the root. From this network the polyp-stems are given off, each about a quarter of an inch in length, of a rich pinkish cream-colour, and bearing at its summit a single crimson polyp with a double row of transparent colourless tentacles. The body of the polyp is fusiform, sometimes nearly cylindrical, and consists of an endoderm having its cells laden with granules of the richest carmine-colour, covered by an ectoderm of transparent white—a white blond dress over a crimson satin petticoat. The polyps, like others of this class, have the habit of turning themselves inside out, when the internal surface of the deep-coloured velvety endoderm is readily observed. On such occasions masses of granular matter are frequently ejected, which are composed of small pigment-globules filled with crimson fluid. The tentacles are eight in number, four of which are long and held nearly erect, and alternate with the rest, which are shorter and more expanded. The thread-cells are inconspicuous.

This beautiful little zoophyte, when seen with a single lens, presents a perfect garden of minute animal flowers covering the roots of the sea-weed. The reproductive apparatus was not observed.

Hydractinia echinata.

In a former number of this Journal (vol. iv. ser. 3. p. 50) Prof. Allman has remarked, with regard to *Hydractinia,* that "the

* Read to the Royal Physical Society of Edinburgh, Feb. 27, 1861.

solid chitinous polypary [polypidom] is covered externally by the cœnosarc [polypary], thus reminding us of the sclerobasic corallum of some of the Actinozoa." This doctrine had been previously promulgated by Quatrefages (Ann. des Sc. Nat. xx. 232), who considered the polypidom to be an endoskeleton deposited in the substance of the polypary, like the solid axis of *Gorgonia*. If this view were correct, it would not only remove *Hydractinia* from the Tubulariadæ, but would segregate it from the whole of the Hydroid Zoophytes, not one of which is destitute of an investing polypidom.

In the 'Edinb. Phil. Journal' for April 1857, I stated, in a paper on *Hydractinia*, my conviction of the incorrectness of Quatrefages's opinion, and that the mode of secretion of the polypidom of *Hydractinia* did not differ from that of the rest of the Tubulariadæ, as was seen in the development of its young and its propagation by stolons. Since then I have come to the following conclusions, after the examination of a very large number of specimens, some hatched from the egg and adherent to glass, others removed as cuttings from adult specimens and transplanted on glass, to which they readily grow, and others removed entire from the shell of the *Pagurus* by acid, and put up in spirit or balsam.

The *polypidom* and *polypary* are found in the following forms, all of which are frequently combined in the same specimen :—

1. An open network of delicate chitinous tubes without spines, enclosing a polypary composed of several combined endodermal tubes surrounded by a single layer of ectoderm. Found in very young specimens, or in old ones growing on protected parts of the shell. (Analogous to *Clava repens* (mihi), the *C. discreta* of Allman.)

2. An open network as in the last; the tubes of thick brown chitine, with single hollow spines rising from a single tube, or from the confluence of four tubes.

3. A close reticulate plate, as in *Clava cornea* (mihi) and *C. membranacea* (mihi), formed from states 1 or 2 by the continual filling-up of the meshes by anastomosing branches, with or without spines.

4. A fleshy plate of ectoderm permeated by a network of endodermal tubes, and covered above and below by a delicate investment of chitine. Found on the growing borders of the zoophyte, and especially in cuttings of old specimens transferred to glass.

The *spines* are composed of one tube or many parallel tubes: they may be single (Pl. V. fig. 4), and developed on a single tube of the polypidom, like those of *Podocoryne fucicola*; single at their summits and of several tubes at their base (figs. 5 & 6);

composed entirely of several (8–12) conjoined tubes (fig. 7); reticulate by the lateral anastomosis of their tubes; or consisting of long ridges of tubes reared against each other.

The polyps spring from one or several confluent tubes of the polypary; they are covered at their origin, and for a little distance above it, by a delicate prolongation of the polypidom. This may be detected by dyeing the whole zoophyte with tincture of kino, which gives different tints to its chitinous and fleshy elements, or by steeping it alternately in spirit and water, when the coverings of the polyps and polypary become inflated as in figs. 2 & 3.

The *polyps* are of several shapes and functions, which I have described in the paper cited above. It will be sufficient to enumerate them here:—

1. Alimentary polyps, with mouth and tentacles.
2. Reproductive polyps, with rudimentary mouth and tentacles.
3. Spiral polyps—a modification of the last; generally barren (fig. 3).
4. Sessile generative sacs of the polypary.
5. Tentacular polyps, or great tentacles of the polypary (fig. 2).

In the reproductive organs of *Hydractinia* there is a gradual transition from the reproductive polyp to the sessile generative sac; the polyp loses its dot-like mouth, its tentacles, its head or upper part, and finally dwindles down to a mere sperm-sac. This change is generally seen in those specimens which have long been kept in captivity. In these specimens, too, many of the alimentary polyps are often converted into large inflated sacs destitute of mouth and tentacles, and showing through their parietes white longitudinal ridges, which indicate the number of zooid elements of which they are composed.

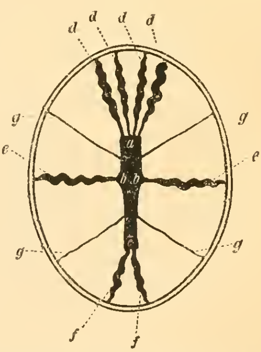
In the natural history of this remarkable zoophyte there are other points of peculiar interest, which, having already described, I need only mention here:—the slow development and unique shape of the planuloid larva; the powerful muscular structure of the polyps, especially the spiral ones, the office of which last has yet to be discovered; and the intimate sympathy and combined action which subsist between the various parts of the whole animal.

Halcampa Fultoni, n. sp. (a parasitic Actinia).

In a late volume (vi. p. 432) of this Journal appears an account of a parasitic Actinia, *Philomedusa Vogtii*, by Herr Fritz Müller. In 1858 I took a parasitic Actinia which evidently belongs to the same genus. The following account of it is extracted from the 'Proceedings of the Royal Physical Society,' published in the 'Witness' on the 16th of May 1860. It was there denominated '*Peachia Fultoni,*' but it evidently belongs to the genus *Halcampa* (Gosse).

"The author stated that, in the summer of 1858, he took, by dipping, a great number of Medusæ of the genus *Thaumantias,* off Granton Pier. To the peduncle of one of these was attached a small Actinia, about half an inch in length and one-eighth of an inch in diameter. From its general appearance he considered it to be a young specimen of *Actinia troglodytes,* which had been seized by the Medusa, dragged from its native mud, and brought captive to the surface of the water; but it was unfortunately lost before he could examine it carefully. In June, his friend Mr. Fulton, of Granton Pier, brought him some specimens of Thaumantias, to one of which another Actinia, of the same species as the one he had before observed, had attached itself by swallowing the peduncle of the Medusa. The body of this Actinia was of a transparent yellowish-white colour, and marked by twelve paler lines, indicating the situation of the longitudinal septa within. The oral disk was oval, and formed by the basis of the tentacles and the mouth. The tentacles were twelve in number, of a rich umber-brown colour. About one-half of each from the base was marked with five opake pale-yellow lozenges, and from thence to the top by four bands of the same pale-yellow colour. The brown matter consisted of amorphous pigment-granules, the yellow matter of highly refractive and exceedingly minute molecules, apparently calcareous. Each tentacle was curved backwards, and resembled the abdomen of a wasp. The pigment could be forced through the top of the tentacle by pressure, indicating an opening at that part. The mouth, instead of being linear, as in the Actinias, tended to assume a quadrangular or crucial form, though the constantly varying shape of the disk rendered a description of it difficult. The stomach was very peculiar, and differed from that of the Actinias. It was a flat and obscurely quadrangular sac in transverse section (fig. 3). Its angles he should describe as superior (a), lateral (b), and inferior (c). The superior angle was connected to the parietes of the body by four septa (d), the lateral angles each by one septum (e), and the inferior angle

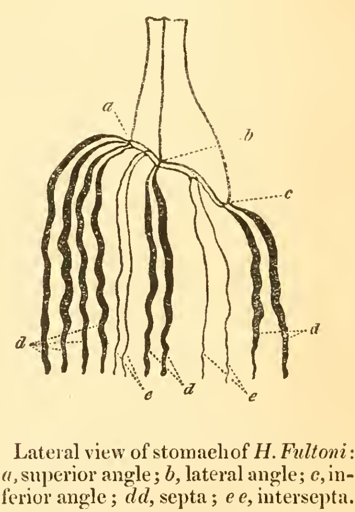
Fig. 3.



Transverse section of *H. Fultoni*: *a*, superior angle of stomach; *b b*, lateral angles of ditto; *c*, posterior angle of ditto; *d d d d, e e, f f,* septa, *g g g g,* intersepta, uniting stomach with parietes.

by two septa (f). These septa were continued downwards, as in the Actinias, to the lower extremity of the body, and had their free edges bordered by a convoluted ciliated band, furnished with cnidæ, or thread-cells. The stomach and parietes were further connected by four intersepta (g), as he should call them—one between each of the lateral and anterior angles of the stomach, and one between each of the lateral and posterior angles; but these intersepta bore no convoluted bands. The septa probably bore ovaries or spermaries, the intersepta not, in which case the reproductive system of the animal now described agreed in simplicity with that of the polyp of the Alcyonidæ, which had only eight septa, each bearing ciliated bands. The upper part of each of the septa and intersepta was perforated by an oval opening, so as to give an uninterrupted passage beneath the tentacles to the circulation of the fluids of the body. By tracing this passage in the Lucernarias, he had come to the conclusion that it was the homologue of the circular canal of the gymnophthalmatous Medusa. The attachments of the stomach thus resembled those of the same organ in the other Helianthoid and Alcyonian polyps; but in shape it widely differed from these. In *Actinia* and *Alcyonia* the stomach was a flattened sac, open, and evenly truncated at its lower extremity. In the animal now described the lower border of the stomach curved gently downwards from the superior to the lateral angles (fig. 4 *a, b*), and from the lateral to the inferior angle it bent deeply and abruptly downwards (*b, c*), while the last-named angle itself was produced outwards and downwards, so as to form a beaked process, as shown in the figure. The thread-cells of the tentacles are simple and unbarbed, those of the septal bands furnished with a zigzag thread. When the animal was separated from the peduncle of the Medusa and placed in a dish of sea-water, it slowly moved from place to place by the aid of the tenacious palpocils which studded the tentacles and upper part of the body, and alternately filled itself like a balloon, and emptied itself by a vermicular contraction of the

Fig. 4.



Lateral view of stomach of *H. Fultoni*: *a*, superior angle; *b*, lateral angle; *c*, inferior angle; *dd*, septa; *e e*, intersepta.

parietes, which commenced beneath the tentacles and passed backwards. When dilated, it was seen that the animal was destitute of a sucking disk, and that the posterior part of the body terminated in a funnel-shaped depression opening into the cavity of the body, and permitting ingress of water therein. During contraction this funnel was everted, and became a cone, through the apex of which the fluid was again ejected."

XIII.—*On some new Species of Mollusca from the North of China and Japan.* By Arthur Adams, F.L.S. &c.

Genus Buccinum, Linnæus.

Buccinum Japonicum, A. Adams.

B testa ovato-fusiformi; spira producta, lævigata, tenui, imperforata, epidermide corneo-fusca longitudinaliter plicata et laminata, transversim ad costas producta et fimbriata induta; anfractibus $6\frac{1}{2}$, in medio angulatis, cingulis elevatis transversis acutis (circa 6 in anfractu ultimo) instructis, interstitiis lineis elevatis longitudinalibus ornatis; basi spiraliter lirata; apertura ovata, antice breviter et late canaliculata, canali emarginata; labro margine incrassato et reflexo.

Hab. Okosiri; Sea of Japan; 35 fathoms.

This is a beautiful little species of *Buccinum* proper, about an inch in length, and with the epidermis, in fresh specimens, very prettily disposed. Like most deep-water shells, it is very thin.

Genus Trichotropis, Brod. & Sow.

Trichotropis (*Iphinoë*) *quadricarinata*, A. Adams.

T. testa turbinata, subconica; spira elata, anguste umbilicata, fusca; anfractibus $4\frac{1}{2}$, spiratis, postice angulatis; anfractibus superioribus carinulis rotundatis transversis et liris elevatiusculis transversis, lineis confertis elevatis obliquis undulatis decussatis; anfractu ultimo carinulis transversis rotundatis quatuor, lineis elevatis longitudinalibus decussato, basi concavo, lirulis tribus concentricis ornato; apertura semicirculari, antice producta et vix canaliculata; labio rectiusculo; labro margine biangulato.

Hab. Mino-Sima; 63 fathoms.

Genus Rissoa, Fréminville.

1. *Rissoa miranda*, A. Adams.

R. testa pyramidato-ovata, turrita, imperforata, solida, sordide alba; anfractibus $5\frac{1}{2}$, convexis, longitudinaliter costatis, costis prominentibus, distantibus, in medio nodosim angulatis, interstitiis simplicibus, suturis zonula elevata instructis; anfractu ultimo ad partem superiorem costato, costis validis, in medio tuberculatim angulatis, ad partem inferiorem cingulis transversis elevatis quatuor instructo; apertura ovata; labro margine extus incrassato.

Hab. Mino-Sima; 63 fathoms.

2. *Rissoa* (*Goniostoma*) *procera*, A. Adams.

R. testa aciculato-turrita, apice obtuso, alba, tenuicula; anfractibus $4\frac{1}{2}$, convexiusculis, transversim striatis; apertura ovata; peritremate integro, continuo, recto; labro antice subeffuso.

Hab. Gulf of Pe-chili; 5 fathoms.

Genus ONOBA, H. & A. Adams.

1. *Onoba mundula*, A. Adams.

O. testa ovato-conoidali, imperforata, pallide fusca; anfractibus $4\frac{1}{2}$, convexis, supremis longitudinaliter costellatis; anfractu ultimo lirulis transversis confertis regularibus ad partem superiorem obsolete decussatis instructo; apertura ovata, antice vix effusa; labio rufo tincto.

Hab. Korea Strait; 63 fathoms.

2. *Onoba elegantula*, A. Adams.

O. testa elevatim turbinata, umbilicata, tenui, semiopaca, alba; anfractibus $5\frac{1}{2}$, convexis, longitudinaliter obsolete strigosis, transversim creberrime striatis; apertura oblonga; peritremate simplici, acuto, continuo.

Hab. Gulf of Pe-chili; 7 fathoms (mud).

Genus SETIA, H. & A. Adams.

1. *Setia candida*, A. Adams.

S. testa ovato-conoidali, rimata, alba, lævi, nitida, vix opaca; anfractibus $4\frac{1}{2}$, convexis; apertura subcirculari; labio tenui, arcuato.

Hab. Sado Island; 30 fathoms.

2. *Setia tricincta*, A. Adams.

S. testa ovato-conoidali, imperforata, pallide fusca, tenui, semiopaca; anfractu ultimo fasciis tribus rufis angustis ornato; regione umbilicali rufo tincta; apertura subcirculari; labio arcuato.

Hab. Awa-Sima; in shell-sand.

3. *Setia bifasciata*, A. Adams.

S. testa ovato-conoidali, imperforata, alba, lævi, nitida, semipellucida; anfractu ultimo fasciis duabus rufo-fuscis angustis transversis succincto; anfractibus $3\frac{1}{2}$, convexiusculis; apertura subcirculari; labio in medio vix angulato.

Hab. Awa-Sima; in shell-sand.

Genus ALVANIA, Risso.

Some naturalists, of an obstructive nature, or of the "old school," refuse to see any groups which are not already in their mind's eye, and will insist on calling a thing a "spade" when it is certainly a "rake." These small shells, according to them, are species of *Rissoa*, of a short cancellated kind, with subcircular apertures, and with the peritreme usually thickened.

1. *Alvania circinata*, A. Adams.

A. testa imperforata, elevatim turbinata, tenui, pallide rufa; anfractibus $4\frac{1}{2}$, convexis, cingulis elevatis transversis rufo-fuscis subnodosis ornatis, interstitiis lineis longitudinalibus, vix elevatis cancellatis; apertura subcirculari; labio rufo-fusco tincto; labro simplici.

Hab. Island of Sado; 30 fathoms.

2. *Alvania semicostata*, A. Adams.

A. testa solida, imperforata, ovato-conica, sordide alba; anfractibus $3\frac{1}{2}$, planatis, longitudinaliter costatis, transversim liratis; costis parvis, tenuibus, distantibus, in anfractu ultimo ad peripheriam desinentibus; basi spiraliter lirata; apertura ovata, postice angustata; labro simplici.

Hab. Mino-Sima; 63 fathoms.

3. *Alvania tiarula*, A. Adams.

A. testa imperforata, tenui, turbinata, corneo-lutescente; anfractibus $3\frac{1}{2}$, planiusculis, postice coronulatis et angulatis, longitudinaliter costatis; costis validis, distantibus, lirulis elevatis decussatis; anfractu ultimo costis ad peripheriam desinentibus; basi lirulis concentricis instructa; apertura subcirculari; labro simplici.

Hab. Tabu-Sima; 25 fathoms.

4. *Alvania cælata*, A. Adams.

A. testa ovato-conica, solida, imperforata, pallide fusca; anfractibus $4\frac{1}{2}$, convexiusculis, longitudinaliter costatis, transversim valde liratis; costis crassis, validis, distantibus, interstitiis liris elevatis decussatis; costis in anfractu ultimo ad peripheriam terminantibus; basi valde lirata; apertura ovata.

Hab. Tsu-Sima; 25 fathoms.

5. *Alvania clathratula*, A. Adams.

A. testa elevatim turbinata, rimata, pallide fusca; anfractibus $4\frac{1}{2}$, convexis, costis longitudinalibus elevatis et liris transversis validis regulariter clathratis; liris in anfractu ultimo ad partem anticam obsoletis; basi liris validis spiralibus instructa; apertura subcirculari.

Hab. Tsu-Sima; 16–25 fathoms.

6. *Alvania Mariella*, A. Adams.

A. testa ovato-turbinata, rimata, tenuicula, fusca; anfractibus $4\frac{1}{2}$, convexis, supremis liris longitudinalibus et transversis concinne cancellatis; anfractu ultimo liris 8 elevatis transversis, interstitiis ad partem superiorem cancellatis; apertura subcirculari; labro simplici.

Hab. Tsu-Sima; 26 fathoms. Korea Strait; 46 fathoms.

7. *Alvania concinna*, A. Adams.

A. testa ovato-conica, imperforata, solida, rufo-fuscescente, longitudinaliter costata, transversim valde lirata; costis validis, distantibus, interstitiis liris elevatis transversis decussatis; costis in anfractu ultimo ad peripheriam desinentibus; basi spiraliter lirata; apertura late ovata; labro albicante, margine subincrassato.

Hab. Tsu-Sima; 26 fathoms.

8. *Alvania ferruginea*, A. Adams.

A. testa ovato-conica, valida, crassa, solida, imperforata, ferruginea, costis validis longitudinalibus nodosis et liris elevatis transversis valde clathrata; apertura subcirculari; labro albo, margine incrassato.

Hab. Yesso (Hakodadi Bay; 7 fathoms).

Genus Capulus, Montfort.

1. *Capulus japonicus*, A. Adams.

C. testa ovata, pileiformi, alba, tenui, epidermide lutescente obtecta, lineis incrementi concentricis corrugata, longitudinaliter radiatim striata; apice spirali, recurvato, ultra marginem posticum producto; apertura ovata, aperta, margine tenui, regulari, postice reflexo.

Hab. Mino-Sima; 63 fathoms.

When in fine condition, this species is sometimes faintly marked with irregular reddish-brown blotches and obscure rays.

2. *Capulus depressus*, A. Adams.

C. testa ovata, pileiformi, valde depressa, tenui, fragili, fasciis latis fuscis obsolete radiatim ornata, epidermide fusca concentrice corrugata obtecta; apice spirali, parvo, postice reclinato; apertura aperta, expansa, margine tenui, membranaceo; intus nitida, albida, calcarea, obsolete radiata aut maculosa.

Hab. Cape Notoro; Saghaleen.

Genus Leucotina, A. Adams.

1. *Leucotina insculpta*, A. Adams.

L. testa ovato-conica, rimata, alba, solidula; spira elata, acuta; anfractibus convexiusculis, transversim liratis, liris planis, æquidistantibus, interstitiis concinne subtiliter punctatis; apertura ovata; plica parietali superiore; labio antice subexplanato; regione umbilicali impressa, rimata.

Hab. Korea Strait; 46 fathoms.

2. *Leucotina punctata*, A. Adams.

L. testa ovata, solidiuscula, imperforata; spira producta, acuta; anfractibus planiusculis, transversim sulcatis, sulcis valde punctatis; apertura ovata; labio antice subincrassato; plica parietali superiore.

Hab. Tabu-Sima; 25 fathoms.

Genus Fossar, Adanson.

Fossar japonicus, A. Adams.

F. testa ovato-conica, alba, solida, anguste umbilicata; anfractibus $2\frac{1}{2}$, superne angulatis, apice parvo, acuto; anfractu penultimo cingulis tribus transversis, ultimo cingulis novem elevatis distantibus transversis instructo, interstitiis lineis elevatis longitudinalibus ornatis; apertura semiovata; labro margine crenato; rima umbilicali angusta.

Hab. Tsu-Sima; 16–26 fathoms.

Genus Sao, H. & A. Adams.

Sao lagenula, A. Adams.

S. testa cylindrico-pyramidali, antice gibbosa, regione umbilicali impressa, transversim striata, striis subdistantibus, sordide alba, apice perforata; apertura lineari, antice valde dilatata; labio brevi, incrassato; labro recto, postice producto, antice rotundato et arcuato.

Hab. Gulf of Pe-chili; 5 fathoms.

This species belongs to a natural group of *Bullidæ* indicated by my brother and myself in our 'Genera' under the name of *Sao*. The species are numerous, and some are included among the species of *Cylichna*. They belong, however, neither to that genus nor to *Atys*, under which we have placed it, approaching much nearer the *Scaphander* group.

Genus Gasteropteron, Meckel.

Gasteropteron sinense, A. Adams.

G. animali carneocolore, ubique carmineo punctatim et reticulatim picto, corpore pallidiore, integumento subpellucido visceribus conspicuis; pedis lobis magnis, liberis, marginibus integris, rotundatis, superficie rubro punctata ac reticulata.

Hab. Hulu-Shan Bay (Regent's Sword); 3 fathoms (mud).

I obtained three individuals of this species in the dredge from three fathoms mud. I placed them in a clear bottle of salt water, and observed them some time. Chiaje might well be excused for regarding the genus as a Pteropod, for at first sight it has all the appearance and action of a Pneumodermon. My specimens appeared to want the power of crawling altogether; the animals, after taking short flights, usually upside down, through the water, by butterfly-flappings of the side-lobes of the foot, gently alighted and remained stationary on their stomachs, with the swimming-lobes folded together over the back, until ready for another little excursion. The lower surface of this species, moreover, is coloured exactly like the fins, and shows no signs of a creeping disk. I believe the genus should be placed in the family *Lophocercidæ*, or, rather, *Icaridæ*; for Prof. E. Forbes had previously described *Lophocercus* under the name of *Icarus*. The Chinese species seems to differ from the Mediterranean *Gasteropteron* in being covered with crimson punctate and reticulate markings. Other points of difference are shown in my drawings.

Genus Doriprismatica, D'Orbigny.

Doriprismatica festiva, A. Adams.

D. dorso plano; tentaculis luteis; pallio cæruleo ultramarino, luteo late marginato, antice et inter tentacula maculis duabus, in medio linea lata lutea longitudinali et utrinque ejus maculis sex luteis elongatis picto; branchiis luteis; pede cæruleo ultramarino, maculis albidis oblongis quinque utrinque ornato.

Hab. Tsu-Sima (among weeds in pools, low water).

A species remarkable for the vivid colouring of its body and strongly marked pattern. The proboscis (large and retractile, but short) is of a pink colour.

Genus Coryphella, Gray.

Coryphella Alderi, A. Adams.

C. pallide lutea, semipellucida; tentaculis vix annulatis, luteis; tentaculis oralibus aurantiis, magnis, elongatis; branchiis fasciculatis, singula pallide lutea, linea carminea mediana picta, apice carminea.

Hab. Off Matsumai, Island of Yesso; Straits of Tsugar (on Zostera).

A very delicate and lovely species, about an inch long, and which I have much pleasure in dedicating to the naturalist best qualified to appreciate its beauty.

Genus Aplysia, Gmelin.

1. *Aplysia marmorea*, A. Adams.

A. dorso elevato; lobis pedis magnis, amplis, viridi alboque marmoreis; tentaculis anterioribus latissimis, truncatis; tentaculis posterioribus sublinearibus, obtusis. Testa magna, tenui, fragili, antice valde dilatata; apice vix involuto, subincrassato.

Hab. Mah-lu-San (Port Hamilton); tidal pools; caught also in the sein.

A large species; sometimes 10 inches long.

2. *Aplysia marginata,* A. Adams.

A. dorso elevato; lobis pedis magnis, dilatatis, marginibus albo, deinde fusco marginatis; rufo-fusca, brunneo variegata et punctata; tentaculis anterioribus latis, brevibus, truncatis; tentaculis posterioribus parvis, subacutis. Testa fragili, tenui, semimembranacea, subtriangulari, antice dilatata ac rotundata; apice vix involuto.

Hab. Mah-lu-San (Port Hamilton); pools in rocks; low water.

Subgenus Phycophila, A. Adams.

Corpus compressum, elongatum; pedis solea angusta. Testa elongata, oblonga, tenui, plana, membranacea; apice non involuto.

3. *Aplysia* (*Phycophila*) *euchlora,* A. Adams.

A. viridis, lævis, compressa; solea angustata; tentaculis anterioribus elongatis; tentaculis posterioribus angustis, apicibus truncatis; cauda producta. Testa membranacea, oblonga, antice dilatata; apice non involuto.

Hab. Straits of Tsugar or Tseuka (crawling on floating Zostera).

This animal I have observed before, during the voyage of the 'Samarang.' It is figured in Mrs. Gray's 'Figures of Molluscous Animals' (tab. 179. fig. 1); it has not, however, been described. It is oceanic in its habits, or at least found at some distance from the shore. *Aplysia ocellata,* A. Ad., figured also from my drawing in Mrs. Gray's work, is another species of this subgenus.

Genus Helicina, Lamarck.

Helicina japonica, A. Adams.

H. testa depresso-conica, crassa, solida, fusco-lutescente, oblique crebre striata; anfractibus $3\frac{1}{2}$, convexiusculis; apice obtuso; anfractu ultimo ad peripheriam rotundato; basi convexa, callo tenui nitido obtecta; apertura semiovata, perobliqua; columella brevi, crassa, rotundata; peristomate duplicato, interiore tenui, recto, exteriore crasso, rotundato, reflexo. Operculum semiovatum, tenue, calcareum.

Hab. Tabu-Sima (damp banks, roots of trees).

Genus Anomia, Linnæus.

1. *Anomia radulina*, A. Adams.

A. testa valva dorsali ovata, irregulari, convexa, alba, radiatim costellata, costellis squamulosis, squamulis acutis imbricatis; regione umbonali lævi; apice acuto, postico; intus alba, margaritacea; cicatrice musculari superiore magna, rotundata.

Hab. Mino-Sima; 63 fathoms.

2. *Anomia pustulosa*, A. Adams.

A. testa valva dorsali ovata, regulari, planiuscula, sordide alba, lineis incrementi concentricis instructa, tuberculis confertis, rotundis, planiusculis, areolis depressis circumcinctis ornata; umbone parvo, vix prominulo, ad marginem posticum posito; intus margaritacea; margine crenulato; cicatrice musculari superiore magna, oblonga, inferne dilatata.

Hab. Tabu-Sima; 25 fathoms.

N.B. In a paper on new species of Mollusca from Japan, forwarded by me in May last from Shang-tung, for publication in the 'Annals,' I described one species under the name of *Agatha virgo*. The generic name should have been *Myonia*, not *Agatha*.

Shanghai, China,
Dec. 6, 1860.

XIV.—*On the Palæontology of the Coralline Oolites of the Neighbourhood of Oxford.* By J. F. Whiteaves, F.G.S. &c.

[Plate IX. B.]

The object of the following paper is to give a detailed list of the fossils from the Coralline Oolite of the neighbourhood of Oxford, in order that geologists may be enabled to compare the faunas of the same formation in the respective counties of Oxon, Berks, Yorkshire, Wilts, and Dorset.

One of the leading features in the palæontology of this stratum in the neighbourhood of Oxford is the great rarity of the Brachiopoda. During several years' active collecting I have not met with even a fragment of a shell that belonged to this family, nor do I know of a specimen in any of our local collections. The Cephalopoda of the Oxfordshire Coralline Oolites appear to have a somewhat limited range in time, being, generally speaking, confined to the Middle Oolites. This seems to favour D'Orbigny's well-known views on the limited vertical range of that class. On the other hand, many of the Bivalves and Gasteropoda occur as low down in the series as the Great and Inferior Oolites. Eighteen species in my list of the Oxfordshire Coralline Oolite fossils have been recorded also from the Inferior Oolite; and the catalogues of fossils from the Coral Rag and Calcareous Grit of Yorkshire and the neighbourhood of Weymouth would supply many more species common to both formations. As the exact boundary between the Coral Rag proper and the Lower Calcareous Grit of the district now under consideration has not been accurately defined, the term "Coralline Oolite" is used in this paper collectively, to include both of these formations. From the Upper Calcareous Grit (if that stratum occurs near Oxford) I have no fossils, nor do I know of any.

The principal localities whence these fossils have been procured are,—Headington quarry, Bullingdon Green, the quarry near the windmill on the Shotover Road, another between Cumnor and Besselsleigh, and the well-known pits at Marcham, near Abingdon. The *Crenatula Listeri*, mentioned in Prof. Morris's Catalogue of British Fossils as occurring in the Coralline Oolite of Shotover (but with a query attached), I omit, having good reason to suppose that the Portland Oolite is the stratum to which it should be referred. Again, Dr. Fitton, in his elaborate paper "on the Strata below the Chalk," gives the well-known Liassic *Rhynchonella tetraedra* as a fossil of the "Oxford Oolite" at Wheatley, but with some doubt. Surely this is a mistake. Omitting these two species, the following series has been procured from the Coralline Oolite of the Oxfordshire district. The species with an asterisk affixed are found also in the Inferior Oolite.

PLANTÆ.

Carpolithes conicus, *Lind. & Hutt.*

ZOOPHYTA.

Thecosmilia annularis, *Flem.*
Rhabdophyllia Phillipsi, *M.-Edw.*
Cladophyllia Conybearei, *M.-Edw.*
*Isastræa explanata, *M'Coy.*
—— Greenhoughi, *M.-Edw.*

ECHINODERMATA.

Cidaris Smithii, *Wright.*
—— florigemma, *Phil.*
Hemicidaris intermedia, *Flem.*
Pseudodiadema versipora, *Phil.*
Hemipedina Marchamensis, *Wr.*
Pygaster umbrella, *Agassiz.*
Echinobrissus scutatus, *Gmel.*
Pygurus pentagonalis, *Phil.*
—— costatus, *Wright.*
—— Blumenbachii, *Koch & Dunk.*(?)

ANNELIDA.

Serpula tricarinata, *Sow.*
—— runcinata, *Sow.*
Vermicularia ovata, *Sow.*
Vermilia sulcata, *Sow.*

CRUSTACEA.

Glyphea rostrata?, *Phil.*

MOLLUSCA.

Gryphæa mima, *Phil.*
—— nana, *Sow.*
*Ostrea gregaria, *Sow.*
*—— solitaria, *Sow.*
Placunopsis similis, n. sp.
*Pecten lens, *Sow.*
*—— vagans, *Sow.*
—— similis, *Sow.*
*—— vimineus, *Sow.*
*—— articulatus, *Schl.*
*Hinnites abjectus, *Phil.*

*Lima pectiniformis, *Schloth.*
—— rigida, *Sow.*
—— rudis, *Sow.*
—— rustica, *Sow.*
—— læviuscula, *Sow.*
—— elliptica, n. sp.
Gervillia aviculoides, *Sow.*
Avicula expansa, *Phil.*
—— ovalis, *Phil.*
Perna —— ?
—— —— ?
Trichites Plotii, *Lhwyd.*
Pinna lanceolata, *Sow.*
*Modiola bipartita, *Sow.*
—— pulchra, *Phil.*
—— Lycetti, n. sp.
Lithodomus inclusus, *Phil.*
Arca, n. sp.
Cucullæa contracta, *Phil.*
—— corallina, *Lyc.*
Trigonia clavellata, *Sow.*
*—— costata?, *Sow.*
Corbis lævis, *Sow.*
Lucina —— ?
Sowerbya triangularis, *Phil.*
? —— Deshayesia, *Buv.*
Cardium Crawfordii, *Leck.*
—— —— ?
Isocardia tumida, *Phil.*
Cypricardia isocardina, *Buv.*
*Opis Phillipsii, *Mor.*
—— corallina, *Lyc.*
——, n. sp.
Astarte ovata, *Smith.*
——, n. sp.
*Cyprina dolabra, *Phil.*
*Quenstedtia lævigata, *Phil.* sp.
Thracia Studeri?, *Ag.*
*Myacites Jurassi, *Goldf.*
Goniomya litterata, *Sow.*
Pholadomya —— ?

Actæon retusus, *Phil.*
Cylindrites Luidii, n. sp.
Bulla elongata?, *Phil.*
Pleurotomaria bicarinata, *Sow.*
—— reticulata, *Sow.*
——, n. sp. allied to *Anglica*, Sow.
Phasianella —— ?
Littorina muricata, *Sow.*
—— lævissima, n. sp.
*Nerita minuta, *Sow.*
Neritopsis Guerrei, *Heb. & Desl.*
Chemnitzia Heddingtonensis, *Sow.*
*—— striata, *Sow.*
—— melanoides?, *Phil.*
Natica cincta, *Phil.*
—— arguta, *Phil.*
—— clio?, *D'Orb.*
Ceritella costata, n. sp.
Nerinæa Goodhallii, *Sow.*
—— —— ?
—— —— ?
—— —— ?
Cerithium muricatum, *Sow.*
Alaria seminuda, *Heb. & Desl.*
Ammonites perarmatus, *Sow.*
—— plicatilis, *Sow.*
—— excavatus, *Sow.*
—— vertebralis, *Sow.*
—— cordatus, *Sow.*
Nautilus hexagonus, *Sow.*
Belemnites abbreviatus, *Miller.*

Pisces.

Gyrodus Cuvieri?, *Ag.*
—— —— ?
Pycnodus —— ?
Sphærodus —— ?
Lepidotus —— ?
Hybodus obtusus, *Ag.*

Reptilia.

Teleosaurus? (teeth of).

Notes on the preceding Species.

Pygurus costatus and *Blumenbachii.*—These are given on the authority of Dr. Wright. I have never seen specimens in this district.

Pecten articulatus, Schlotheim.—Of this species I have several very perfect specimens, and believe it to be only a variety of *Pecten vimineus,* Sow.

Pinna lanceolata.—Inserted on the authority of Prof. Phillips.

Lithodomus inclusus, Phil.—The *L. amygdaloides* of Prof. Morris is identical with this shell. The figure given by Lhwyd gives a tolerably good idea of Phillips's species; and it is common in the Bullingdon Coral Crag and the Islip Cornbrash—two localities given by Lhwyd for his "*Pholas amygdaloides*."

Sowerbya triangularis, Phil., sp.—I am not prepared to admit, with my friend Dr. Lycett, that this species is the same shell as the *Isodonta Deshayesia* of Buvignier, at least if any reliance is to be placed on Prof. Phillips's figure.

The anterior umbones and the shortly-truncate anterior extremity of *S. triangularis* readily distinguish it from the *Sowerbya* (*Isodonta*) *Deshayesia*, a shell which is nearly equilateral. As the English variety of *I. Deshayesia* differs slightly from the French type; and as Prof. Phillips's figure of his "*Cucullæa triangularis*" is not very characteristic, I give new figures of each of these shells.

Cypricardia isocardina, Buv.—M. Buvignier describes and figures his shell as smooth; but my only specimen, fortunately in good preservation, shows a sculpture consisting of very strongly-marked longitudinal striæ covering the whole surface of the shell. The specimen figured is from the Coralline Oolite of Bullingdon. Prof. Phillips informs me that it occurs in the same stratum at Malton.

Opis Phillipsii, Morris.—The *Opis bicarinata* of Buvignier is very near to this species, and may perhaps be identical with it.

Cylindrites Luidii, n. sp.—This shell was rudely figured by Luidius (tab. 6. fig. 420) from the Coralline Oolite of Besselsleigh, where it is not uncommon: he calls it "cochlites cylindroides minor, turbine productiore." I have much pleasure in dedicating this species to the memory of one of our earliest local palæontologists.

Pleurotomaria, n. sp. (allied to *Pl. anglica*, Sow.).—Probably the shell alluded to by Sowerby, in the 'Mineral Conchology,' under the head of *Trochus* (*Pleurotomaria*) *similis*, of which he states that "the blue Lias of Weston, and in the neighbourhood of Yeovil, Lackington Park, *Shotover*, &c., abound with this *Trochus*."

In the Coralline Oolite at Bullingdon I met with a single example of this species, equal in size to Sowerby's type, and certainly closely resembling it; but, owing to the hardness of the matrix, I completely failed to extract it.

Littorina lævissima, n. sp. This shell has been figured in the Supplement to Mr. Damon's 'Geology of Weymouth' (pl. 5. fig. 6) as a *Phasianella*, but without any distinctive appellation. I have had a series of specimens from the Coralline Oolite of Besselsleigh for a long time in my cabinet, and, on the whole, think that they should rather be referred to the genus *Litto-*

rina. The specific term I have chosen refers to the smooth and unornamented surface of the shell.

Nerinæa.—These three species (two from Cumnor and one from Bullingdon) are evidently distinct, but are *too imperfect to be identified* satisfactorily.

My best thanks and acknowledgments are due to my friend Dr. Lycett for his most valuable assistance in determining several critical species mentioned in this paper.

Description of new Species.

Placunopsis similis. Pl. IX. B. figs. 1, 2.

Shell ovately orbicular, oblique; upper valve (the only one known at present) convex; umbones marginal; surface covered with dense, very fine, radiating striæ, which are decussated by the lines of growth.

Locality. Coralline Oolite near Besselsleigh, where it is somewhat rare.

Lima elliptica. Pl. IX. B. figs. 3, 4.

Shell convex, elliptic-ovate, oblique; centre of the shell covered with acute longitudinal costæ, which become nearly obsolete at the sides; interstices very finely longitudinally striate, as is also the anterior portion of the shell; auricles unequal (the posterior being the largest) and quite smooth.

Locality. Coralline Oolite about Bullingdon and the Shotover road; also in the same rock at Pickering, as I am informed by Dr. Lycett.

This shell bears a general resemblance to *Lima gibbosa*, Sow.; but that species is not so oblique; and when minutely examined, its sculpture will be found to be very different.

Modiola Lycetti. Pl. IX. B. fig. 5.

Shell oblong, concentrically striated, umbones terminal; dorsal surface convex, terminating in a ventricose, bluntly-rounded extremity; inferior border somewhat concave.

Locality. This little species occurs sparingly in the Coralline Oolite of Bullingdon, and in the quarry near the windmill on the Shotover road.

Ceritella costata. Pl. IX. B. fig. 10.

Shell turreted; spire elongated; whorls flattened, with straight longitudinal costæ, which, in the body-whorl, only occupy the upper part of the volution.

Locality. Coralline Oolite near Besselsleigh, but rare.

Closely allied to *Ceritella longiscata*, Mor. and Lyc.; but our species wants the keel on the upper part of the volutions (one of the distinctive features of *C. longiscata*), and in the last-mentioned species there are no costæ on the body-whorl.

EXPLANATION OF PLATE IX. B.

Fig. 1. *Placunopsis similis.*
Fig. 2. Portion of the shell magnified, showing the sculpture.
Fig. 3. *Lima elliptica.*
Fig. 4. Portion of ditto, magnified.
Fig. 5. *Modiola Lycetti.*
Fig. 6. *Cypricardia Isocardina*, Buv.
Fig. 7. *Sowerbya triangularis*, Phil. (sp.).
Fig. 8. *Sowerbya Deshayesia?*, Buv., var.

Fig. 9. *Cylindrites Luidii.*
Fig. 10. *Ceritella costata.*
Fig. 11. *Neritopsis Guerrei*, Heb. & Desl., var.

XV.—*Contributions to an Insect Fauna of the Amazon Valley.* COLEOPTERA : LONGICORNES. By H. W. BATES, Esq.

[Continued from p. 52.]

7. *Oreodera remota*, Pascoe.

Ægomorphus remotus, Pascoe, Trans. Ent. Soc. n. s. vol. v. pt. 1.

O. elongata, minus depressa, postice valde attenuata, tomento holosericeo violaceo-brunneo vestita : elytris marginibus maculis tribus lateralibus punctisque discalibus nonnullis quorum duobus majoribus pone medium atro-violaceis. Long. 8 lin. ♀.

Head brown: eyes distant on the vertex. Antennæ brown; basal half of each joint, from the fourth, greyish. Thorax with the disk as well as the fore and hind margins punctured; lateral tubercles prominent, acute; anterior dorsal ones acute, posterior more obtuse, shining black. Elytra rather elongated, tapering to the apex, which is very obliquely truncated, the external angles of the truncature produced and acute; the base is densely studded with shining black granulations accompanied by punctures; the small rounded violet spots on the disk, near the apex, cover each a shallow shining puncture; the lateral spots are merely expansions of the dark violet border, and are placed, one at a third, another at two-thirds the length of the elytra, and the third, much smaller one, near the apex. Under-surface of the body and legs clothed with ashy-brown pile. The tarsi, especially the claw-joints, are remarkably elongated.

Taken at St. Paulo on the Upper Amazons, on the slender trunk of a dead standing tree. The pile covering this species is of a much coarser texture than that of most other species of the genus; it resembles in this respect *O. glauca*, but it does not lie so compactly as in that species. The species was referred by Mr. Pascoe to the genus *Ægomorphus* of Dejean, which, however, had not at that time been characterized, and was a loose assemblage of species belonging to four or five different genera.

8. *Oreodera sericata*, n. sp.

O. valde depressa, fulvo-brunnea, tomento tenuissimo holosericeo griseo subtus densiore vestita: elytris plaga magna laterali pone humeros albo-grisea, prope basin punctatis, dimidio apicali lævissimo. Long. 5½ lin.

Head brown: eyes distant on the vertex: antennæ piceous. Thorax with the lateral tubercles obtuse, the three dorsal ones very slightly elevated and clothed with pile. Elytra obliquely truncated at the apex, sutural angles rounded off, the external ones obtuse; base with a number of large simple punctures, which do not reach beyond one-third the length except along the sides, the rest perfectly smooth and silky; the pile is extremely fine, thin, silky, and changeable. Legs clothed with grey pile. Under-surface densely clothed. The white patches on the elytra reach the suture and occupy nearly one-half the surface.

Taken at St. Paulo on the Upper Amazons.

9. *Oreodera cretata*, n. sp.

O. depressa, apicem versus attenuata, tomento tenuissimo holosericeo fulvo vestita: elytris plaga oblonga laterali apud medium cretaceo-alba. Long. 4½ lin.

Head and antennæ fulvous: eyes rather distant on the vertex. Thorax with the lateral tubercles obtuse and the three dorsal ones only slightly indicated; punctured on the hind part of the disk as well as along the fore and hind margins. Elytra truncated obliquely at the apex, sutural angles very obtuse, external ones slightly produced and acute; punctured, partly in lines and sparingly over the basal half. The oblong lateral chalky spot is clear white. Body beneath and legs silky fulvous.

On the banks of the Cupari (R. Tapajos), on dried branches.

§ § Disk of thorax with no trace of tubercles. Elytra less distinctly, sometimes scarce perceptibly, truncated at the apex.

a. Elytra depressed.

10. *Oreodera simplex*, n. sp.

O. elongata, angustata, tomento holosericeo varia sordido olivaceo vestita: elytris fasciis tribus abbreviatis indistinctis pallidioribus. Long. 5 lin.

Head and antennæ dark brown, the base of each antennal joint (from the fourth) ringed with grey. Thorax with the lateral tubercles obtuse; disk uneven, punctured posteriorly and on the lateral tubercles as well as along the fore and hind margins. Elytra narrow and only slightly tapering, the apices slightly truncated, punctured moderately over the basal half and on the disk to the apex. The pile is of a dingy yellowish olivaceous colour, varied with a paler shade, which forms three obscure semi-belts on the elytra. Legs and under-surface ashy-brown.

Ega, on dried branches.

11. *Oreodera griseo-zonata*, n. sp.

O. depressa, apud humeros lata, apicem versus attenuata, tomento holosericeo griseo-brunneo vestita: elytris fascia latissima basali albo-grisea, apices versus lineis flexuosis griseis brunneisque ornatis. Long. $4\frac{1}{2}$ lin.

Head and antennæ brown; base of each antennal joint (from the fourth) grey: eyes distant on the vertex. Thorax with the disk nearly even; a few punctures on each side, besides those on the fore and hind margins. The elytra have the shoulders more produced and pointed than in the allied species, they have a few punctures near the base, and the apices are singly rounded: the broad grey belt across the basal half has its fore margin arched posteriorly, so as to leave a space around the scutellum dark brown; it passes beneath entirely over the mesosternum: the grey and brownish waved lines on the apical half are obscure and silky. Body beneath and legs pitchy-brown, clothed with ashy-brown pile.

Ega and banks of the Tapajos, on dead twigs.

b. Elytra somewhat convex. (Subgenus *Anoreina.*)

12. *Oreodera* (*Anoreina*) *nana*, n. sp.

O. curta, convexiuscula, fuliginosa, tomento fusco et flavo-ferrugineo vestita: elytris lateribus rotundatis, apices versus attenuatis, utrinque apud medium macula magna laterali triangulari albo-grisea. Long. $3\frac{1}{2}$ lin.

Head and thorax dark drown: eyes distant on the vertex. Antennæ brown, the basal part of many of the middle joints pale testaceous. Thorax with the disk smooth, even; lateral tubercles very obtuse. Elytra punctured throughout, towards the base densely, towards the apex sparingly; they are sooty-brown varied with obscure rusty-yellow patches; each has on the side, about the middle, a large greyish-white triangular spot, not generally touching the suture. Under-surface of the body brown; legs pitchy-black, clothed with ashy pile. Tarsi moderately slender.

Santarem and Para; on dried twigs.

Genus ÆGOMORPHUS.

Thomson, Class. des Céramb. p. 336.

Char. emend. Body narrow, thick, and somewhat convex. Head as in *Oreodera*, the muzzle being very slightly prolonged beyond the lower margin of the eyes, its anterior angles obtuse: the eyes distant on the vertex. Antennæ rather shorter; the proportions of the joints the same; but they are not fringed beneath, as in *Oreodera*. Sides of thorax furnished with a large conical tubercle. Prosternum behind and mesosternum in front steeply inclined; clothed with long hairs in the ♂ (at least in *Æ. moniliferus*). Anterior acetabula angulated. Second and third ventral segments contracted in the middle in the ♀; the fifth very large, its apex truncate-emarginate and densely hairy. Tarsi broad, claw-joint long; fore tarsi neither dilated nor fringed in the ♂.

The name of this genus first appears in Dejean's Catalogue, but it was first characterized by M. Thomson in the present year; the characters given, however, although numerous, omit the chief peculiarities of the group. The thickness and convexity of the body, nakedness of fore tarsi in the male, and shape of the sterna are the chief points of distinction. M. Thomson places it in the group Trypanidiitæ,—an arrangement quite unintelligible on his system, as it does not agree at all with the characters of the section to which the Trypanidiitæ belong.

1. *Ægomorphus obesus*, n. sp.

Æ. elongatus, convexus, crassus, nigro-brunneus, tomento griseo tessellato vestitus: thorace nigro bivittato: elytris apicem versus attenuatis, sinuato-truncatis, angulis externis productis. Long. 11 lin. ♀.

Head clothed with a fine grey pile, leaving three narrow longitudinal lines on the vertex brownish black. Antennæ shorter than the body, grey; tips of the joints (from the third) dusky. Thorax with the lateral tubercles conical acute, and with two large slightly-raised dorsal tubercles; the fore and hind margins and sides punctured; clothed with grey pile; the dorsal tubercles and a stripe from each to the hind margin black, or thinly clothed with brownish-black pile. Elytra each with three or four slightly elevated longitudinal ridges, disappearing at about half the length; a row of granulations (accompanied by punctures) on each ridge, besides three or four other rows in the interstices; the sides near the base also densely granulate-punctate: the fine hoary-grey pile is in large patches near the base; elsewhere it forms regular rows of small, distinct, oblong spots. Under-surface of the body clothed with dense silky yellowish-grey pile, longest on the pro- and mesosterna. Legs clothed with grey pile, leaving spots on the femora, the tips of the tibiæ, and of the claw-joints of the tarsi black. Abdomen (in ♀) with the second to the fourth ventral segments contracted in the middle; apical segment very large, tumid near the apex, which latter is truncate-emarginate and densely hairy.

Taken at Para. It resembles very much *Æ. adspersus* (Dej.), Thoms. Class. p. 337. It may be a local form of that species.

2. *Ægomorphus moniliferus*, White.

Ægomorphus moniliferus, White, Cat. Long. Col. in Brit. Mus. ii. p. 374, pl. 9. fig. 7.

This, as will be seen from the excellent figure and description above quoted, is a narrower and more depressed insect than *Æ. obesus*. The ♂ has all the three sterna covered with a dense brush of hairs, more erect and of a brown colour on the metasternum. The apical ventral segment in the ♀ is large, with a longitudinal impressed line ending in a fovea before the apex; the latter is emarginate-truncate and densely hairy.

Found at Para and Santarem, on trunks of felled trees.

Genus Myoxomorpha.

White, Cat. Long. Col. in Brit. Mus. ii. p. 355.

Body thick, convex, elongated. Head broad, muzzle short, somewhat narrowed from the eyes; sides rounded, obtuse: eyes distant on the vertex, very large, especially the lower lobes, which advance considerably on the forehead. Antennæ shorter than the body, simple, neither grooved nor fringed. Thorax with large and very acute lateral tubercles. Elytra convex, elongated, their surface without ridges, apices briefly truncated. Legs moderate, tarsi short, femora clavate; the fore tarsi in the males simple, neither dilated nor fringed. Prosternum narrow, simple, with the acetabular sutures angularly gaping; mesosternum broad, quadrate, horizontal. Abdomen with the terminal ventral segment sinuate-truncate in the males.

The generic name of *Myoxomorpha* was first applied in French collections to the *Acanthoderes funerarius* of Dejean's Catalogue*. Neither the genus nor the species has yet been characterized; but Mr. White, in the Catalogue of the Longicorn Coleoptera of

* *A. funerarius*, Dej. Cat. *A.* oblongus, crassus, niger, subtilissime punctulatus. Caput nigrum, vertice utrinque macula cana. Antennæ crassæ, nigræ, articulis tertio quartoque maxime elongatis supra sulcatis, reliquis abbreviatis. Thorax niger, tuberibus lateralibus conicis, dorso trituberculato, marginibus cano-maculatis. Elytra simplicia, apice conjunctim rotundata, ubique sparsim granulato-punctata, nigra, basi et pone medium confluenter cano-maculata vel cana nigro-maculata. Long. 5–11 lin. ♂ ♀.
Hab. Mexico.

the British Museum, adopted the genus, adding to it the *Acanthoderes funestus* of Erichson. *A. funerarius,* however, is a true *Acanthoderes,* having dilated and fringed fore tarsi in the males: it differs from most of the species only in the rounded tips of the elytra, a character presented by many of its congeners; therefore the generic name can apply only to *A. funestus. Myoxomorpha,* as thus defined, is very closely allied to *Acanthoderes,* its chief distinction being the simple fore tarsi in the males. The ungrooved antennal joints, the voluminous eyes, narrow prosternum and horizontal mesosternum also separate it well from the majority of the species.

1. *Myoxomorpha funesta,* Erichs.

Acanthoderes funestus, Erichson in Schomb. Reise, iii. 573.

In facies and colours this species has some resemblance to *A. funerarius.* It is black, clothed beneath and on the legs with a fine silvery hoary tomentum. The forehead, vertex, a broad central vitta on the thorax, the scutellum, and the apical half of the elytra are also clothed with a very fine silky whitish pile, —the apical half of the elytra having a large patch on each side, and a number of small rounded spots of a black colour.

Found throughout the Amazon region, sparingly, under the loose bark of felled trees, chiefly of *Inga* and other Leguminosæ, in newly-made plantations. It is very sluggish in its motions

[To be continued.]

XVI.—*A Catalogue of the Zoophytes of South Devon and South Cornwall.* By the Rev. Thomas Hincks, B.A.

[Plate VI.]

The title of this paper requires a word of explanation. The term *Zoophyte* is adopted for the sake of convenience, and is used in the sense in which it was employed by Dr. Johnston, to embrace the Hydroid, Asteroid, and Helianthoid polypes, and the Polyzoa. According to the later and more accurate classification, the beings associated under this common name are thus distributed:—The subkingdom Cœlenterata has been constituted for the true Polypes and the Medusæ; and in this the Hydroids and the Lucernaridæ rank under the class Hydrozoa, the Asteroids and Helianthoids under the class Actinozoa. The Polyzoa, by virtue of their Molluscan affinities, take their place amongst the Molluscoida.

No apology need be offered for adding one more to the number of local catalogues. Their significance and value, when carefully and conscientiously prepared, are now fully appreciated. My object has been not merely to draw up a bare list of species, but to embody the miscellaneous observations which have accumulated during many years of study, and so to illustrate to some extent the general history as well as the geographical distribution of these interesting tribes.

The district embraced by the catalogue comprehends the whole of the South Devon coast, and that portion of the Cornish which extends from Plymouth to the Deadman Point, situated about twenty-four miles to the west of the Eddystone Lighthouse. It presents almost all the conditions favourable to the development of marine life, and accordingly there are few portions of the English coast which equal it in fertility and in the beauty of its productions. The climate is genial, and the waters are remarkable for their translucency and purity. The marine vegetation is of the richest character. There is considerable variety in the geological features, accompanied by a corresponding diversity of habitat, which allows of a more varied population. A series of fine bays and estuaries afford the most favourable localities for the littoral and Laminarian species; and in these warm and comparatively sheltered waters many of the most lovely kinds attain a wonderful luxuriance. Torbay itself is a marvellous treasury of marine life. Its ample shores are clothed with a submarine vegetation as rich and beautiful, in its way, as the verdure which here seems almost to mingle with the sand, and affording a home or shelter to innumerable tribes.

The limestone, which borders a considerable portion of the Bay has been hollowed by the action of the water into caves and pools and fissures, which are the chosen retreats of the Actiniæ, and yield a large proportion of the rarer and more beautiful kinds to the careful investigator. Here and there the beach is strewn with large blocks of rock, the surface of which is worn into a multitude of little basins, in which the smaller and more delicate zoophytes find a congenial habitat. Elsewhere the limestone forms a kind of flooring, comparatively level, and intersected by deep and narrow clefts, draperied by the various kinds of weed, whose dark recesses are rich in interesting forms. But nowhere, perhaps, is the profusion of life so remarkable as in the little coves, which are overspread between tide-marks with stones of moderate size, which can be turned over with ease and examined at leisure. The most striking features in such situations are the luxuriant growth of certain Campanulariadæ (*Laomedea flexuosa* chiefly), and the wonderful size and beauty of the littoral kinds of *Lepralia* and *Membranipora*. Of the former genus (*Lepralia*) the most characteristic shore species are the *L. unicornis, Pallasiana, granifera,* and *nitida*. Forests of the *Laomedea flexuosa* invest almost every stone.

In other parts of the Bay, sand is not wanting for the burrowing species of Actinozoa, such as *Peachia hastata*. The dredging is equally productive. The rough ground (at from 15–20 fathoms) yields in rich profusion the various stony Polyzoa (*Lepralia, Membranipora, Cellepora*, &c.), while under the rocky shores the Vesiculariadæ abound; and in certain spots the *Halidrys* is taken up, festooned with the beautiful *Mimosella gracilis*, which has hitherto been found only on the western coast.

The Salcombe estuary, between Torbay and Plymouth (the favourite dredging-ground of Montagu), is also full of attractions for the zoophytologist. It is peculiarly rich in the Laminarian species,—a fine belt of weed edging its rocky shores, and including several large *Zostera*-beds. At the low spring-tides, it is also unsurpassed for shore-collecting. The finer Actiniæ occur in great plenty and splendour. A little way up the estuary there is a Scallop-bed, on which Membraniporidæ and some of the Cyclostomata abound. Plymouth Sound and Start Bay are likewise prolific hunting-grounds, while the rocky and precipitous shore in the neighbourhood of Dartmouth yields a rich harvest of Actiniæ.

Through the Brixham and Plymouth trawlers, acquaintance is readily made with the products of the Coralline zone. Their labours are chiefly carried on in about 30 fathoms' depth; and here the larger Sertularian zoophytes are taken up in immense quantity and of most luxuriant growth. The most characteristic species are *Sertularia argentea* and *abietina*, *Plumularia falcata*, *Laomedea longissima*, *Campanularia verticillata*, and *Coppinia arcta*. *Sertularia tamarisca* and *Antennularia antennina* are also abundant. *Plumularia myriophyllum* is of rarer occurrence, and so are *S. nigra* and *pinnata*. *Eschara foliacea* is brought up by the trawlers in great quantity at certain points, and *Gorgonia verrucosa* is common all along the coast at a depth of from 30–40 fathoms. The very rare *Caberea Boryi* belongs to this region, being frequently parasitic on the *Eschara*.

The materials which I have been able to obtain from still greater depths are but scanty. They consist almost entirely of *Pinnæ*, taken up in a range off the Deadman Point, from about 60 fathoms. They are thickly crusted with various species of *Lepralia* (*reticulata, trispinosa, linearis, variolosa, Malusii*, &c.), with *Alecto* and *Hippothoa*, *Diastopora*, and *Tubulipora* (*patina, hispida*, and *serpens*), and bear considerable numbers of the *Tubulipora penicillata*. *Plumularia Catherina* is also found upon them. I shall give a complete list of the species procured from this locality in another portion of this paper.

The wealth of the district now under consideration will be best appreciated if we compare the number of species included in this list with that contained in the largest local catalogue hitherto published. I refer to Mr. Alder's admirable work on the Zoophytes of Northumberland and Durham. This accomplished observer, by whose labours so many departments of natural history have been enriched, has published 164 species as occurring in his district; and this number greatly exceeds the highest contained in any previous list. In the present catalogue about 230 species will be enumerated (more than Dr. Johnston gives for the whole kingdom), of which a considerable number are either altogether new or new to the fauna of this country. The great deficiency in the North is amongst the Zoantharia, of which 10 only are recorded by Mr. Alder, against 37 in the present catalogue. But the West has also a very considerable majority of species both amongst the Hydrozoa and the Polyzoa.

The following Northern zoophytes appear to be wanting in our district:—*Sertularia fusca, S. fallax, S. filicula, Grammaria ramosa, Virgularia mirabilis, Menipea ternata, Cellularia Peachii, Bugula Murrayana, B. fastigiata, Flustra truncata, Carbasea papyrea,* and *Eschara cribraria.* It is hardly probable that any of these would have escaped detection, had they been present.

Amongst the prevalent and characteristic forms of the Western coast are the following:—*Coryne ramosa, Halecium Beanii, Sertularia Gayi, S. nigra, S. pinnata, Plumularia similis, Campanularia Hincksii, Laomedea gelatinosa, Gorgonia verrucosa, Caryophyllia Smithii, Balanophyllia regia, Hoplangia, Sagartia bellis, S. rosea, S. nivea, Bunodes gemmacea, Halcampa microps, Peachia hastata, Zoanthus Couchii, Z. sulcatus, Tubulipora phalangea, T. penicillata, Pustulipora deflexa, Beania mirabilis, Cellepora edax, Eschara foliacea, Membranipora Lacroixii, Lepralia Pallasiana, L. Gattyæ, L. adpressa, L. Cecilii, Scrupocellaria scrupea, Caberea Boryi, Flustra papyracea, Mimosella gracilis.*

Some of these are noted as being extremely abundant, others as having only occurred in the district, or as being confined to the south and west coasts.

As it is important to multiply data for determining the range of geographical distribution, I have inserted in the catalogue any localities for the different species which have come to my knowledge.

Several lists of Devon and Cornish Zoophytes have been printed, the most extensive being the one contained in Mr. Couch's 'Cornish Fauna,' published in 1838. In this work 124 species are recorded. In the 'Natural History of Torquay, Dawlish, and Teignmouth,' by Turton and Kingston, some species are enumerated; and there is a meagre list of about 60 in Bellamy's 'Natural History of South Devon' (1839). Dr. Johnston's 'History of British Zoophytes' contains a good many Devon habitats, chiefly supplied by Mrs. Griffiths and Mr. C.

W. Peach; and a few are given in Mr. Busk's 'Catalogue of Polyzoa.' For the Zoantharia the great authority is Mr. Gosse's 'Actinologia Britannica,' which furnishes a very large number of Western localities. I have availed myself of all these sources of information, so as to multiply the habitats as much as possible, and to include some species which had not come under my own observation.

With respect to classification, I have found myself unable to follow any single text-book. Dr. Johnston's work, admirable as it is, and valuable and attractive as it must always continue to be, has been left behind by the progress of science. Its classification is now obsolete.

I have followed Messrs. Frey and Leuckart, whose views are sustained by the authority of Prof. Huxley, in regarding the true Zoophytes as constituting, with the Acalephs, a new subkingdom—Cœlenterata—embracing two classes, the Hydrozoa and the Actinozoa. Of the former, four orders are included in this catalogue, which are adopted from Huxley's great work on the 'Oceanic Hydrozoa'—the Hydridæ, Corynidæ, Sertularidæ, and Lucernaridæ*. For the second of these the name *Tubularidæ* seems to me preferable, but the point is not of sufficient moment to be insisted upon.

Amongst the Sertularidæ I have retained the genus *Plumularia* as it stands in Dr. Johnston's work; but there can be little doubt that it ought to be dismembered, as suggested originally by Prof. E. Forbes. From *Campanularia* I have separated the small sessile or subsessile species (represented by *C. dumosa*) with densely corneous tubular cells, and have constituted the genus *Calicella* for their reception†.

In the classification and nomenclature of the Zoantharia I have followed Mr. Gosse‡, and for the Polyzoa have employed as a text-book Mr. Busk's admirable 'Catalogue,' the genera in which have been constituted after an extensive examination of foreign as well as British forms.

I must not omit this opportunity of acknowledging the valuable assistance which I have received from my friend Mr. Alder in the preparation of this catalogue. His extensive and accurate knowledge and remarkable skill in the discrimination of species have often been of essential service to me.

I am also much indebted to the zeal and intelligence of Mr.

* In conformity with the recognized principles of nomenclature, I have altered the termination of two of Prof. Huxley's ordinal names from *iadæ* into *idæ*.

† Rep. of Brit. Assoc. for 1858, p. 126.

‡ The excessive multiplication of genera in Mr. Gosse's beautiful work is much to be regretted.

William Laughrin, of Polperro, for the supply of many rare and interesting specimens. To collectors in the various departments of marine zoology I can recommend him as a most efficient ally.

Subkingdom *CŒLENTERATA.*

Class HYDROZOA.

Order **CORYNIDÆ**, Huxley. Fam. **Coryniadæ.**

1. Clava, Gmelin.

C. multicornis, Johnston.

Syn. *C. repens*, T. S. Wright, Edinb. New Phil. Journ. for July 1857.
C. discreta, Allman, Ann. & Mag. Nat. Hist. for November 1859.

Between tide-marks; commonly on stones.

Dr. T. Strethill Wright, in his valuable observations on *Clava* in the 'Edinb. New Phil. Journal,' has corrected the error of previous naturalists, who have universally described the polypes of this genus as naked and single. There is great diversity in the size of the cup-like extension of the polypary, which surrounds a portion of the polype-body. Frequently it is nothing more than a very delicate envelope which invests the base, and in this condition may readily escape detection. In other cases it rises to a considerable height, and forms a true hydrotheca, which covers a third or more of the body.

2. Vorticlava, Alder.

V. humilis, Alder, Catal. of the Zoophytes of Northumberland and Durham, 12, pl. 1. figs. 1–3.

Dredged on *Salicornaria* in Salcombe Bay.

A single polype only occurred. The number of the lower tentacles was nine. They seemed to be slightly enlarged above, though not truly capitate like those of the upper circle.

The *Corymorpha annulicornis* of Sars (Forhandl. i Vidensk. Selsk. i Christiania, 1859) may possibly prove to be a second species of this genus.

3. Hydractinia, Van Beneden.

H. echinata, Fleming.

On shells (*Buccinum* most frequently, *Trochus zizyphinus*, *Natica*); common.

4. Myriothela, Sars.

M. arctica, Sars.

Attached to stone, in a rock-pool at Meadfoot, Torquay.

I have only found one specimen; but Mr. Cocks speaks of the species as abundant in Cornwall.

The sporosacs are borne on polypoid supports (blastostyles), which are clustered about the lower part of the body, and exhibit what seem to be three or four rudimentary tentacles at the top. The base of the polype gives off a few radical prolongations, by which it is attached. Dr. Strethill Wright, I am informed by Mr. Alder, is inclined to believe that *Myriothela* possesses a polypary. I have little doubt that this is the case, as I have noticed an appearance as of some horn-coloured substance investing the base of the body.

5. Clavatella, Hincks.

C. prolifera, Hincks, Ann. & Mag. Nat. Hist. for Feb. 1861.

In the smaller rock-basins, between tide-marks, Torquay; not uncommon.

I find in my note-book a rough sketch of a polype obtained at Whitby, Yorkshire, in 1858, which I have little doubt was the *Clavatella.*

6. Coryne, Gaertner.

1. *C. ramosa,* Ehrenberg. Johnston, Brit. Zooph. pl. 6. figs. 4–7.

Syn. *Syncoryna Listerii,* Van Beneden.

In rock-pools between tide-marks; very common all along the west coast.

This species is a characteristic South-Devon form. Its favourite habitat is amongst the luxuriant vegetation which clothes the sides of the tide-pools, where it attains a great size, and, when laden with its rose-coloured gonophores, adds not a little to the beauty of their scenery. I have a specimen from Torbay which is nearly 4 inches in height.

2. *C. fruticosa,* n. sp. Plate VI. figs. 5, 6.

Polypary delicate, strongly annulated throughout, of a bright horn-colour, much branched; branches ringed throughout, constricted at their origin and widening upward, giving off short ramuli, and commonly folding together on one side of the stem, so as to present a somewhat secund appearance. Polypes elongate, swollen below, tapering and pointed above; tentacles not numerous, short, capitate extremities small, a verticil of about five immediately below the mouth, the rest scattered. Gonophores densely clustered chiefly about the lower part of the body, sessile, non-medusiferous, very large when mature.

This species, which only attains a height of less than half an inch, forms dense, clustered, bushy masses on *Fucus.* It is of very delicate habit, its stems being only about half the thickness of those of *C. ramosa.* Its polypes differ widely from those of the latter species, which are cylindrical, of great length, and furnished with very numerous tentacles.

Exmouth, on *Fucus*. [Mount's Bay, on the same.]

3. *C. Cerberus*, Gosse, Devonshire Coast, 222, pl. 14. fig. 4, &c.

Torquay. This minute species was found by Mr. Gosse in a glass jar containing Actiniæ, &c., brought from Torquay. Judging from the character and disposition of the tentacles, it should probably be referred to the genus *Stauridia*.

Family **Tubulariadæ**.

1. Eudendrium, Ehrenberg.

1. *E. ramosum*, Linn.

Torbay and Salcombe, dredged on other zoophytes; amongst the refuse of the Plymouth trawlers, sparingly.

2. *E. capillare*, Alder, Northumb. and Durham Catal. 15, pl. 1. figs. 9–12.

Torbay, dredged on *Sertularia argentea*. Mr. Alder has also obtained it from Plymouth.

3. *E. insigne*, n. sp.

Polypary minute, slender, closely ringed throughout, giving off occasionally a short branch also annulated. Polype very large and tall; body somewhat vase-shaped, very opake, reddish; tentacles about 20. Gonophores produced towards the base of the body, globose, on short stalks, of an orange-colour. Height about a quarter of an inch.

Hope's Nose, Torquay, on rocks between tide-marks, rooted in a mass of sponge.

I know of no species to which the above form can be referred, and have therefore ventured to describe it as new, though it has only occurred to me once. The characters are sufficiently distinctive. The stem is regularly annulated, like that of a *Coryne*, throughout its entire length. The branching is of the simplest kind. The polypes are remarkable for their size and splendour, being much larger and more striking than those of *E. ramosum*. The body is of a pretty shape, and very opake. There seems to be a membranous extension of the polypary, forming a shallow cup round the base of the polypes.

In one of the specimens I noticed two orange gonophores, placed as described above. In this case the polype itself had almost disappeared. The diminutive size and the littoral habitat are also distinctive points.

2. Atractylis, T. S. Wright.

A. ramosa, Van Beneden.

Torbay, dredged.

This species, figured by Van Beneden ('Recherches sur les Tubulaires') under the name of *Eudendrium ramosum,* has a coarse compound stem, is much branched, and sometimes attains a height of about 3 inches. The ends of the branches are dilated; but the cup is very frail, and soon disappears after the death of the polype.

A form has occurred to me at Llandudno, on the Welsh coast, having a simple stem, of humbler size and less branched than the above, with a well-marked cup at the extremity of the branches, and bearing here and there elongate bodies, supported on separate ramuli. The polype has from 10–12 tentacles.

I am unable at present to decide whether these two forms are referable to the same species.

3. Bimeria, T. S. Wright.

B. vestita, Wright, Edinb. New Phil. Journ. for July 1859.

Syn. *Manicella fusca,* Allman, Ann. & Mag. Nat. Hist. for July 1859.

Torbay and Salcombe, dredged, on other zoophytes; not uncommon. [Whitby, Yorkshire.]

4. Tubularia, Linnæus.

1. *T. indivisa,* Linn.

Common, between tide-marks and from deep water.

2. *T. Dumortierii,* Van Beneden.

Salcombe Bay, dredged; rare.

I do not feel very certain about this species. I have referred to it a very beautiful *Tubularia,* the tubes of which are single, slender, light-coloured, and rise here and there from a mass of sponge.

3. *T. larynx,* Ellis.

Common under stones, in rock-pools.

4. *T. gracilis,* Harvey.

Dartmouth, on the chain of the steam bridge; Devonport, in a similar situation (*J. B. Harvey*).

The British *Tubulariæ* require further examination and more accurate discrimination. There are, I believe, several undescribed species.

5. Corymorpha, Sars.

C. nutans, Sars.

A single specimen of a *Corymorpha* was obtained some years ago by Mr. Alder at Fowey, Cornwall, which he has allowed me to examine. It is very inferior in size to the *C. nutans* of Sars, and the number of tentacles is somewhat smaller; but in all other points it agrees with that species.

[To be continued.]

EXPLANATION OF PLATE VI.

Figs. 1–4. *Halecium tenellum*, natural size and magnified.
Figs. 5, 6. *Coryne fruticosa*, magnified.
Figs. 7, 8. *Sertularia fusiformis*, natural size and magnified: 7 *a*, gonotheca magnified.

XVII.—*On the Nomenclature of the* Foraminifera.

By W. K. Parker, M. Micr. Soc., and T. R. Jones, F.G.S.

[Continued from vol. vi. p. 347.]

Part. VI. *Alveolina.*

The nomenclature of this genus serves to illustrate the confusion of terms in which these and others of the *Foraminifera* have been entangled. Deshayes and D'Orbigny have each given an account, but the following history is fuller and more complete.

Fortis* and Deluc† wrote of fossil *Alveolinæ* about the same time (1801 and 1802). The former figured and described three varieties (from Gerona, Roussillon, and Grignon), and treated of them as members of his comprehensive group *Discolithus* (*Disc.* xi, xi *a*, & xi *b*). Deluc described and figured one from Bengal ‡ and one from Grignon §, and remarked that they must be varieties of one species, which he referred to as "le petit fossile ovoïde à côtes de melon."

In 1802, a short paper appeared in the 'Bullet. des Sciences Soc. Philom.' no. 61. p. 99, signed C. V., noticing two minute shells which Bosc had found in calcareous sandstone near the village of Auvert (or Anvers), near Pontoise, in the valley of the Oise, and which he referred to Lamarck's *Alveolites* (a genus of Corals, instituted in 1801). These are named ‖ respectively "Alvéolite grain de fétuque" ¶ and "Al. grain de millet." The

* Journ. de Phys. vol. lii. p. 106 &c. pl. 2. figs. 7, 8, 9, 1801; and Mémoire sur les Discolithes, 1802, in the Mém. Hist. Nat. Italie, vol. ii. p. 112 &c. pl. 3. figs. 6–11, pl. 4. fig. 4. In 1770, Guettard figured what appears to be a spheroidal *Alveolina* (Mémoires sur diff. part. des Sciences et Arts, vol. iii. p. 430, pl. 12. fig. 15), under the name of "Madrépore globulaire feuillé."

† Journ. de Physique, 1802, vol. liv. p. 176 &c. pl. 1. figs. 11–14.

‡ *Alveolina ovoidea*, D'Orb. § *Alveolina Boscii*, Defr.

‖ See also Bosc's Hist. Nat. Coq. 1802 (Buffon de Déterville), and his article "Alvéolite" in the 'Nouveau Dict. Hist. Nat.' 1816.

¶ The figure given of this was subsequently referred to by Brongniart (1822), in Cuvier's 'Ossemens Fossiles,' ii. p. 270, as *Alveolites Milium*, Bosc. It ought to be *A. Festuca*, the other being *A. Milium*.

figures accompanying the note show that the former (pl. 5. fig. 3) is a fusiform *Alveolina*, the latter (fig. 4, very bad) being possibly a shorter and thicker ovoidal *Alveolina* (although Defrance refers to it subsequently as being his *Fabularia discolithes*). These are noticed by G. L. Duvernoy in the 'Dict. Sc. Nat.' 1816, vol. i. p. 557, in the article "Alvéolite," where the *Alveolites* of Bosc are still confounded with Lamarck's genus of Corals of the same name. In the Supplement to the same volume (article "Alvéolites," p. 136), Defrance observes that "l'espèce à grain de fétuque" is Fortis's *Discolithus** xi *b*, and that Fortis's *Disc.* xi *a*, from Vendemiers in Roussillon, is a larger form. Defrance here states that both the foregoing and the "Alvéolite grain de millet" occur abundantly near Paris, in the "calcaire coquillier grossier," at Grignon, Montrouge, Meudon, Valognes, and Courtagnon, and at Chaumont also; but here the "Al. grain de fétuque" is the biggest, the other being very small. He adds, provisionally, another species (*Alveolites Larva*), from Valognes, smooth, pointed at the ends, and sometimes 18 millimetres (8 lines) in length. In 1820 (Dict. Sc. Nat. vol. xvi. pp. 103, 104), Defrance separated the so-called "Alvéolites" of Bosc from Lamarck's genus of Corals, and named one of them (grain de fétuque) "Oryzaire-Bosc" (*Oryzaria Boscii*), and the other (grain de millet) "Fabulaire-discolithe" (*Fabularia discolithes*†). The type of the latter‡ he had from Grignon, and a variety from Valognes; and from Chaumont he had another, which he named "Fabulaire sphéroïde."

In 1803, Fichtel and Moll § figured and described two fossil forms (from Austria and Hungary), which they termed *Nautilus Melo*, α and β.

In 1808, De Montfort || published new generic and specific names (*Borelis melonoides* and *Clausulus Indicator*) for the two varieties figured by Fichtel and Moll, and a binomial appellation (*Miliolites sabulosus*) for the fossil fusiform variety common at Grignon.

* Fortis's term "Discolithus" has been generally overlooked by naturalists, and the French form of the plural, "Discolithes," misused for it.

† This is the *Discolithus* ix. of Fortis (*op. cit.* p. 109, pl. 2. fig. Z); and, as it was named *Nummulites ovata* by De Roissy in 1804 (Hist. Nat. Mollusques, Suite de Buffon, vol. v. p. 59), it had already a specific name.

‡ From the published figures given by De Blainville and D'Orbigny, we know the species that Defrance here refers to. Bosc's "Alvéolite grain de millet" (Bullet. Soc. Philom. no. 61. pl. 5. fig. 4) is most probably an ovoidal *Alveolina*.

§ Test. Microscop. &c.; see Annals of Natural History, 3rd ser. v. p. 182.

|| Conchyliolog. Systémat.; see Ann. Nat. Hist. 3rd ser. vi. p. 342.

In 1811, Parkinson * figured and described a fossil *Alveolina* under the generic name of *Fasciolites* †.

In 1812, Lamarck ‡, taking no account of Montfort's genera, and without referring to others, gave the genus the name of *Melonites*, using Fichtel and Moll's figures as the base of his observations. In 1816 (Encycl. Méth. descript. plates) *Melonites* was again used by Lamarck, and both *Melonia* and *Melonites* appear in 1822 (Hist. Nat. Anim. s. Vert. vii.), Lamarck's two species standing as *M. sphærica* and *M. sphæroidea*. *Melonia* (Mélonie), provisionally established for such recent members of the group as might turn up (according to Lamarck's nomenclatorial plan), was sometimes confounded with Montfort's *Melonis* (also "Mélonie"), especially as De Blainville, besides adopting Lamarck's "Melonia" (Dict. Sc. Nat. 1824, vol. xxxii. p. 176), misprinted "Melonia" for "Melonis" (Dict. Sc. Nat. 1824, vol. xxx. p. 17). Cuvier also (reuniting Montfort's three genera) and others followed Lamarck. Deshayes used "Melonia" in the 'Dict. Class. Hist. Nat.' 1826, vol. x. p. 350, and in the continuation of the 'Hist. Nat. Vers' (Encycl. Méthod. vol. iii.), 1830.

In 1826, D'Orbigny §, endeavouring to reduce the then existing chaos to order, went back to the oldest definite name, namely "Alveolites;" and, modifying its termination, both to distinguish it from that of Lamarck's Coral, and to match it with the majority of the names of *Foraminifera*, especially such as have recent representatives (according to Lamarck's plan), he adopted it under the form of *Alveolina*, and arranged under it seven specific forms (six fossil and one recent), with their synonymy.

In 1828, Deshayes ||, in a paper on the *Alveolinæ*, describing five species, and in the 'Encycl. Méthod.' vol. ii. (1830), published in full for the most part what D'Orbigny had given in abstract, adopting D'Orbigny's term *Alveolina*.

In 1846, D'Orbigny ¶ states that he had then seen nine species of *Alveolina*, two of which were living (New Holland and Cuba), and seven were fossil. Of the latter the majority were from the Tertiary beds of Paris, Bordeaux, the Pyrenees, and Austria, one

* Organic Remains of a Former World, vol. iii. p. 158, pl. 10. figs. 28–31; also in his 'Outlines of Oryctology,' 1822.

† The same as *Alveolina oblonga*, D'Orb., and *Melonia Fortisii*, Desh.

‡ Extrait de son Cours de Zoologie, &c., par M. Delamarck. We have inadvertently omitted to notice this work in our Monograph on the Lamarckian Species of *Foraminifera* in the Annals Nat. Hist. 3rd ser. vol. v. and vol. vi.

§ Annales des Sc. Nat. 1826, vii. p. 306.

|| Annales des Sc. Nat. 1828, xiv. p. 230.

¶ Foram. Fossiles du Bassin Tertiaire de Vienne, p. 143, &c.

only having been found in the Lower Chalk (Craie chloritée inférieure—l'étage Turonien) at the mouth of the Gironde.

In Bronn's 'Leth. Geognost.' 3rd edit. vol. iii., we find another elaboration of the nomenclature of this genus. Objecting to "Discolithus," "Alveolites," and "Alveolina," Bronn follows Ehrenberg in adopting Montfort's term "Borelis" (which we regard as unnecessary); and, with the four species described in the 'Lethæa,' the synonymy is abundant. D'Archiac and Haime also give the synonymy of three species (Fossiles de l'Inde, 1853, p. 348, &c.).

The following is a still more complete synopsis of the chief known varieties of *Alveolina.*

1. Nautiloid, discoidal, much-compressed variety. *Alveolina Rotella,* D'Orb.

1846. Orbiculina Rotella, *D'Orb.* For. Foss. Vienn. p. 140, pl. 7. figs. 13, 14. D'Orbigny himself notices the marked difference between this and the known *Orbiculinæ* in the style of its spiral growth and its outer border.

2. Spherical and oblate-spheroidal variety. *Alveolina Melo,* var. *a,* F. & M.

1802. Discolithus XI., *Fortis,* Mém. ii. p. 112, pl. 3. figs. 6, 7; pl. 4. fig. 4.
1803. Nautilus Melo, var. *a, F. & M.* Test. Micr. p. 118, pl. 24. figs. *a–f.*
1808. Clausulus Indicator, *De Montf.* Conch. Syst. i. p. 178.
1816. Melonites sphærica, *Lamarck,* Encycl. Méth. pl. 469. fig. 1 *a–f.*
1824. Melonia sphærica, *Blainville,* Dict. Sc. Nat. xxxii. p. 176, Conch. pl. 15. fig. 2.
1826. Alveolina Melo, *D'Orb.* Ann. Sc. Nat. vii. p. 306. no. 2.
1828. Alveolina Melo, *Desh.* Ann. Sc. Nat. xiv. p. 230.
1846. Alveolina Melo, *D'Orb.* Foram. Foss. Bassin Vienne, p. 147, pl. 7. figs. 15, 16.
1853. Alveolina Melo, *Carter,* Journ. Bombay Asiat. Soc. v. p. 134, pl. 2. fig. 15.
1853. Alveolina Melo, *D'Arch. & H.* Foss. de l'Inde, p. 348.

3. Prolately spheroidal variety. *Alveolina Melo,* var. *β,* F. & M.

1803. Nautilus Melo, var. *β, F. & M.* Test. Micr. p. 118, pl. 24. figs. *g, h.*
1808. Borelis melonoïdes, *De Montf.* Conch. Syst. i. p. 170.
1816. Melonites sphæroidea, *Lam.* Encycl. Méth. pl. 469. fig. 1 *g, h.*
1824. Melonia sphæroidea, *Blainv.* Dict. Sc. Nat. xxxii. p. 176, Conch. pl. 15. fig. 3.
1826. Alveolina Melo, *D'Orb.* Ann. Sc. Nat. vii. p. 306. no. 2.
1828. Alveolina Melo, *Desh.* Ann. Sc. Nat. xiv. p. 230.
1838. Melonia costulata, *Eichwald,* Zool. Spec. ii.; Viln. pl. 2. fig. 1.
1839. Alveolina pulchra, *D'Orb.* Foram. Cuba, pl. 8. figs. 19, 20.
1842. Melonia (Borelis) sphæroidea, *Ehrenb.* Monatsber. Akad. Wiss. 1842, p. 274.
1846. Alveolina Hauerii, *D'Orb.* Foram. Foss. Vienn. p. 148, pl. 7. figs. 17, 18.
1848. Alveolina subpyrenaica, var. globosa, *Leym.* Mém. Soc. Géol. France, 2 sér. i. p. 360, pl. 13. fig. 10.
1853. Alveolina sphæroidea, *Carter,* Journ. Bombay Asiat. Soc. v. p. 134, pl. 2. fig. 16.
1853. Alveolina sphæroidea, *D'Arch. & H.* Foss. de l'Inde, p. 348.

1853. Alveolina costulata, *Eichwald,* Leth. Rossica, Dern. Période, p. 8, pl. 1. fig. 4.
1854. Borelis sphæroidea?, *Ehrenb.* Mikrogeol. pl. 37 D. figs. 1-3.
1854. Borelis (Melonia) Melo, *Ehrenb.* Mikrogeol. pl. 37, 10. fig. 1.

Nos. 2 and 3 cannot be at all distinctly separated, the variation being so slight. They should be united (as Fichtel and Moll as well as D'Orbigny had them) under the one term "Alveolina Melo."

4. Elongate-oval variety. *Alveolina ovoïdea,* D'Orb.

1802. *Deluc,* Journ. Phys. liv. p. 179, pl. 1. figs. 11, 12.
1802. Discolithus XI. *a, Fortis,* Mém. ii. p. 113, pl. 3. figs. 8, 9.
1811. Fasciolites, *Parkinson,* Org. Rem. iii. p. 158, pl. 10. figs. 28-31.
1826. Alveolina ovoïdea, *D'Orb.* Ann. Sc. Nat. vii. p. 306. no. 3.
1826. Alveolina oblonga, *D'Orb.* Ann. Sc. Nat. vii. p. 306. no. 4.
1826. Alveolina Fortisii, *Desh.* Dict. Class. Hist. Nat. x. p. 352.
1828. Alveolina oblonga, *Desh.* Ann. Sc. Nat. xiv. p. 232.
1840. Fasciolites elliptica, *Sow.* Trans. Geol. Soc. Lond. 2 ser. v. p. 329 &c., pl. 24. figs. 17, 17 *a.*
1846. Alveolina subpyrenaica, *Leym.* Mém. Soc. Géol. France, 2e sér. i. p. 360, pl. 13. fig. 9.
1853. Alveolina elliptica, *D'Archiac,* Hist. Prog. Géol. iii. p. 245.
1853. Alveolina elliptica, *Carter,* Journ. Bombay Asiat. Soc. v. p. 134, pl. 2. fig. 17.
1853. Alveolina ovoidea, *D'Arch. & H.* Foss. de l'Inde, p. 349.

5. Fusiform variety. *Alveolina sabulosa,* Montf.

1802. *Deluc,* Journ. Phys. liv. p. 179, pl. 1. figs. 13, 14.
1802. Discolithus XI. *b, Fortis,* Mém. ii. p. 114, pl. 3. figs. 10, 11.
1802. Alvéolite grain de fétuque, *Bosc,* Bullet. Sc. Nat. Philom. Soc. no. 61. pl. 5. fig. 3.
1808. Miliolites sabulosus, *De Montfort,* Conch. Syst. i. p. 174.
1820. Oryzaria Boscii, *Defrance,* Dict. Sc. Nat. xvi. p. 104.
1822. Alveolites Milium, *Brongn.* Cuvier's Ossem. Foss. ii. p. 270.
1826. Alveolina Boscii, *D'Orb.* Ann. Sc. Nat. vii. p. 306. no. 5.
1826. Melonia Boscii, *Desh.* Dict. Class. Hist. Nat. x. p. 352.
1828. Alveolina Boscii, *Desh.* Ann. Sc. Nat. xiv. p. 233.

6. Cylindrical or subcylindrical variety. *Alveolina elongata,* D'Orb.

1816. ?Alveolites Larva, *Defrance,* Dict. Sc. Nat. i. p. 137.
1826. Alveolina elongata, *D'Orb.* Ann. Sc. Nat. vii. p. 307. no. 6.
1826. Alveolina Quoii, *D'Orb.* Ann. Sc. Nat. vii. p. 307. no. 7.
1828. Alveolina elongata, *Desh.* Ann. Sc. Nat. xiv. p. 234.
1828. Alveolina Quoii, *Desh.* Ann. Sc. Nat. xiv. p. 234.

Besides the above-noticed varieties of *Alveolina,* which are both recent and of Tertiary age, there are some very interesting varieties occurring in the Carboniferous Limestone, of Palæozoic age. These belong to the genus *Fusulina,* proposed by G. Fischer de Waldheim for some fusiform Foraminifers occurring in great abundance in the white Carboniferous Limestone of Russia*.

* Oryctograph. Moscou, p. 126, pl. 13. figs. 1-11.

1830. Fusulina cylindrica, *Fischer*, Oryctographie du Gouvernem. de Moscou, p. 17, pl. 13. figs. 1–5.
1830. Fusulina depressa, *Fischer*, ibid. figs. 6–11.
1845. Fusulina cylindrica, *D'Orb.* Géol. Russ. ii. (Palæont.) p. 15, pl. 1. fig. 1.
1846. Fusulina cylindrica, *D'Orb.* Foram. Foss. Vienne, p. 112, pl. 21. figs. 15–17.
1859. Fusulina cylindrica, *Eichw.* Leth. Rossica, 5th livr. p. 349.

In the 'Geology of Russia and the Ural Mountains,' vol. ii. p. 15, pl. 1. fig. 1, D'Orbigny figured and described the *Fusulina cylindrica*, and again in his 'Foram. Foss. Vienn.' p. 112, pl. 21. figs. 15–17; and it may be noticed that the figures show a remarkable longitudinal, slit-like septal aperture, and that his description also points to a Nonionine style of shell.

In his great work * on fossil microscopic remains, Ehrenberg has illustrated several varieties of *Alveolina* from the Carboniferous Limestone of Russia under the generic names "Alveolina" (the fusiform varieties) and "Borelis" (the more globular forms): most of these he recognized in 1842 and 1843 †, comparing them with the *Melonia sphæroidea* of Blainville; and he stated also that *Fusulina* was a closely allied shell (Bericht. 1842, p. 274). He has also, in the 'Mikrogeologie,' figured several natural siliceous casts of a shell, which he also terms "Alveolina" and "Borelis," according to their fusiform or spherical shapes, but which at first sight appear to belong to a Nonionine Foraminifer, such as D'Orbigny described his "Fusulina" to be. These casts indicate the presence of a large slit-like aperture in the shells to which they belonged; and the lateral portions of the chambers taper off more or less rapidly. Of this Nonionine form Ehrenberg's figures illustrate five varieties, namely—

1. Alveolina prisca, *Ehrenb.* Mikrogeol. pl. 37. XI. figs. 1, 2 (the shell of the *Alveolina* of this name is also figured on the same plate).
2. Borelis labyrinthiformis, *Ehrenb.* Monatsb. Berlin, 1843, p. 106; Mikrogeol. pl. 37. XI. fig. 3.
3. Borelis Palæolophus, *Ehrenb.* Mikrogeol. pl. 37. XI. figs. 4, 5.
4. Borelis Palæophacus, *Ehrenb.* Mikrogeol. pl. 37. XI. fig. 6.
5. Borelis Palæosphæra, *Ehrenb.* Mikrogeol. pl. 37. XI. figs. 7, 8.

Four of these vary merely in the gradually greater compression of the shell (their order, if arranged according to the amount of compression, being fig. 1, fig. 7, fig. 6, and fig. 4).

Ehrenberg's Alveoline shells from the Carboniferous Limestone are—

1. Borelis princeps, *Ehrenb.* Monatsb. Berlin, 1842, p. 274; Mikrogeol. pl. 37. X. C. figs. 1–4.

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* Mikrogeologie, von C. G. Ehrenberg. fol. Leipzig, 1854.
† Monatsberichte Akad. Wissensch. Berlin, 1842, p. 273; 1843, p. 105.

2. Alveolina montipara, *Ehrenb.* Mikrogeol. pl. 37. x. c. figs. 5, 6.
3. Borelis sphæroidea?, *Ehrenb.* Monatsb. Berlin, 1842, p. 274; Mikrogeol. pl. 37. x. d. figs. 1–4.
4. Borelis constricta, *Ehrenb.* Monatsb. Berlin, 1842, p. 274; Mikrogeol. pl. 37. x. d. figs. 5, 6.
5. Alveolina prisca, *Ehrenb.* Monatsb. Berlin, 1842, p. 274; Mikrogeol. pl. 37. x. d. figs. 7–9.

Nos. 2 and 5 differ from the others in being fusiform. No. 4 appears to be the same as the *Fusulina Hyperborea,* Salter, Belcher's Arctic Voyage, 1855, ii. p. 380, pl. 36. figs. 1–3.

We have examined (with the assistance of Mr. George West) the structure of some Russian specimens equivalent to No. 3, and find them to be really *Alveolinæ,* but having the following interesting features, which Mr. G. West, who so well knows the characters of *Alveolina,* having worked with Dr. Carpenter on that subject, recognized and pointed out to us. In this palæozoic *Alveolina* the chambers have a *simple* character as compared with those of the recent *Alveolina*: the transversely long chambers are divided, by comparatively few secondary septa, into rather large compartments, the gibbous roofs of which give a faintly nodular appearance to the surface of the shell; whilst the recent *Alveolina* (see Dr. Carpenter's Monograph on this species, Phil. Trans. 1856, pl. 28. fig. 23) has its chambers divided into very numerous narrow oblong cells, giving a striated appearance to the shell. An analogous difference in structure is observed (as Mr. G. West has also remarked to us) between the simple and the compound *Orbitolites,* as is well shown in Dr. Carpenter's Monograph on the *Orbitolites* in the Phil. Trans. 1856, pl. 5. figs. 1 & 6.

In some shells the septal apertures may be seen obscurely as minute round openings; but in other individuals the principal aperture of the middle chambers forms a slit-like opening, as shown by D'Orbigny. If the casts figured by Ehrenberg bore small offshoots on the casts of the lateral portions of the chambers, answering to intercommunicating passages, they would then appear to correspond more exactly to the interior of these curious *Alveolinæ* than they now do.

Another old *Alveolina* is Ehrenberg's *Borelis* (*Melonia*) *sphæroidea* (Monatsbericht. Berlin, 1843, p. 105; and Mikrogeol. pl. 37. ix. a. figs. 1–3), obtained by him from the yellow "Melonien-Jurakalk" of the Kaiserstuhl, Baden. In this specimen the figured sections are those of the *simple* form; but the exterior has much of the aspect of a compound *Alveolina.* The recent *Alveolina Melo* (from Karst, near Trieste) is figured, for comparison, in the 'Mikrogeologie,' pl. 37. 10. fig. 1 *a–f*, under the name of *Borelis* (*Melonia*) *Melo*.

All the *Alveolinæ*, recent and fossil, that we have yet seen present but one specific characterization in their structure, however much their external form may vary in shape from round to cylindrical, or in size from the dimensions of a grain of sand to one or more inches in length. For nomenclatorial purposes the first-established specific appellation, accompanied by varietal names, will serve well—*Alveolina Melo*, varr. *sabulosa*, *elongata*, &c. For particulars as to its structure we refer the reader to Dr. Carpenter's Monograph on *Alveolina* in Phil. Trans. 1856.

XVIII.—*Notes on the Hydroid Zoophytes*. By Prof. Allman.

1. *On the Locomotive Sexual Zooid of* Dicoryne conferta.

In the 'Annals of Natural History' for November 1859 I described, under the name of *Dicoryne*, a new genus of Tubularidan Zoophytes, assigning to the species on which I founded the genus the name of *stricta*.

Since then, Mr. Alder has obtained perfect specimens of a zoophyte which in his valuable "Catalogue of the Zoophytes of Northumberland and Durham" he had previously described under the name of *Eudendrium confertum*, and has satisfied himself that my *Dicoryne stricta* is identical with the *Eudendrium confertum* of that work.

Having recently seen, in the possession of Dr. Strethill Wright, specimens of the *Eudendrium confertum* sent to him by Mr. Alder, I have no hesitation in assenting to Mr. Alder's view of the identity of the two animals—an identity which I did not before recognize in consequence of the original description and figure of *Eudendrium confertum* having been apparently given from imperfect specimens, as no notice is taken in them of the very characteristic proliferous polypes (*Gonoblastidia*, Huxley).

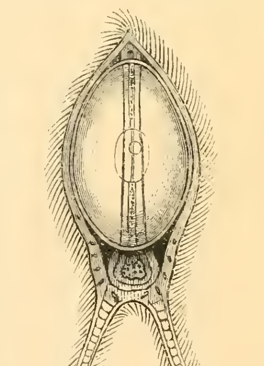
While, however, there can be no question as to the validity of the genus *Dicoryne*, the specific name of *stricta* which I gave to the zoophyte must be abandoned, and that of *conferta*, which had been assigned to it by Mr. Alder, its discoverer and original describer, retained.

When I published an account of this remarkable genus, I had seen only male specimens; since then, however, female individuals have fallen into my hands, and I have been enabled to make a more complete investigation of the structure of the gonophores and of the phenomena connected with the sexual reproduction of the zoophyte.

The gonophores of *Dicoryne* are, as I have already described (*loc. cit.*), borne upon peculiar polypes destitute of tentacula and mouth. They are of an oval shape, shortly pedunculated, and grouped in clusters of from about 10 to 20 or more in each. The male and female are similar in form. They consist of an external sac (ectotheca*), within which is a second sac (endotheca) containing the ova or spermatozoa, and with a long simple spadix occupying its axis. Immediately behind the endotheca, and between it and the ectotheca, two tentaculum-like processes are given off exactly opposite to one another; and these, continuing to lie between the two membranes, run forward for some distance towards the summit of the gonophore. No mesotheca is developed.

When the gonophore attains maturity, the ectotheca bursts, and the endothecal sac, separating itself from the peduncle just behind the two tentacular processes, escapes into the surrounding water, leaving the torn ectotheca attached to the summit of the peduncle.

The body thus set at liberty is a sexual zooid of an exceedingly singular kind, and, so far as we yet know, without any exact parallel. Immediately on acquiring its freedom it throws back its two tentacles, which had been previously turned forward as they lay impacted between the ectotheca and endotheca of the gonophore, and which now becoming extended to two or three times their former length, diverge from the posterior extremity of the liberated zooid. Its form is that of an oval, pointed at one end (anteriorly) and truncated at the other (posteriorly), so as somewhat to resemble the front view of a mitre, and with the two tentacles diverging from the truncated extremity. Anteriorly it consists of a spacious sac, which is occupied by the generative elements surrounding a long spadix which extends through the entire axis of the sac, impinging upon its summit and there remaining adherent to its walls; while posteriorly the zooid becomes more contracted, and into this part the sac does not extend. The whole body is covered with long cilia, which



* For an explanation of the terminology employed in the present paper, I must refer to my "Note on the Structure and Terminology of the Reproductive System in the Corynidæ and Sertulariadæ," published in the 'Annals of Natural History' for July 1860.

extend even to the extremities of the two tentacles, and by whose aid the zooid swims actively in the surrounding water.

The endoderm of the tentacles presents very distinctly the septate condition so frequent in the tentacles of the Hydrozoa; and by carefully managed compression this peculiar structure can be plainly seen to be continuous with a similar one in the endoderm of the spadix, where, however, it is looser and less regular, and does not encroach upon the central cavity. The cavity of the spadix is lined with a thick glandular layer whose cells are filled with reddish-brown matter.

In the male zooids the spadix is surrounded by a continuous mass of spermatozoa; in the female, the place of the spermatozoa is occupied by ova, which are invariably two in number, and are placed one on each side of the spadix, and in such a position that only one is visible when the zooid is viewed in the plane of the two tentacles.

The spermatozoa are caudate corpuscles, the corpuscle having the form of a cone, with a broader base than is usual among the Hydrozoa.

The ova present a well-defined germinal vesicle, in which a germinal spot is visible or may be easily rendered so by slight compression. They are invested by a proper membrane, which is remarkably thick and richly studded with thread-cells—a character of which I am not aware of any other instance among the Hydrozoa.

The sac which contains the generative elements is simply the endotheca of the original gonophore; its walls contain abundance of thread-cells. The narrow posterior portion from which the tentacles spring represents the base of the manubrium, with the ectoderm and endoderm not separated from one another by the intervention of ova or spermatozoa.

The sexual zooid of *Dicoryne conferta* always swims with its body in a vertical position, carrying the posterior or tentacular extremity uppermost, and maintaining all the time a constant rotation on its longer or vertical axis.

If we now compare the sexual zooid of *Dicoryne conferta* with the medusoid of other species, we shall find that it corresponds exactly to an ordinary medusoid reduced to the manubrium, but having the place of the umbrella occupied by two tentacles. The tentacles themselves are, I believe, the representatives of the radiating canals of the medusoid. It will be recollected that they are turned forward while the zooid is still enveloped by the ectotheca; and it may also be borne in mind that in certain medusoids, as those, for example, of *Laomedea dichotoma,* the umbrella is frequently inverted and thrown back, so as to assume the position of the tentacula in the free zooid of *Di-*

coryne. In order, then, to convert this zooid into a medusoid, little more is necessary than to suppose the number of the tentacles increased to four by the symmetrical development of two others, their extremities connected by a circular canal, and their sides by a continuous muscular membrane (umbrella).

Besides medusoids and the body now described, the only other form of locomotive zooid with which I am acquainted among the Phytoidal Hydrozoa is one recently described by the Rev. T. Hincks (Ann. Nat. Hist. Feb. 1861, p. 74) as being produced by *Clavatella*, a Tubularidan zoophyte discovered by him on the south coast of England. Mr. Hincks has made *Clavatella* and its zooid the subject of a beautiful memoir, and has shown that the zooid is identical with the *Eleutheria* of De Quatrefages.

It will at once be seen that the sexual and locomotive zooid of *Dicoryne* is very different from that of *Clavatella*; for while the latter in its development and structure, as shown by Mr. Hincks, is closely related to a digestive polype, the zooid of *Dicoryne* has manifestly a nearer relation to a medusoid.

2. *Corymbogonium capillare*, Alder.

Mr. Alder, in his Catalogue, describes and figures a new zoophyte under the name of *Eudendrium capillare*. The description and figure there given are amply sufficient for all purposes of identification; but as the specimen from which the characters were drawn was preserved in spirit, it was impossible to render them as complete as if the author had been in possession of the living animal.

An opportunity has recently been afforded me of examining the zoophyte in a living state, having obtained it in small quantities in May last, while dredging in the Firth of Forth; and I have thus been enabled to supply some deficiencies which must necessarily exist in descriptions drawn up from spirit-specimens alone.

I have further been compelled to separate this zoophyte from the genus *Eudendrium*, in which it had been placed by Mr. Alder, and to construct for it a new one, for which I would propose the name of *Corymbogonium*, and which may be defined as follows:—

Corymbogonium, mihi.

Polypes with a single verticil of filiform tentacula. Gonophores (male)* in umbelliform clusters on the extremities of separate non-polypiferous branches; bilocular. Polypary investing the whole of the stems and branches of the cœnosarc.

Name.—From κόρυμβος, a cluster of berries; γόνος, offspring.

* I have seen no female specimens; and Mr. Alder makes no mention of the sex of the specimen described by him.

C. capillare, Alder.

Zoophyte erect, rising to half or three-quarters of an inch in height from a creeping radicular tube; much and irregularly branched; branches of equal thickness with the main stems, capillary, ringed at their origin; branches which carry the gonophores short, lateral or else springing from the creeping basal tube. Polypes with about 24 or 26 tentacula. Gonophores pure white. Polypes light brown, becoming darker and more opake in the older parts.

The general character of the polypes, cœnosarc, and polypary of the present zoophyte is that of the genus *Eudendrium*. The remarkable umbelliform clusters, however, in which the gonophores are borne on the summits of non-polypiferous branches, afford a character whose importance cannot be neglected, and which renders it necessary to separate from that genus the subject of the present communication.

The whole zoophyte is very minute, and may in consequence be easily overlooked. The only specimens I obtained were attached to a piece of *Delesseria sanguinea* brought up in the dredge from a depth of about four fathoms. They adhered to the fronds of the Alga by a creeping, branched and anastomosing radicular tube.

The male gonophores (no specimens of the female having yet been seen by me) are supported each on a short peduncle.

The umbel-like clusters in which they are grouped have been fully noticed by Mr. Alder; they contain usually from ten to fifteen gonophores in each cluster. The ramuli on whose extremities they are borne are shorter than the fully-developed polypiferous ramuli, and arise further back than these, springing either from the principal branches or directly from the radicular tube.

The ramuli which thus carry the gonophores contain an extension of the cœnosarc, which becomes naked at their extremities and there enlarges into a common basis for the support of the cluster. This enlarged basis, though entirely destitute of mouth and tentacles, is manifestly the representative of a polype, and corresponds to the gonoblastidia of *Dicoryne*.

The structure of the gonophore is remarkable. Its peculiar moniliform shape has been noticed by Mr. Alder. At first this body is in the form of a spherical sac raised on a short peduncle. It contains a large simple spadix, which occupies the entire axis of the sac, and which soon becomes surrounded by the spermatogenous tissue. A small cellular mass next shows itself on the summit of the gonophore, and increases in size, while its interior becomes hollowed out into a cavity which communicates with that of the gonophore. Into this cavity the spadix gradually extends itself, while part of the spermatozoal contents of the original sac also pass into the newly-formed cavity. The superadded portion continues to increase in size, and soon acquires a form exactly resembling that of the original sac, so that each gonophore now presents a double sac, one superposed upon the summit of the other. Into this second sac the original one continues to discharge its contents, and gradually contracts as the terminal one enlarges. In the terminal sac the spermatozoa attain to their full maturity, and ultimately, in the shape of pyriform caudate corpuscles, escape from it by an aperture in its summit.

BIBLIOGRAPHICAL NOTICES.

British Wild Flowers. Illustrated by J. E. Sowerby. 8vo. London: Van Voorst, 1860.

A reissue of this useful book has been commenced by Mr. Van Voorst in monthly parts. The book consists of 80 coloured plates, containing figures of a portion of each of 1600 British flowering plants. These figures are very nicely executed, and are parts of the complete representation of the plant which is to be found in the well-known 'English Botany' or its Supplement. In most cases they amply fulfil the purpose for which they are intended. Being clear, and usually characteristic of the plants, they will be found convenient for removing temporary difficulties caused by want of memory or an imperfect knowledge of allied species. Such a book is sure to be useful, and seems to supply a want that has long been felt.

Certainly there are cases in which we should have made a slightly different selection from the original plate, or added an outline of some organ not there delineated: the judgment of the artist or his adviser differed considerably from ours in the estimation of what would be most useful to the student. But that is a very small fault; for it only renders the book a little less useful than it might have been.

We do not think much of the letterpress which accompanies the plates; and, indeed, its author claims very little credit for it. No person must attempt to use it as a descriptive flora. If the descriptions had been left out, much space would have been saved, and the value of the book not diminished. All the letterpress requisite is the name of the plant and a few references to descriptions by recognized authors.

We wish that all the plants of which figures have appeared in the 'Supplement to English Botany' had been inserted in these plates. Those contained in vol. iv. of the 'Supplement' seem to be omitted; and as they consist chiefly of the more recent discoveries, or what are called critical plants, their want will often be felt. Mr. Sowerby may perhaps have done well in giving figures of some plants included by mistake in 'English Botany,' in order that his 'Wild Flowers' might present a complete view of the contents of that great work; but he certainly should not have omitted the last supplementary volume.

In a work of such humble pretensions and at the same time so useful as the present, we do not wish to be hypercritical; but it is necessary to notice a few instances in which the figures are incorrect, either through blindly copying an originally erroneous plate, or from accidental changes made by the artist.

219. *Cerastium semidecandrum* does not represent any known plant: the diaphanous part of the bracts (characteristic of the species), which is badly represented in the original plate, is totally omitted here.

241. *Hypericum Androsæmum* is duly copied from the 'English Botany,' but is now universally admitted not to represent the true plant.

444. *Epilobium alsinifolium.* We have learned from the original drawings and notes that Eng. Bot. t. 2000 is formed of the flowers of *E. montanum* (copied into the 'Wild Flowers') and the base of the stem of *E. obscurum*. *E. alsinifolium* is therefore not represented in 'English Botany' nor in 'Wild Flowers.'

537. *Œnanthe pimpinelloides* is not the true plant, but is *Œ. Lachenalii*. The real *Œ. pimpinelloides* is not figured in 'English Botany.'

613. *Valeriana dioica*, and 614. *V. officinalis.* This is a good example of the uselessness of scraps, either as specimens or figures. No person unacquainted with these very different plants could distinguish them by these figures, which nevertheless are carefully copied from parts of the original plates.

1215. *Anacharis Alsinastrum.* This sketch is taken from the good plate in the 'Annals of Natural History,' but the parts are badly selected. A flower with three styles should have been given, and the long tube represented.

1244. *Neottia gemmipara.* The drawing has been taken from the bad plate in the 'Supplement to English Botany,' instead of the beautiful figure in the 'Linnæan Transactions' (xix. t. 32).

We have already mentioned one drawing of a plant not included in the 'English Botany;' and there seems to be only one other, viz. 13. *Ranunculus pantothrix.* It is quite impossible to say what plant this is intended to represent; for no *Water-Ranunculus* ever had such leaves as are there depicted. We suspect, judging from the flower, that it may have been taken from a specimen of *R. Drouetii*.

It will be seen from the few remarks that we have felt it necessary to make that the great bulk of the 1600 figures are good; many of them are excellent.

We strongly recommend the book to our readers. Figures of 1600 plants for £3, or more than 26 for a shilling, cannot be considered otherwise than exceedingly cheap.

Narrative of the Canadian Red River Exploring Expedition of 1857, *and of the Assinniboine and Saskatchewan Exploring Expedition of* 1858. By HENRY YOULE HIND, M.A., F.R.G.S. 2 vols. 8vo. Longmans: London, 1860.

In these two handsome volumes we have an account of the expeditions sent forth by the Canadian Government for the exploration of the vast tract of country intervening between Lake Superior and the Rocky Mountains, partly with the view of ascertaining what portions of this region are adapted for the establishment of colonies, and partly to determine the most practicable route for an overland communication with the colony of British Columbia, planted on the shores of the Pacific. The latter object has been most served by Captain Palliser's investigation of the passes of the Rocky Mountains leading into British territory on the eastern side of that chain; and it is also to the researches of that gentleman that we are indebted for the knowledge of that remarkable belt of fertile country which stretches from Red River in the east to the foot of the Rocky Mountains in the west, and must be of the highest importance in any future scheme of communication between the shores of the Atlantic and Pacific within British territory in North America.

We have, however, little to do here with the portions of the narrative bearing directly upon these questions, although, of course, all the natural-history information acquired by the gentlemen of the expeditions is of more or less importance in arriving at sound conclusions upon such subjects. Mr. Hind's descriptions of his canoe-voyages through the almost interminable chain of rivers and lakes which occupy so large a portion of the surface of the country explored will be found exceedingly interesting, as are also his accounts of the beauty of much of the scenery through which he passed, and especially of the numerous cataracts occurring in the rivers—the latter far more welcome to the lovers of the picturesque than to the voyageurs, who have to carry their canoes and cargoes over a considerable space of ground at every interruption of this nature. Several of these falls form the subjects of some of the illustrations of the book, and are of great beauty.

Storms of great violence frequently occur in the country traversed by the expeditions, and the hailstones appear to attain a most extraordinary size. They fall with such force as to batter and almost disable the hands of the voyageurs engaged in paddling the canoes, and occasionally even break through the birch bark of which these frail vessels are made, or the still tougher buffalo-skins under which the travellers seek for shelter.

A vast extent of country appears to be quite inapplicable to the purpose of colonization; but many spots of great fertility are found along the course of the rivers. One of these is the Selkirk settlement on Red River, which, however, occupies a part of the eastern extremity of the fertile belt above referred to, stretching from Lake Winnipeg to the foot of the Rocky Mountains. This little settlement appears to be a perfect agricultural paradise, its only drawback being its difficulty of access; and it gives one the most favourable anticipations of the future usefulness of the 65,000 square miles of similar country which, as calculated by Captain Palliser, form the fertile belt in British North America. Agricultural operations in this region seem, however, to be exposed to a drawback which will appear rather novel to English colonists, in the spread of a species of Locust, described by Dr. Harris under the name of *Acrydium femur-rubrum*. These insects were very destructive in the Red River settlement in 1819, but occurred only in small numbers from that year to 1857 (the year of the expedition to Red River), when they appeared in vast quantities over an immense extent of country, in some places devouring everything green that came in their way, and migrating from place to place in such enormous crowds as to give a peculiar appearance to the sky. Many notices of the occurrence of these destructive creatures will be found in Mr. Hind's narrative.

Vast as is the surface still covered by water in the region of the great American Lakes, there is sufficient evidence, according to Mr. Hind's observations, of its having formerly extended over a far greater area and gradually receded. Long ranges of hills, generally forming the escarpments of plateaux of elevated prairie, run more or less parallel to the general outline of the lake basin, and these have every appearance of having at no very distant period formed the successive shores of an enormous body of water; raised beaches and terraces are by no means of uncommon occurrence; and most of the rivers take their course through broad valleys of erosion, which must have been formed by streams of far greater volume than is attained by the highest floods of the present day. We can understand how this immense amount of surface-water may have been drained off; but Mr. Hind describes another kind of diminution of water-supply which is not quite so intelligible. His investigation of the Assiniboine shows that the quantity of water discharged by that river into the Red River is but little more than half that passing Fort Ellice at a distance of 280 miles from its outlet,—the amounts being 9,979,200 cubic feet per hour at Fort Ellice, and only 5,702,400 at Lane's Post, distant 22 miles from the confluence with Red River. The most singular part of the business is, that the amount of water in the river increases more than 25 per cent. during the first half of its course from Fort Ellice,—the quantity passing the mouth of the Little Souris being 12,899,040 feet per hour. Thus, according to Mr. Hind, considerably more than half the water passing the mouth of the Little Souris river must be lost in some way during the passage of the Assiniboine from that point to Lane's Post, a distance of 118 miles. Mr. Hind supposes the loss to take place by evaporation; but although the river receives no considerable affluents during the latter half of its course, this cause seems quite inadequate to the production of an effect of such magnitude, and we can only suppose that the waters must find some other outlet which has escaped the notice of the explorers.

With regard to the aboriginal population of Rupert's Land, we find many interesting notices scattered through the pages of Mr.

Hind's narrative; but all the facts brought forward by him assist in proving that the Indians are gradually diminishing in numbers. The instinct of hunting is strong in the Indian; and even the half-breeds, or children of white men by Indian mothers, exhibit the same tendency in its fullest extent. This constitutes one of the greatest difficulties in the way of preserving the remnant of these interesting tribes. Mr. Hind, like all other unprejudiced observers, sees clearly that the work of civilization must precede that of christanization; but so great is the love of the wild life of the prairie-hunter both in Indians and half-breeds that it is almost impossible to keep them in a stationary and settled condition, without which all efforts at cultivation are useless. Indeed such a condition of life on the part of the Indians is so much against the interests of the Hudson's Bay Company, within whose territory these explorations have been carried on, that they appear to be rather lukewarm in the matter and give but cold encouragement to the efforts of missionaries, as the adoption of a settled mode of life and the eschewing of "fire-water" would undoubtedly cause a very great falling off in the supply of skins. In fact all the habits of these native tribes seem to tend directly towards their rapid extinction: their fondness for spirits, their love of scalp-taking with its attendant wars, and their utter improvidence would alone be sufficient to account for a steady diminution in their numbers; but when we read Mr. Hind's account of the reckless manner in which they destroy one of their main supplies of game, the Buffalo—nay, actually drive these beasts from their hunting-grounds by carelessly setting fire to the prairies, thus increasing every year the dfficulty of obtaining their necessary supplies, we can no longer wonder that the race of the red man seems doomed.

Mr. Hind states that the hunters of the Red River district firmly believe in the existence of two kinds of Buffalo, which they call the "prairie Buffalo" and the "Buffalo of the woods." These two supposed species are said to differ in size, colour, hair, and horns. The skin of the "wood Buffalo" is much larger than that of the common animal; the hair is very short, and the mane is not curled. Two skins, said to be those of the wood Buffalo, seen by Mr. Hind in Selkirk settlement, bore a very close resemblance to the skin of the Lithuanian Bison. The wood Buffalo is said to be very scarce, and to occur only to the north of the river Saskatchewan and on the flanks of the Rocky Mountains. This point might be worth the attention of some of our sporting Englishmen, who seem to find no country too distant now-a-days for their hunting excursions.

The geology of the Great Basin of Lake Winnipeg, of course, constitutes a prominent feature in this narrative, and many sections are described in the course of the work. The eastern boundary of the basin, and in fact the eastern shore of Lake Winnipeg itself, is formed by the metamorphic rocks belonging to the Laurentian system of Sir Wm. Logan and Mr. Hunt, which constitute a chain of mountains running from the north bank of the St. Lawrence past Lake Superior, and then passing in a north-westerly direction to the shores of the Arctic Sea. To the westward these rocks are skirted by a broad belt of Silurian rocks, which form the western shore of Lake Winnipeg, and these, again, are succeeded in a westerly direction by beds of Devonian age,—the two series forming the broad and nearly level district between Lake Winnipeg and the first range of hills. The base of these hills is also formed by Devonian rocks, from which salt-springs issue in many places, and are worked with considerable profit, although in the rudest fashion. No traces of Carboniferous, Permian, Triassic, or Jurassic rocks were detected by Mr. Hind, who, however, states that, in the sections examined by him, a portion amounting to about 400 feet, between the Devonian rocks below and the Cretaceous above, was inaccessible in consequence of its being covered by drift. The most remarkable feature in the geology of Rupert's Land is the great development of the Cretaceous series of rocks, which form the capping of the hills just mentioned as lying to the westward of Lake Winnipeg, and extend therefrom in a wide plateau, broken here and there by small hills, to the Grand Coteau du Missouri, which they form, and beyond which, in the territory of the United States, they are covered by the Tertiary beds, occupying the greater part of the valley of the Missouri River. Northward these rocks have been traced beyond the north branch of the Saskatchewan River, and their further extension is unknown. Tertiary beds, the search for which was of importance from the circumstance of the occurrence of lignite in them, both in the basin of the Missouri and that of the Upper Saskatchewan, were not met with in the region explored by the expeditions, although rolled fragments of lignite were often met with in abundance in the river-sections of recent deposits.

With these remarks we take leave of Mr. Hind's narrative, of which we hope we have said enough to indicate that it contains a great amount of highly interesting information. It is illustrated with numerous excellent woodcuts of localities, Indians, articles of dress, and fossils, and with several maps and geological sections.

Tabular View of the Orders and Leading Families of Myriapoda, Arachnida, Crustacea, Annelida, *and* Entozoa. Society for Promoting Christian Knowledge, London, 1861.

The title conferred upon this little book by its publishers is hardly, to our notions, expressive of its contents; it is rather a *pictorial* than a tabular view of the Annulose division of the animal kingdom, exclusive of the Insects and Rotifera, and consists of four large mounted folding plates of characteristic forms of the classes mentioned in its title. These plates are also sold mounted on a roller and varnished, so as to form a diagrammatic illustration of the great group of Annulosa, with the omission, as above stated, of the important class of Insects, which may probably be intended to form the subject of a similar publication.

The subjects in the present work have been arranged, as stated on the last plate, by Mr. Adam White and Dr. Baird—the former taking charge of the three plates of Arthropod forms, the latter of the single plate of Annelida and Entozoa. The classification adopted calls for little remark, although we cannot but regret that some slight confusion seems to have crept into Mr. White's arrangements. Thus in the first plate we have the order Thysanura introduced—perhaps justly, on account of its close alliance with the Myriapoda; but we do not know why the Myriapoda should be designated an Order if separated from the true Insects; nor can we justify the establishment of the separate *orders* Arachnida, Acaridæ, and Pycnogonida, with no indication of the *class* to which they may be referred. Under the class Crustacea we find the ordinary subdivisions; but even here the group of Malacostraca is denominated a *subclass*, whilst its equivalents the Entomostraca and Cirripedia are called *divisions*. These may be slight objections; but to beginners, for whose use these plates are intended, they will be sufficiently puzzling. The plate of Worms, illustrating its subject far less completely, is open to no objections of this kind. We notice, however, that *Pentastoma* (*Linguatula*) is placed here amongst the Entozoa, although its true place appears to be with the Mites, and that Dr. Baird still retains a family of Cysticercidæ in spite of recent researches.

The subjects have been selected with great judgment. They are for the most part, if not entirely, copied from well-known works, and the plates have been well engraved by Mr. Lowry. As companion illustrations to popular works on Natural History they will prove of great service, and we think would be rendered still more valuable to the young naturalist by the addition of two or three pages of letter-press containing a real "Tabular View" of the classes illustrated.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

March 26, 1861.—Dr. J. E. Gray, V.P., in the Chair.

On the Ophidians of the Province of Bahia, Brazil. By Dr. Otho Wucherer, Corr. Memb.

In the present paper I propose to give a list of the Snakes of the province of Bahia which I have been able to collect during the last two years, enumerating them in the order in which they occur in the Catalogues of the British Museum, and adding such remarks as I may be enabled to make.

Of the family of *Crotalidæ* I have seen :—

1. *Craspedocephalus atrox.*
2. *C. bilineatus.*
3. *Lachesis mutus.*
4. *Crotalus horridus.*

Of these the first seems to be the most common, particularly in some districts. To judge by what I have heard of the danger of its frequent bite, and what is commonly stated concerning the number of victims of the *Fer de lance* in the West Indies, *C. atrox* is a much less dangerous animal than *C. lanceolatus*. The frequent occurrence of the bite of *C. atrox* is easily accounted for, as it is commonly met coiled up in the middle of footpaths, and is not easily disturbed unless trod upon. Neither *C. lanceolatus* nor *C. brasiliensis* have as yet been observed by me. Of the scarce *C. bilineatus* I have only seen two specimens ; but I hear that six specimens have been found together in the colony Leopoldina, near Ilheos. I shall refrain from making any further remarks on this genus until I shall have collected more specimens for comparison than I at present possess. All my specimens of *C. atrox* differ from those described by herpetologists in having fewer longitudinal series of scales (23–25).

Lachesis mutus is far from being scarce. The largest specimen I have seen measured 10 feet.

Crotalus horridus is chiefly an inhabitant of the interior of the province, but is not very scarce on a row of hills which extends through the city of Bahia. In some parts of the province (for instance in Ilheos) it has, according to trustworthy testimony, never been seen.

Of the family *Viperidæ*, the only species, according to Dr. Gray, which is found in the Western World is Peruvian.

Of the numerous freshwater species of the family of *Hydridæ* few representatives seem to occur in the Brazils, *Helicops angulatus* being perhaps the most common species in this province. A second species, *Helicops Leprieurii*, Dum. et Bibr., still appears to be scarce in the collections. Perhaps a description taken from fresh specimens may facilitate its identification.

Diagnosis.—Head ovate, short ; three frontals, anterior trigonal, between the nasals ; labials entire ; superciliaries large, almost of the length of the vertical ; vertical elongate ; loreal distinct ; one or two anterior and two posterior oculars ; occipitals elongate ; body fusiform ; scales in nineteen rows, truncated, polished, smooth, those of the middle and hinder part of the back and of the tail keeled ; tail distinct, tapering.

Description.—Head ovate, flat on the vertex, not very distinct ; cleft of mouth moderate ; eyes superior, moderate, pupil round ; three frontals, anterior small and almost triangular (irregularly quadrangular, with an obtuse posterior angle) ; nostrils superior, between two nasals ; vertical moderate, elongate, with the lateral edges parallel or slightly divergent posteriorly, rectangular behind ; occipitals large, elongate ; eight upper labials, entire, the seventh much larger than the rest, fourth and fifth reaching to the eye, rostral broader than high, its upper angle very obtuse ; series of teeth of moderate length, posterior tooth longest, grooved, anterior all equal ; body fusiform ; tail distinct, rather short, tapering ; scales moderate, truncated behind, polished, in nineteen rows, those of anterior part and of sides of body smooth, of posterior part and of tail keeled ; no scales of the middle line in any part larger ; ventral shields narrow ; anal divided ; subcaudals in two rows.

Above olive, with three darker longitudinal streaks, or rows of spots sometimes confluent, alternating in the different rows ; inferior half of upper labials and body beneath yellowish; belly and tail beneath with transverse black streaks, some of which do not reach across (chequered as in *Liophis*).

Length of cleft of mouth $\frac{5}{8}$ inch, breadth of head $\frac{5}{8}$ inch; length of tail $5\frac{1}{2}$ inches; total length 22 inches.

The specimen described is in the collection of the British Museum.

This Snake is not very rare in the moist valleys in and about the city of Bahia.

Of the family *Boidæ* some of the most formidable members occur here, as in other parts of Brazil.

1. *Epicrates cenchria*,
2. *Xiphosoma caninum*,
3. *Boa constrictor*, and
4. *Eunectes murinus* have been noticed by me. The most common species in Bahia appears to be *Eunectes murinus*. It is the "*Sucurujaba*" of the natives, and is very frequently seen in close proximity to the town of Bahia, but very large specimens are here but seldom found. On the borders of the S. Francisco river they attain an enormous size. I should rather think that it must have been this snake, and not the *Boa constrictor*, which Dr. Gardner in his 'Travels in Brazil' mentions as having swallowed a horse. The *Boa* does not grow so large by far. *Eunectes murinus* seems to possess an extraordinary capability of fasting: a friend of mine kept the largest specimen I ever saw in close confinement for three years; and it was never known to swallow anything during this whole period. It died much emaciated.

The first species of the family of *Calamariidæ* which I have met with is new, and I conclude this first part of the paper with a description of it:—

Geophis Güntheri.

Diagnosis.—Upper labials seven, the third and fourth coming into the orbit; a single pair of chin-shields. Dirty-orange, with a longitudinal jet-black band from the occiput to the end of the tail.

Description.—Total length $12\frac{3}{4}$ inches; length of tail $1\frac{3}{4}$ inch; head indistinct, depressed. Body almost cylindrical; tail cylindrical, tapering. Cleft of mouth short; eyes moderate. Rostral shield broad, just reaching the surface of the head; two pairs of frontals, the anterior pair in direct contact with the rostral; the posterior frontals reaching the orbits; vertical almost regularly triangular; superciliaries moderate, occipitals rather large and elongate, slightly forked behind. Nasal pierced by the nostril. Loreal none. Anterior ocular elongate, not touching the supraorbital. Two posterior oculars sometimes confluent into one. Seven upper labials, the third and fourth reaching the orbit, the sixth and seventh largest; two temporals on the side of the occipital, the anterior one touching both posterior oculars. Series of maxillary teeth short, the hinder longest, not grooved. Ground-colour dirty orange; crown blackish. From the occiput to the tip of the tail a longitudinal jet-black streak with sharply defined edges, forked just behind the occiput into two diverging extremities, which cover the edge of the occipitals ; tips of light-coloured scales black. On the sides of the body some irregular black spots, which, on the posterior part of the body, form an uninterrupted narrow line.

The specimen described was sent to me from Caunavieras, which is to the south of the city of Bahia. It is now in the British Museum. According to information received from Dr. Albert Günther, this is a new species, belonging to the genus *Geophis* of Wagler. I propose to name it after him, in acknowledgment of his unremitting kindness in aiding my endeavours to become acquainted with the Brazilian Ophidians.

Bahia, February 11th, 1861.

Characters of some New Species of American Passeres. By Philip Lutley Sclater, M.A., Ph.D., Secretary to the Society.

1. Polioptila Buffoni.

Figuier à tête noire de Cayenne, Buff. Pl. Enl. 704.—*Motacilla cærulea*, Gm.—*Polioptila leucogastra*, Sclater, P. Z. S. 1855, p. 12 (*partim*).

Plumbea, subtus alba : pileo toto, alis et cauda nigris : tectricum alarum majorum marginibus externis, secundariorum pogoniis externis, caudæ rectricibus duabus extimis et tertia ex majore parte albis : rostro et pedibus nigris, illius tomiis pallidioribus.

Long. tota 4·0, alæ 1·9, caudæ 1·8, rostri a rictu 0·6 poll. et dec.

Hab. In Guiana et Nova Granada int.

Mus. P. L. S.

Obs. Similis *P. leucogastræ* ex Brasilia, sed minor, et rostro longiore, rectrice extima omnino alba, et harum secunda et tertia fere usque ad basin albis dignoscenda.

2. Troglodytes hypaëdon.

"*Troglodytes aëdon?*," Sclater, P. Z. S. 1859, pp. 363, 372; Sclater et Salv. Ibis, 1859, p. 9.

Similis *T. aëdoni* ex America boreali, sed colore corporis subtus omnino brunnescenti-rufo ; lateribus corporis saturatioribus, rufis, neque transfasciatis : crisso nigro transvittato.

Hab. In Mexico meridionali et Guatemala.

Mus. P. L. S.

This Wren, which I have heretofore not separated from *T. aëdon*, is certainly as distinct from that bird as *T. Parkmanni* and other recognized species. It is in fact more nearly allied to *T. furvus* of South America than to the northern form ; but differs also from the *T. furvus* in the deeper colouring of the under surface, the throat and belly of the latter species being medially of a nearly pure white.

3. Basileuterus uropygialis.

Olivaceus, capite cinerascente : superciliis, oculorum ciliis et cor-

pore subtus pallide cervinis, ventre albescente: uropygio et caudæ dimidio basali pallide fulvis, hujus apice cinerascente olivaceo: rostro nigro, pedibus pallide carneis.

Long. tota 4·5, alæ 2·7, caudæ 1·8.

Hab. In Brasilia.

Mus. P. L. S.

I have one specimen of this bird in my collection, received from M. Verreaux and marked "Brazil." It is most nearly allied to *B. semicervinus*, mihi (P. Z. S. 1860, p. 84), from Ecuador; but the uropygium and body beneath are much more lightly coloured; and the back is olive and head cinereous, almost as in *B. stragulatus*, with which it also nearly agrees in the coloration of the lower surface.

4. Hylophilus insularis.

Supra olivaceus, pileo et dorso superiore ochraceo-brunnescentibus, dorso inferiore, alis extus et cauda viridescentibus: fronte, oculorum ambitu et corpore subtus pallide ochraceis, tibiis et crisso virescentibus: tectricibus subalaribus pallide citrinis: rostro corneo, subtus pallidiore, pedibus carneis.

Long. tota 4·7, alæ 2·5, caudæ 1·9, tarsi 0·7, rostri a rictu 0·6.

Hab. In ins. Tobago.

I have a single specimen of this *Hylophilus*, presented to me by Sir William Jardine, by whom it was received from Mr. Kirk, amongst other birds collected in Tobago. It appears to belong to a well-marked though hitherto unnoticed species of this little group,—the bill nearly agreeing with that of *H. thoracicus*, though stronger and rather more arched, and the feet being likewise rather large and strong. The first primary is rather longer than in any other species of the genus that I am acquainted with, measuring 1·6 (in.) from the base of the wing to its extremity. In *H. thoracicus*, however, it is perhaps quite as long proportionately, the wing of *H. insularis* being generally larger than that of the former species. In its dull-olive dress, brownish head, and pale buffy colour beneath, this bird is readily distinguishable from other members of the group.

5. Chlorophanes guatemalensis.

Chlorophanes atricapilla, Sclat. & Salv. Ibis, 1859, p. 14, et 1860, p. 32.

Similis *C. atricapillo* ex America merid., sed differt colore corporis clariore viridi, capitis nigro nucham totam occupante, et rostro magis crasso et elongato.

Hab. In Guatemala.

The differences between this and the southern bird appear to be so constant, although so small in amount, as to render a distinct name necessary; and I have therefore chosen one which indicates the locality of the bird.

6. Chlorophonia flavirostris.

Psittaceo-viridis, remigibus alarum et rectricibus intus nigricantibus, illarum pogoniis externis cærulescenti-viridibus: subtus *paulo dilutior, ventre medio et crisso flavis : rostro et pedibus flavis.*

Long. tota 4·0, alæ 2·3, caudæ 1·2.

Hab. In rep. Æquator. *Mus.* P. L. S.

I have a single example of this *Chlorophonia* in my collection, received by Mr. Gould with other birds from Ecuador, from the eastern slope of the Andes, I believe. It appears to be the female of some undescribed species of this group. It may be readily distinguished from other species by its yellow bill and pale-yellow feet, and from *C. longipennis*, *C. frontalis*, and *C. viridis*, which are probably its nearest allies, by the absence of the blue round the eye.

7. Euphonia vittata.

Nigro-cæruleo-nitens : vitta frontali angusta fulvo-flavida : abdomine saturate fulvo-flavo, lateribus flavicantibus, tectricibus subalaribus albis, citrino tinctis : rectrice una utrinque extima in pogonio interno albo notata : rostro et pedibus nigris.

Long. tota 4·2, alæ 2·4, caudæ 1·4.

Hab. In Brasilia.

Obs. Affinis *E. xanthogastræ*, sed fronte angusto aurescente, et cervice nigra in ventrem magis producta facile dignoscenda.

I have only a single specimen of this very distinct species of *Euphonia*, which, from its make, is evidently a Brazilian skin. I received it from M. Verreaux of Paris.

8. Tanagra subcinerea.

Flavicanti-olivacea, alis caudaque nigricantibus eodem colore limbatis ; pileo cæruleo, margine postico ad nucham viridescente ; lateribus capitis et loris nigris : subtus pure cinerea, subalaribus pallide flavis ; crisso fulvescenti-flavo : rostro nigro, mandibulo inferiore plumbescente ; pedibus carneis.

Long. tota 6·75, alæ 3·2, caudæ 2·9.

Hab. In Venezuela et ins. S. Trinitatis.

This Tanager is a climatic form of *Tanagra cyanocephala* of Transandean Peru and Ecuador, and *T. auricrissa* of New Granada. It most closely resembles the former bird, but may be distinguished by the paler ashy colour of the lower surface, the duller yellowish-green of the crissum, and the less extent of the yellow on the under parts of the wings. The wings are also comparatively shorter, and there is less olivaceous colouring on the flanks of the Venezuelan bird. In the New Granadian *T. auricrissa* the under surface is tinged with blue, and the crissum is golden yellow.

9. Ramphocelus ephippialis.

♂. *Coccineus : alis et cauda cum tibiis et subalaribus nigris : interscapulii totius plumis nigris obscuriore coccineo terminatis : rostro et pedibus nigris, illius mandibula inferiore ad basin alba.*

♀. *Similis* R. brasilii *et* R. dorsalis *fœminis.*

Long. tota 7·5, alæ 3·1, caudæ 3·1.

Hab. In ripis fl. Amazonum sup.

This *Ramphocelus*, of which I have specimens of both sexes, received by M. Verreaux from the Upper Amazon, is only distinguished from *R. brasilius* by its back between the wings being black, with the margins of the feathers only scarlet. In this respect it is further removed from *R. brasilius* than *R. dorsalis*, which is exactly intermediate between the two. M. Jules Verreaux informs me that all the specimens received from this locality were similarly marked; so that the variation, though small, seems to be constant.

10. Saltator isthmicus.

Olivaceus, uropygio grisescente; alis fusco-nigris, extus olivaceo limbatis: cauda fusco-grisescente, rectricum apicibus albicantibus: subtus sordide albus olivaceo flammulatus, gula immaculata et cum ventre imo et crisso albicantibus: tectricibus subalaribus fulvescenti-albis, campterio flavido: rostro nigro, pedibus corylinis.

Long. tota 7·0, alæ 3·5, caudæ 3·6.

Hab. In Isthmo Panama.

I have two specimens of this *Saltator* in my collection. I obtained them from Mr. John Bell, of New York, in 1856, who informed me that he shot them on his passage across the Isthmus of Panama on his return from California. The species is very closely allied to two others in my collection,—one from Trinidad, which I take to be the *Saltator maculipectus*; and the other from Bogota, which I consider to be probably *S. striatipectus* of Lafresnaye. The three species, however, are so closely allied, that it is possible that one of M. de Lafresnaye's descriptions may be intended for the present bird.

The *Saltator isthmicus* may be distinguished from the Trinidad bird by the less-pure white on the throat and belly, the more-regular flammulations of the lower surface, and its uniform black bill. The Bogotan (*S. striatipectus*) is much darker on the breast and head, and has much less olivaceous in its coloration. The point of the bill is, likewise, pale in the latter bird.

On the Affinities of Balæniceps.
By A. D. Bartlett.

On appearing before you this evening with new evidence of the affinities of this bird, and in endeavouring to aid in settling a subject so long disputed and frequently discussed, I beg to refer, first, to the elaborate and carefully written paper by Mr. Parker, in which this bird, after the most careful examination and comparison of its bones, is considered to be an *Ardeine*.

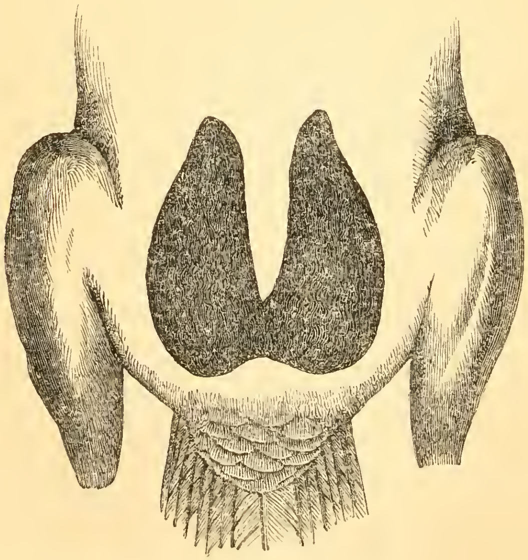
I have, then, to observe that, from an entirely different course of examination, and by the consideration of its other structures, I have arrived at the same conclusion; and I hope, with the assistance of my friend Mr. Stewart, to prove to the satisfaction of our ornithological friends, that there is no longer any doubt in the matter.

The death of the survivor of the two birds brought home by Mr. Consul Petherick has afforded me the opportunity of making a more accurate examination of its structure; and this has led me to the discovery of two remarkable powder-down patches which, it will be remembered, I stated on a former occasion * I had failed to find in the living bird.

Upon removing the skin from the body of this bird, I was so struck by its close resemblance to the Herons, that I immediately killed a Heron and removed its skin also, in order to form a fair opinion by a close comparison of all the parts of these two birds. The exact form of the body and limbs was most remarkable; the structure of the hind toes (upon which so much stress has been laid) was alike, these turning backwards, forwards, or sideways in both species. The head and neck, however, of *Balæniceps*, when compared with the same parts of the Common Heron, present some very considerable differences. These differences consist, first, of the much larger head, and consequently stronger neck, in *Balæniceps* as compared with the Heron. Doubtless these modifications have reference to the food and the mode of obtaining that food. Many illustrations can be found of similar modifications; I may refer to one in the group under consideration, which results from the comparison of *Cancroma* with *Eurypyga*, and which presents, perhaps, the most extreme modification in the form of the bill in two birds of the same family.

As far as I was able to examine the viscera of the *Balæniceps*, I could discover nothing that would lead me to doubt its Ardeine

Fig. 1.



affinities; the stomach, liver, intestines, &c., of the two birds appeared exactly to correspond in structure and arrangement.

* See 'Annals' for April 1861, p. 326.

Directing my attention to the skin of *Balæniceps,* I was surprised at finding on the lower part of the back, reaching from the end of the scapulars to the base of the tail, two large, well-defined powder-down patches. The drawing (fig. 1) represents these two patches *in situ* on the body of the bird stripped of its feathers. These remarkable patches are dark-coloured on the inside of the skin ; and on the outside the down is of extreme thickness, and the quantity of white or grey powder very great. This powder, when examined under the microscope, appears excessively oily, and will not mix with water. It is greasy to the touch, and is evidently produced by the growth of the down. It appears, in fact, to be the quill-shafts of the down broken up ; or perhaps the down roots secrete this powder, which is distributed over the entire plumage, rendering the feathers impervious to water, in the same way that the oil-glands effect this in other birds. In this bird, however, the oil-glands are extremely small, not larger than the oil-glands of a Sparrow.

With reference to these patches, it is my intention to point out in the birds that I consider allied to *Balæniceps* the existence of these patches of down ; and I may remark that the attempt to arrange animals by such means is not new, as, for instance, in the case of the *Ruminants,* some of the genera are distinguished by peculiar patches of hair, which are said to be glandular, upon the legs, &c. ; and, again, the *Viverridæ* are distinguished by the existence or otherwise of anal and other glands and pouches.

I therefore proceed to point out the species more or less allied to *Balæniceps* that exhibit these singular structures. In the New World form (*Cancroma*) this structure appears to be most fully

Fig. 2.

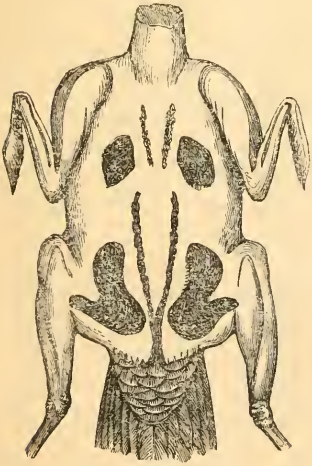
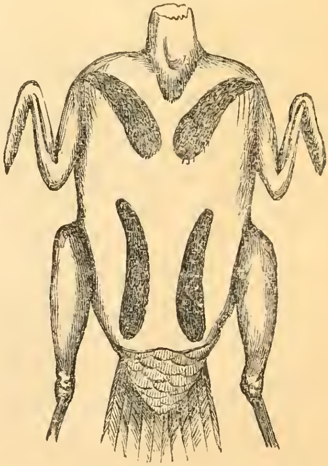


Fig. 3.



developed, this bird having four pairs of these powder-down patches, as shown in fig. 2, which represents the upper, and fig. 3, which gives the lower surface of the body of this bird; while in the Old World form (*Balæniceps*) one pair only exist, as we have seen in fig. 1.

It is worthy of notice, that the true Herons, which inhabit both the Old and New World, and which have generally been regarded as the type of the group, have three pairs of these patches; the little and certainly aberrant form of Heron, *Eurypyga*, has only one pair of these down patches; while intermediate between this bird and the Herons come the Bitterns, in which two pairs of these patches exist*.

By these remarks one is naturally led to observe the often-noticed correspondence of forms in the Old and New World,—as, for instance, the Ostrich of Africa represented by the Rhea of America, the Camel of the Old World by the Llama of America, the Lion by the Puma, and many other similar representations.

In the work on 'Pterylographie,' published by Ch. L. Nitzsch, the author, who evidently has paid great attention to the subject, says that "these powder-down patches are found (but in a much smaller degree) in the genus *Tinamus*†, one or two Parrots, and also in some of the Birds of Prey." I have not, however, met with them in any group except the *Ardeæ* and their allies. I can assert most positively that no traces of these patches exist in the Pelicans, Storks, or Cranes. I have also taken considerable trouble with *Scopus*. This bird is considered by Prof. Reinhardt to be closely allied to *Balæniceps*. I cannot find anything to justify such a belief; the skins and skulls of the two birds are so entirely different, that it is useless to enter into any further details respecting them.

There is one thing, however, that I wish to remark, and I do so with considerable uneasiness lest I should be accused of casting a doubt upon the veracity of the gentleman to whom we are indebted for the first living specimens of this rare bird; and this consideration would have prevented my making the remark, had not my great desire been to call attention to the subject in the hope of obtaining a truthful explanation of what appears to me inexplicable. I refer to the statement, made by Mr. Petherick, that *Balæniceps* runs about in search of food immediately after it is hatched. If this be true, it is one of the most extraordinary facts I have yet met with.

* Having had many opportunities of studying the habits of the living examples of *Eurypyga* and *Botaurus*, I have observed a striking resemblance in these birds, particularly in the drooping and spreading out of the wings, in which position the beautiful markings upon every feather are finely displayed. I have so frequently seen this attitude assumed by both these birds, that I am satisfied it was not merely an accidental thing.

† Since writing the foregoing I have examined *Tinamus*. The structure referred to by Nitzsch appears to differ so widely from the down-patches of the Ardeine family, that I shall describe it in another paper upon this subject, which I hope to have ready shortly.

April 9, 1861.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

On a New Species of the Family Boidæ. By Dr. Albert Günther.

Pelophilus Fordii.

Head rather narrow; neck slender; body thick, compressed; tail conical, tapering, prehensile. The anterior part of the head is covered with regular shields, symmetrically arranged; the posterior part from the orbits is scaly. There are four pairs of frontal shields, two small shields being intercalated between the posterior pair; then follows a large square vertical shield, the largest of all the shields of the head, situated between the superciliaries. The nasal opening is small, between three shields—namely between the two nasals and the anterior frontal. Three or four loreals, two anterior and five posterior oculars. Thirteen upper labials, the sixth, seventh, and eighth entering the orbit; none of them grooved. Pupil vertical, elliptical. Scales smooth, in twenty-eight series on the posterior part of the neck, and in thirty-three on the middle of the body. Ventral shields rather narrow, 253; anal 1; subcaudals entire 70.

The ground-colour is a reddish olive, more yellowish inferiorly; a reddish-brown streak from the nasal shield through the orbit to the angle of the mouth. A series of about eighty transverse reniform spots from the head to the end of the tail; each spot light reddish brown, edged with dark brown. Another series of similar but smaller and irregular spots along each side; belly nearly uniform.

Length of the head $\frac{2}{3}$ inch, of trunk 22 inches, of tail 4 inches.

This species comes from Western Africa, but I am not aware from what particular part. I have named it after Mr. Ford, whose merits in herpetology are well known by his truly artistical drawings.

On a New Species of Fish of the Genus Gerres. By Dr. A. Günther, For. Memb.

Gerres longirostris, Rapp.

$$\text{D. } \frac{9}{11}. \quad \text{A. } \frac{3}{8}.$$

The height of the body is one-half of the total length (without caudal). Præorbital and præoperculum not serrated. *Dorsal fin not notched*; the spines are moderately strong, the length of the second being four-sevenths of that of the head, or two-fifths of the depth of the body. The second and third anal spines are nearly of the same strength, and considerably shorter than those of the dorsal fin. Silvery, with darker stripes along the series of scales.

Hab. Cape of Good Hope.

This species is distinguished from all the others by the dorsal fin, which has the upper margin even, without any indication of a notch. It has been established by Professor W. von Rapp from specimens in the Museum of Tübingen.

MISCELLANEOUS.

Classification of the Foraminifera. By A. E. Reuss.

Prof. Dr. A. E. Reuss, of Prague, who has studied the Foraminifera, especially as occurring in the fossil state, for many years, has lately offered the following systematic arrangement of the class to the Imperial Academy of Vienna. Dr. Reuss observes that a system based exclusively on one isolated character can never be expected to be a faithful interpretation of *natural* relationship. This can be rendered visible only by regarding as much as possible the total sum of characters,—placing, of course, in the first rank the most important and general among them.

The *chemical constitution* of the shell, as yet scarcely attended to, is among these characteristics. A considerable number of the genera of Foraminifera have arenaceo-siliceous shells—a character that may be of use in characterizing not only genera, but even whole families. Another character worthy of consideration in a systematic arrangement is the *intimate structure* of the shell,—the more so as it depends on the secretory powers of the animal, and perhaps also on its bodily organization. The mode in which the *concamerations* are disposed, in double, alternating, straight, or spiral series, is too liable to variation to be made the groundwork of systematic arrangement, as it is in the systems hitherto adopted.

Even the future value of the division into Monomerous and Polymerous Foraminifera may be a subject of doubt. The first of these divisions is subdivided into seven families:—*Gromideæ, Lagenideæ, Spirillinideæ, Squamulinideæ, Oculinideæ, Cornucopideæ*, and *Ammodiscideæ*. The second division comprises fourteen families:—*Rhabdoideæ, Cristellarideæ, Polymorphinideæ, Cryptostegia, Textularideæ, Cassidulinideæ* (these six have calcareous, vitreous shells, pierced with delicate pores), *Miliolideæ, Orbitulitideæ, Peneroplideæ* (these three have compact, calcareous, porcelain-like shells), *Lituolideæ, Uvellideæ* (these two have arenaceo-siliceous shells), *Rotalideæ* (with calcareous shells, intersected by ramified channels of various diameters), *Polystomellideæ*, and *Nummulitideæ* (these two have calcareous shells, intersected by ramified channels, and so represent, at least as regards the shell-structure, the highest type of organization within the class of *Foraminifera*).

On the Symmetry of the Echinodermata.

A memoir, in which M. Sars establishes the genus *Echinocucumis* for a Holothuria found in the vicinity of Bergen, at a depth of 40 to 100 fathoms, is followed by some interesting considerations upon the symmetry of the Holothurida, of which the following is a *résumé*.

The celebrated investigations of Johannes Müller have proved that all larvæ of Echinoderms have a bilateral symmetry, and that the adult Echinoderms, although possessing a radiate symmetry, nevertheless retain traces of the primitive bilateral symmetry. The existence of this bilateral symmetry is especially evident in those Holothurida which creep upon a ventral disk (*Psolus*) and in the irregular Echinida (*Spatangi*). There are, in fact, two cases amongst the Echinoderms: sometimes the ventral surface includes an equal part of each ambulacrum, and the mouth is then placed at the centre of the ventral surface (the regular Echinida, Asterida, and Ophiurida); sometimes, on the contrary, the mouth is situated at one extremity, and the ventral surface no longer includes a portion of each of the five rays, but only three rays—the other two rays being dorsal (Holothurida creeping on the ventral surface).

In *Psolus* we find that even the two dorsal rays disappear completely, and there only remain the three ventral ambulacra, of which the median one may sometimes (*Psolus squamatus*) be almost entirely deficient.

These considerations led Johannes Müller to distinguish in the five-rayed Echinoderms a trivium and a bivium; that is to say, two regions, the one including three ambulacra, and the other only two.

M. Sars remarks that in certain Holothurida (most *Cucumariæ*, *Thyone*, &c.) we cannot distinguish a trivium and a bivium—all their ambulacra are equal; but in others we observe slight irregularities in the ambulacral areæ. Thus in *Cucumaria Dicquemarii*, Cuv., of the Mediterranean, there are three ambulacra rather more approximated to each other, and each composed of from two to four rows of sucking-feet, whilst the last two ambulacra are rather more distant both from each other and from the former, and are only composed of from two to three rows of feet. Here we have evidently the first indication of a trivium and a bivium; and from analogy with *Psolus* we may conclude that the former may be regarded as the ventral, and the latter as the dorsal face.

This distinction between the belly and the back becomes still more evident in *Hemicrepis*, Müll. (*Phyllophorus*, Grube). Here the sucking-feet of the middle of the ventral region are cylindrical and soft; on the rest of the ventral surface and on the back they are large, conical, and hardened by numerous calcareous plates. However, as in the genus *Holothuria* (in which there is also a difference of form between the dorsal and ventral feet), the ambulacra are so greatly developed in breadth that the interambulacral spaces disappear completely, so that it is no longer possible to distinguish a trivium and a bivium.

In a Holothuride covered entirely with imbricated calcareous scales armed with a spine, for which M. Sars establishes his genus *Echinocucumis*, there are three complete ambulacra, which, from analogy with *Psolus*, may be regarded as a ventral trivium, and two incomplete ambulacra, which are dorsal and form the bivium. The tentacles, which are ten in number, equally reveal the bilateral structure of the animal. Two of them, larger than the rest, and furnished with small branches, are in fact lateral (one on each side); four others, also furnished with branches, but scarcely so long as the first, are dorsal; lastly, the other four, which are still shorter and simply bifurcated, are ventral. These traces of bilateral structure are again met with in the buccal ring (of which the five ventral pieces are larger than the five dorsal pieces) and in the retractor muscles of this ring. —*Christiania's Videnskabsselskabets Forhandlinger for* 1858, p. 176; *Bibl. de Genève,* Mai 1861, *Bull. Scient.* p. 78.

On the Occurrence of the Opah (Lampris lanta) *on the British Coast.* By Dr. J. E. Gray, F.R.S. &c.

A very fine and large specimen of this rare fish was caught at Herne Bay, on the 4th of July 1861. It has been presented to the British Museum by Mr. Simpson, of the Divan tavern, in the Strand. Another specimen was caught about the same time in Wigton Bay, and brought to the Liverpool market; it weighed 66 lbs., and is now in the Liverpool Museum. The first ray of the ventral fin has a curious angular bend in it, as if it was jointed, at about one-third its length from the base.

On the Japanese and Formosan Deer. By Robert Swinhoe.

Mr. Robert Swinhoe (in a letter dated "British Consulate, Amoy, China, April 5, 1861") remarks:—

"I see in the 'Annals and Magazine of Natural History' for February 1861, page 143, on the Japanese Deer, that a mistake has occurred owing to incorrect information. Mr. Blyth describes a Deer under the name *Cervus taiouanus* from the skull of an adult I sent him. This was procured from the Formosan Deer supposed to be *C. pseudaxis.* Subsequently I sent him four live Deer, which I distinctly informed him were received from Japan; but whether through inability to read my letter, or for some reasons to me unknown, he set down in his belief that the old buck was from Formosa and the other three from Japan. All four of the Deer sent him were from Japan, and the skull alone from Formosa. There can be no possible doubt that the former belong to any other than the Japanese species *C. sika*, Schleg., of the 'Fauna Japonica.' That the Formosan Deer is distinct from the Japanese I have no shadow of doubt, from the various opportunities I have had of comparing the animals from the two different places. The old Formosan bucks stand at least one foot higher than the Japanese bucks, and their horns are somewhat flattened at the end; one of the former has been sent by the Dutch Consul here to Leyden. I am doing my utmost to procure a pair of these handsome animals for the Zoological Gardens. I am told that a Stag is also found near Ningpo, but have never seen examples. The large species from the north found in the Summer Palace Gardens, of which I sent three skins to the Zoological Gardens, you will be able to determine as soon as the 'Harkaway,' in which vessel they were shipped, arrives in England. If the Zoological Society will remunerate the masters of the vessels for the conveyance of live Deer to England, I dare say I can manage to defray all expenses here in procuring the animals."—*Proc. Zool. Soc.* June 11, 1861.

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XIX.—*On the Organic Origin of the so-called 'Crystalloids' of the Chalk.* By H. C. Sorby, F.R.S. &c.

The appearance of Dr. Wallich's interesting paper, published in this Magazine (vol. viii. p. 52), in which he alludes to my having found in chalk objects similar to Coccoliths, induces me to give an account of my researches on the subject. I do not claim the discovery of such bodies in the Chalk, but to have been the first to point out that they are not the result of crystalline action, that they are identical with the objects described as Coccoliths by Prof. Huxley*, and that these are not single separate individuals, but portions of larger cells.

So far as I am aware, the illustrious Ehrenberg was the first who pointed out the ovoid bodies occurring in chalk, in a paper read at the Berlin Academy, Aug. 18, 1836, on "New Microscopic Characters of earthy and compact Minerals†." After alluding to the various minute bodies constituting some kinds of kaolin and agaric-mineral, he says that the most remarkable of all are those found in chalk, which shows small, flat, elliptical disks, similar to each other, consisting of only a few concentric rings, usually only one, and an internal nucleus of irregular character, as shown in his figure, pl. i. 2 B, in Pogg. Ann. He again alludes to them in his Memoir on Chalk and Chalk-marl ‡, saying that in a former paper he had declared that the preponderating substance of chalk, which forms the cementing material, was minute, elliptical, flat, granular bodies and their fragments. He looked upon them then, as he still continued to do, as concretions of a crystalline character, whose

* Deep-Sea Soundings in the North Atlantic Ocean, made in H.M.S. Cyclops. London, 1858.

† Monatsberichte, 1836; Poggendorff's Annalen, 1836, xxxix. 101.

‡ Abhandlungen der k. Akad. der Wissen. zu Berlin, 1838, 67.

form is peculiar to the chalk. In a note at p. 68, he ascribes them to the same kind of action as gave rise to the larger concretions met with in limestone- and clay-deposits, and considered the force which produced them not simple crystallization, though in some respects analogous, and proposes for it the term 'Crystalloid-Bildung.' The same idea is followed out in his paper on Concretions, read at the Berlin Academy, June 29, 1840*, in which he says he had endeavoured to make bodies like those in chalk by artificial chemical means, but had not succeeded, though he had made some to a certain extent similar. It must, however, be borne in mind that he looked upon them as *flat disks*, and not as *curved* in the manner shortly to be described. In his magnificent work, 'Microgeologie' (Leipzig, 1854), he also figures these ovoid bodies at pl. xxv. fig. B. 16, under the term 'Kreide-Morpholithe,' along with various minute radiating groups of crystals, evidently ascribing the whole to an inorganic action more or less closely connected with crystallization. In order to show to what extent such ovoid disks serve to make up some varieties of chalk, he gives (at pl. xxx. B) a highly magnified representation of the chalk of Rugen, and in various other plates shows that they constitute a very large proportion of the whole. It appears to me, however, a great exaggeration to affirm that chalk is *composed* of them, since a still larger part is made up of particles which we may attribute with confidence to the decomposed tissue of Foraminifera and other shells.

The inorganic nature of the ovoid bodies of the chalk has hitherto been almost universally adopted; for the only exception I am acquainted with is the supposition of the Rev. J. B. Reade†, who appears to have ascribed them to Infusoria. But when, about ten years since, I commenced studying the microscopical structure of chalk, I soon became convinced that both these explanations were unsatisfactory. By examining the fine granular matter of loose, unconsolidated chalk in water, and causing the ovoid bodies to turn round, I found that they are not *flat disks*, as described and figured by Ehrenberg, but (as shown by the oblique side view, fig. 5, p. 197) *concave* on one side and *convex* on the other, and indeed of precisely such a form as would result from cutting out oval watch-glasses from a moderately thick hollow glass sphere whose diameter was a few times greater than their own. This is a shape so entirely unlike anything due to crystalline or any other force acting independently of organization—so different to that of such round bodies, formed of minute radiating crystals, as can be made artificially and do really occur

* Neues Jahrbuch für Mineralogie, &c. 1840, 680; Journal für prakt. Chemie, 1840, xxi. 95; Ed. New Phil. Journ. 1841, xxx. 353.

† Mantell's Wonders of Geology, 2nd ed. vol. ii. 953.

in some natural deposits—and pointed so clearly to their having been derived from small hollow spheres, that I felt persuaded that such was their origin. The small cells of Foraminifera occurring in the chalk being just the size and thickness that would agree with this supposition, I endeavoured for a long time to make out that the ovoid bodies were in some way or other derived from them. I thought that, when decomposition took place, perhaps the calcareous matter might have re-arranged itself into more or less circular concretions whilst still in the form of the cells of Foraminifera, and thus, on further decay, they might have broken up into ovoid bodies of the form described above. I sought diligently for proof of this, but in vain, though I convinced myself that a very considerable part of the minute particles of the chalk was certainly derived from the decomposed tissue of Foraminifera. Notwithstanding this, I still adhered to the supposition of their having originated from organic spheres, and endeavoured to clear up the difficulty by studying recent deposits. Some eight or nine years ago, when examining mud from our own shores, I found one single body which was obviously similar to those in the chalk, both in form and optical characters, but was unable to make out its true nature.

In 1858 appeared Prof. Huxley's Report on the Deep-Sea Soundings in the Atlantic, in which, at p. 64, he says that in all the specimens, from depths varying between 1700 and 2400 fathoms, he had found "a multitude of very curious rounded bodies, to all appearance consisting of several concentric layers surrounding a minute clear centre, and looking at first sight somewhat like single cells of the plant *Protococcus*; as these bodies, however, are rapidly and completely dissolved by dilute acids, they cannot be organic, and I will for convenience' sake simply call them *Coccoliths*."

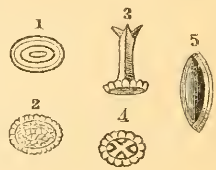
Still nourishing the conviction that ovoid bodies like those in chalk would be found in deep-sea deposits, at my request I was kindly furnished by Prof. Huxley with some of the Atlantic mud from a depth of 2230 fathoms. I was at that time as ignorant of what he had written on the subject as he was of my object, and of the connexion between the bodies he had described and the chalk. Directly I examined it with the microscope, I perceived that my long-cherished belief was true, and that this deep-ocean mud would completely explain the peculiar characters of our Chalk formations. Nor was this all; for on the 27th of August of last year (1860) I found that, as I had predicted several years before, the ovoid bodies were really derived from small hollow spheres, on which they occur, separated from each other, at definite intervals. I therefore read a short paper on the subject at the meeting of the Sheffield Literary and Philosophical Society, on the 2nd of October, in which I showed that the so-called crystalloids of the chalk are not of crystalline or concretionary origin, but are similar to ovoid bodies forming part of spherical cells in some respects analogous to the cells of Foraminifera.

Nearly two months after this, I had the pleasure of making the acquaintance of Dr. Wallich, who had just returned from his voyage in H.M.S. 'Bull-dog,' and found that he also had discovered the true origin of the Coccoliths, as described at p. 13 of his "Notes on the presence of Animal Life at vast Depths in the Sea, &c.," published for private circulation in November 1860, without having been aware of their important relation to chalk. Mr. Roberts, however, in his paper on "High and Low Life*," when alluding to Dr. Wallich's interesting discoveries, says, "Their discovery in a living state in this ooze is of high geological importance; for microscopical investigation, undertaken by Mr. Sorby, proves their existence in chalk-rocks, associated there, as they are in this North Atlantic Ocean, with Globigerinæ. Indeed, chalk itself is seen to be little else than a compacted mass of Foraminifera-shells, whole and fragmentary, and may be best described by using the very words by which Dr. Wallich introduces to science this recent deposit."

Having thus given a history of the subject, I will proceed to describe some of the facts I have observed, but at the same time shall not attempt to give anything like a complete account of the microscopical structure of chalk, which could not be done without a number of illustrations. Moreover, there are some interesting questions requiring further investigation, which I hope to describe in detail when treating on the microscopical structure of rocks in general. The drawings of Coccospheres and Coccoliths which I made nearly a year ago agree very closely with the figures accompanying Dr. Wallich's paper (pp. 53 & 54). I must confess that, as he justly observes, one is tempted to conclude that there is some connexion between Coccospheres and Globigerinæ; but, at the same time, I feel inclined to think that they may be an independent kind of organism, related to, but not the mere rudimentary form of, Foraminifera. Their optical properties are entirely different. Each cell of Globigerinæ, when alone or attached, gives a splendid well-defined black cross and coloured rings when examined with polarized light, which is readily explained by the fact of the shell being made up of minute crystals of calcite, arranged with their principal axis perpendicular to the surface of the shell. No such cross is, however, seen in the case of Coccospheres; and the cell-wall between the Coccoliths has such a very weak depolar-

* 'Geologist,' 1861, iv. 1.

izing action, that I very much doubt its calcareous nature. The individual Coccoliths, when on the spheres, or, still better by far, when detached, each give an extremely well-defined black cross; and their depolarizing action is much too powerful to allow us to suppose that this is due to the same arrangement of the carbonate of lime as in the shell of Globigerinæ, and that the Coccoliths are the commencement of calcification. At the same time it is not impossible that they might come off from the cells before general calcification took place; and I have found some shells of Foraminifera which showed imperfectly-defined oval bodies, giving black crosses with polarized light, thus proving that such a radiate arrangement of the carbonate of lime as that in Coccoliths does occasionally, though rarely, occur in the shell of Foraminifera. With respect to the individual Coccoliths, their optical characters prove that they have an extremely fine radiating crystalline structure, as if they had grown by the deposition of carbonate of lime on an elongated central nucleus, in accordance with the oval ringed structure shown in fig. 1 (magnified 800 linear).



In order to obtain a satisfactory knowledge of chalk, we should commence with the study of thin sections of the harder varieties. I am not aware that any one but myself has employed this method of research, but I have by this means succeeded in proving most completely that entire Foraminifera are comparatively rare, and make up only quite a small proportion of the whole. More or less detached and broken cells are, however, very numerous, so much so that in some cases they are almost in contact throughout the whole mass, and it is only the spaces between them that are filled with fine granular matter, which in some other specimens constitutes nearly the whole rock. In general, however, the constitution of chalk is intermediate between these two extremes. The nature of the granular matter is best learned by an examination of those very soft specimens which have not been much altered since deposition. When seen in water, under a bit of thin glass, with a power of from 400 to 800 linear, it is easy to perceive that a considerable part is made up of the decomposed tissue of Foraminifera. There are often also small well-defined groups of radiating crystals, similar to those named by Ehrenberg 'Krystaldrusen,' and figured on pl. xxv. B. 12–15 of his 'Microgeologie;' the nucleus is sometimes a minute fragment of the decomposed tissue of Foraminifera; and there can be no doubt respecting their crystalline and inorganic origin. They, however, differ entirely from the well-defined oval bodies hitherto described as chalk-crystalloids. These, in form and optical properties, are exactly similar to the Coccoliths of the Atlantic mud. When made to turn round, they both are seen to be concave on one side and convex on the other, as shown by the oblique side view of an unusually large one from the chalk, fig. 5 (magnified 800 linear); and they give the same kind of well-defined black cross with polarized light. Hence we must abandon the idea of their being "peculiar to the chalk," and may possibly be rather led to conclude that they are *characteristic of deep-ocean deposits.* Many of those in the chalk have a decided granular character, as shown in fig. 2 (magnified 800 linear). The rings, instead of being simple, are, as it were, made up of separate beads; and the centre is also of a compound granular character, with various modifications. Judging from Ehrenberg's drawings, and from what he says at p. 136 of his paper on Chalk and Chalk-marl, he appears to look upon this granular structure as their universal character, and concludes that their minute constituent granules were derived from decomposed Foraminifera, and were afterwards arranged into crystalloids by means of some unknown crystalloidal force. However, as already stated, some show no such granular structure, but are precisely similar to those in the Atlantic mud; and the granular constitution of the others admits of a very simple explanation. As is well known, when shells become fossil, they often acquire a crystalline texture; and, in fact, this occurs in the recent dead shells found in the mud of the Mediterranean, described by Marcel de Serres and Figuier*. I have also succeeded, beyond all expectation, in producing artificially the same change in recent shells by keeping them for a month or two in a dilute solution of caustic potash, at a temperature of about 145° C. (293° F.), which, by dissolving the organic matter, permits the carbonate of lime to crystallize according to a new arrangement; and not only do shells consisting of aragonite undergo this change, but also sometimes those made of calcite†, though, in the case of fossils, it has often only occurred in those composed of aragonite. If such a molecular re-arrangement were to take place in the Coccoliths of the Atlantic mud, they would become almost exactly like the granular specimens found in the chalk; and I shall be much surprised if I do not succeed in imitating them by such artificial means as I have just described.

* Annales des Sciences Nat. 3 sér. 1847, vii. 21; Comptes Rendus, 1846. xxii. 1050; Neues Jahrbuch für Mineralogie, 1848, 873; Edinburgh New Phil. Journ. 1847, xlii. 381.

† See Rose's second treatise on Carbonate of Lime, Abhandlungen d. k. Ak. d. Wiss. zu Berlin, 1858, 63, since confirmed and extended by my own experiments.

Though the facts I have already stated appear to me conclusive, yet it is of course satisfactory to find that, though rarely seen to advantage, compound Coccospheres do really occur in the chalk; and, indeed, I had seen and made a drawing of one nearly ten years ago, without having properly understood its nature. They, however, like the Foraminifera, appear to have undergone much more decomposition in the chalk than in the fresh mud of the Atlantic, which is only what might have been expected.

But, besides simple ovoid Coccoliths, and others modified by various marks and apertures, there occur in chalk minute bodies which are apparently somewhat related to them, but differ from anything hitherto found in the Atlantic mud. As an illustration of these, I refer to figs. 3 and 4 (magnified 800 linear). Those like fig. 4 are similar to Coccoliths in being oval and spoon-shaped, but show four marks, arranged in a cross, instead of two, or a single elongated nucleus. When bodies like fig. 3 are made to turn about, the under side of the broad end is seen to be like fig. 4, which is, in fact, so to speak, the ground-plan of fig. 3. There are various forms of these curious objects, which are obviously of organic origin, and may be described as Coccoliths with a sort of spine growing outwards from the centre. These spines are four-sided, are sometimes pointed, sometimes end in a small cross, and sometimes extend into four well-developed wings. When the ovoid base occurs alone, either owing to the spine having been broken off or never developed, it is difficult to distinguish them from some varieties of Coccoliths, or at all events to point out any essential and widely remote difference; and therefore, though I have not yet met with sufficient evidence to prove it, I cannot help thinking that at the Chalk period there was a form of Coccosphere in which the Coccoliths were to a greater or less extent developed into small spines.

It is not easy to determine the extent to which these various ovoid organic fragments serve to make up chalk; but, like the Coccoliths of the Atlantic mud, and to a very similar extent, they and their fragments do certainly constitute a very material proportion of the whole. If to them we add the more or less entire and broken Foraminifera, and such particles as can be shown to result from their decay and from the decomposition of the shells of *Inoceramus*, it appears to me that we are in a position to completely account for the origin of the deposit. The importance of the fact of thus being able to make out the true nature of the so-called 'crystalloids' is, that we can no longer doubt the almost entirely organic origin of chalk. Had they been due to a kind of crystalline action, we might indeed have had good reason for supposing, with Ehrenberg, that the carbonate of lime of which they are composed was derived from decayed Foraminifera; but at the same time a strict proof would have been wanting, and we might have adopted the opinion expressed by Haidinger in his paper on the Metamorphism of Rocks *, and concluded that, though, according to Ehrenberg, chalk does contain very many organic bodies, it does itself consist of rounded forms, which are a chemical deposit from water containing soluble salts of lime. Now, however, that their real origin appears to be established, it is no longer requisite to assume the existence of any unknown crystalloidal force differing from simple crystallization; and we can clearly perceive that, though presenting characteristic differences, chalk is in every respect analogous to what we should have, if the mud now being formed at great depths in the Atlantic, by the accumulation of various minute organic bodies, were to be subsequently more or less altered by molecular changes or chemical actions of a well-known character. There is, however, one striking difference; for the Atlantic mud contains many Diatomaceæ, spicula of Sponges, and other silicious organic bodies, which are very rare in, or absent from, the chalk: it contains, however, silicious concretions; and this contrast in the state and aggregation of the silicious matter in the two otherwise analogous deposits makes me very much inclined to conclude, with Ehrenberg†, that the silex of the flints was derived from disseminated silicious organic bodies, which has collected round various centres of segregational attraction,—though there are some difficulties to remove before that opinion can be finally adopted.

XX.—*On the Sexual Life of Plants, and Parthenogenesis.* By Dr. H. Karsten, Lecturer on Botany at the University of Berlin.

[Concluded from page 99.]

Embryogeny.

The elongated pollen-cells on the stigma of *Cœlebogyne ilicifolia* exhibit no peculiarity in the onward course they pursue to the nucleus of the ovule. The amylum and the vesicles with nitrogenous contents (mucus-vesicles) become dissolved as the pollen grows; and when the pollen-tube has reached the large embryo-sac, it is seen to be filled with fluid, which also in all probability contains a number of vesicles, freely swimming about in it, some with and others without nuclei.

* Haidinger's Wiener Mittheilungen, 1848, iv. 103; Neues Jahrbuch für Mineralogie, 1849, 213.

† Abhandlungen d. k. Ak. d. Wiss. zu Berlin, 1838, 82.

One, or, it may be, two of these free cells attach themselves to the wall of the embryo-sac, with which the pollen-tube is in contact; and thereupon a process of cell-multiplication commences. Not seldom this process goes on for a time in the two germinal cells which may be present; but as a rule, one of them preponderates, and alone proceeds in forming the germinal mass (Pl. X.).

What part the pollen-sac takes in the process—whether its wall, which separates the germinal cell and the embryo-sac, be absorbed, or whether its contents, on becoming fluid, are simply diffused through it by exosmosis—cannot be satisfactorily decided by direct examination.

The larger proportion of the rudimentary cells contained in the fluid of the pollen-tube at the time this comes into contact with the embryo-sac serves for the formation of the albumen which is disposed around the growing germ (Pl. X.).

That the embryo could be formed without the action of the pollen-tube, as Radlkofer and Braun assume because Radlkofer and Deeke frequently failed in detecting the pollen-tube, is an idea no one will accept who is conversant with this kind of investigation, which, in spite of the greatest dexterity and practice, may frequently fail to exhibit in many plants the pollen-tube, which nevertheless undoubtedly exists.

The interesting question, whether, for the complete formation of two germs which are frequently at first simultaneously developed, the action of more than one pollen-tube is necessary, still remains to be answered.

The germinal cells appear, at the time of their first formation, like very delicate-walled vesicles (termed vacuoles); indeed, they seem to be present in the embryo-sac before the pollen-tube reaches it; at least, these cells are often to be seen when the pollen-tube is undiscoverable, although this certainly can never afford evidence that it actually does not exist.

In some of the free swimming-vesicles, whose walls become thicker and more perceptible, a new vesicle arises, which is usually called the nuclear corpuscle, because the free swimming-cells which contain these very small secondary (daughter-) cells have been distinguished as cell-nuclei, on the supposition that a cellulose-layer is deposited around them as the membrane of a cell which served as nucleus to this originally existing cell. This, however, is not correct; for, on the contrary, the membrane itself, the vesicle contained within it, and the daughter-cells or the nuclear corpuscles extend themselves simultaneously by means of cellulose, and one or several small new cells make their appearance in them.

In the embryo-sac the observer has all the different stages of cell-development before his eyes at the same time, and yet he is without a clue to the order of their origin; consequently his judgment may be at fault whether to admit that the outer cell is gradually deposited, in a laminated fashion, upon the inmost cell or nuclear corpuscle, or that the inner cells originate in the fluid contents of the external cells, which in the mean time expand.

In my Dissertation published in 1843, I remarked on the existence of the "daughter-cell," subsequently termed by Mohl the primordial utricle, and have very many times since recurred to this subject, and I still deem it incumbent on me again to make the assertion that the formation of a cell-membrane as a deposit on a mucoid, cellular, &c., nucleus, has, according to my repeated and careful investigations of the subject, no existence in nature. Statements of the sort have arisen wholly from incorrect views of what has been observed, because the phenomena of growth of the membrane and of the chemical changes of the cell-matter were not understood; and I may be allowed to commend to the consideration of physiologists my paper in Poggendorff's Annalen as peculiarly pertinent to the matter in discussion respecting the transformations of cellulose in the progress of growth.

The physico-chemical processes in which the phenomena of cell-growth consist must of necessity be rightly apprehended before we can hope to understand the complicated physiological phenomena of the organism.

In the case of *Cœlebogyne*, I am unable, from the want of material, as before said, to assert positively whether the cellular contents had been given birth to before the arrival of the pollen-tube in the embryo-sac—as is probable, because we are acquainted with cases where albuminous tissue is commenced about barren (non-germinating) seeds—or whether the cell-contents first arise as a consequence of the action of the pollen-tube; and further, whether the commencement of germ-growth in some of these cells is induced by the contiguity of the pollen-tube, or if an actual contact of the two is needed. This relation is of moment in making the comparison between the commonly occurring single germ of the Phanerogamia and vascular Cryptogamia and the usually numerous germs of the cellular Cryptogamia, especially of the Mosses and Liverworts.

In my 'Flora Columbiæ' (p. 41) I assimilate the spores of the Mosses with the polycotyledonous embryos of the Coniferæ, because the spores contained in the sporangia of Mosses, like the divided embryos of the Coniferæ, originate from the multiplication of a single fruitful cell, whilst the numerous embryos present in an embryo-sac of other Phanerogamia* have each a distinct and independent origin in its fluid.

If the fertilizing elements of the cellular Cryptogamia are morphologically so very unlike those of Phanerogamia, the analogy in the construction of the germ in these two great divisions of the vegetable kingdom cannot be extended further; for it is not known with certainty whether the fertilizing contents of *one* pollen-cell suffice for the complete development of several germs, nor whether one antherozoid is of equal value with one pollen-grain. And indeed, were this ascertained, the numerous simultaneous germs of the Mosses cannot be compared with the multipartite embryos of the Gymnospermæ and with the more numerous free embryos of the Angiospermæ; for the free central cell of the moss-sporangium would have to be regarded in the first case as a germ-cell, and in the second as an embryo-sac.

It follows, from our more recent acquaintance with the reproductive phenomena of the Linnæan Cryptogamia, first, *that the form of the reproductive processes is varied the more in direct proportion with the greater simplicity of the organs of vegetation; and secondly, that the number of germs developed as the result of an act of fertilization is the greater in the simpler-organized plants.*

The validity of this second law will be more thoroughly established by the consideration of the reproductive processes of the Lichens, on which I have made some remarks above.

Cœnogonium, Ehrenberg†.

Amended characters:—

Thallus discoideus in ambitu crescens, contextu stuppeo, e tubulis confervoideis, articulatis, subvirescentibus, strato corticali simplici filamentoso albido cancellatim vestitis intertextus. Apothecia terminalia et lateralia, primitus globosa, clausa, denique suborbiculata, scutelliformia, peltata, stipitata; hymenio (disco) aurantiaco; ascis sporigeris, paraphysibus cylindricis apice globosis mixtis; sporis octonis, ellipsoideis, bicellosis.

C. Linkii, Ehrenb.

Tubulorum articuli 0·045 mm. longi, 0·010 mm. in diam., gelatinam virescentem includentes; apothecia plerumque terminalia, subimmarginata.

Habitat in Brasilia.

* I observed from ten to twelve embryos in *Hymenocallis*, three or four in *Mangifera*, *Steriphoma*, and *Socratea*: Schacht, indeed, found as many as a hundred in *Citrus*.

† Horæ Physicæ Berolinenses, 1820, p. 120.

C. Andinum, Krst. Pl. XI.

Tubulorum articuli 0·12 mm. longi, 0·035 mm. in diametro, gelatinam virescentem includentes; apothecia plerumque lateralia, albide marginata.

Crescit in sylvis montuosis Novæ Granatæ et Venezuelæ ad arborum ramos; altitudine 5000–6000′.

The vital phenomena of this plant, together with the presence of an articulated central tube containing a green though formless colouring matter and apothecia, intimate its systematic position to be among the Lichens, where, indeed, both Ehrenberg and Koerber have placed it.

Each of the cylindrical fibres by the interweaving of which the thallus is formed consists, in the first place, of a central articulated cylinder, or a series of endogenous cells, the walls and septa of which are thickened, coloured blue by a solution of iodized chloride of zinc, and not dissolved in caustic potash; in the second, of a looser lamina of very delicate branched and anastomosing tubes which surround the central tube; and in the third place, of an equally delicate structureless cuticle which envelopes the whole plant. The two latter tissues are not coloured blue by the iodized chloride of zinc, whilst they dissolve in solution of potash.

The branching of the fibres is not very considerable; still it is sufficient, by the interweaving of all the horizontally-placed fibres and branches, to build up a complex thallus, which extends itself by a peripheral growth from the central portion, or the point by which it adheres to the twig of a tree.

The discoid apothecia are attached by a short pedicle to the sides of the fibres, in *C. Andinum*, as well upon the upper as on the under surface of all the fibres in the congeries forming the thallus: they are rarely affixed to the extremities of the fibres. The discoid apothecia are coloured orange-red and surrounded by a white border, which in the earlier phases of growth is very prominent.

The orange-coloured disk (*hymenium*) consists of fusiform tubes (figs. 1–6 & 15), which contain each eight bisected elliptical spores (fig. 12), and of somewhat longer '*paraphyses*,' similar in form to the spore-tubes, but with globular, enlarged extremities.

Both the spore-tubes and the paraphyses are supported on short jointed fibres (fig. 12), which are prolonged downwards into the parent-tissue (matrix), consisting of branched, jointed, anastomosing and interwoven narrow cylinders.

This matrix lies upon a similarly constructed tissue, consisting, however, of wider cylinders; which envelope and anastomose largely with it, forming its cortical layer as well as the margin of the apothecium.

The cortical or tegumentary lamina encloses in the first instance the whole rudimentary fruit-disk (hymenium) (figs. 2 & 11), and is burst asunder, during the development of the latter, at the summit of the growing apothecium, whilst it at the same time takes part with the upward growth of the tissue of the matrix and of the hymenium, and ends in the production of the ring or border.

On examining the apothecia in their earliest stage, they are seen to be formed very much in the same way as the young branches; yet throughout the process of development it is evident that the central cell of a simple branch is seated by a wide base upon the articulated stem-fibre (fig. 8), whilst in a branch which is to be converted into a sporangium it has a globular figure and lies on it like a free or independent corpuscle (figs. 7, 9, & 10 *a*). In a word, the youngest apothecium is globular, the young branch fusiform.

The further development of the cortical layer surrounding the central cell renders the distinction between the two structures particularly easy; for the delicate transparent mycelium-like fibres which are woven around the central cylinder of the fibres of the thallus are not uniformly extended to the archegonium, but form, by the generation of daughter-cells, a cell-like coat around the free, globular central cells.

This layer of smaller vesicular cells represents in this organ the cells of the archegonium of higher Cryptogamia which are coalesced into a cylinder.

Some of these vesicles elevate themselves above the surface of the archegonium, and at length detach themselves from the parent-cell (figs. 9 & 10), like the three "dot-cells" of the pollen of *Cœlebogyne* (Plate X.), or the numerous "dot-cells" of the pollen of Alsineæ; and they leave holes behind them in the integument, such as are also seen on the archegonium of *Saprolegnia*.

From the base of this globular apothecial structure (archegonium), the branches of the cortical layer simultaneously elevate themselves above the surface (fig. 7) and grow over the archegonium (as happens in *Coleochæte* and *Saprolegnia*), adhering closely to it, whilst here and there they dilate and form receptacles for a finely-granular mucoid fluid.

These dilatations are met with, as in *Saprolegnia*, above the small apertures left by the detachment of the "dot-cells," and at a later phase of existence are found empty.

Cell-growth now begins simultaneously in the green-coloured central-cell; four daughter-cells arise in it, whilst the surrounding cell-layer (the archegonium) becomes thicker and opake and conceals the enclosed cells.

Moreover the branches surrounding the archegonium as far as its apex ramify still more, particularly about the base, and attach the enlarging archegonium so much the more firmly to the parent branch as well as to other branches adjoining, and constitute for it an outer cortical layer (figs. 2 & 5 *a*, strongly compressed).

In thin longitudinal sections which contain the central tissue of the young archegonium, the centre may be seen entirely filled, for some time after the act of impregnation, with large, thin-walled cells, united in groups of four, containing a cloudy, gelatine-like matter. Some of these cells present no definitely formed corpuscles, whilst others (fig. 4) contain small granules and vesicles, but in no considerable quantity. By tearing and pressing the section under water, these collections of four adherent cells can be isolated.

Similar sections of archegonia of rather larger size show these large delicate cells, developed from the one central free cell of the archegonium, to be completely filled (fig. 3) with little ellipsoidal corpuscles, derived no doubt by an act of multiplication of the vesicles previously formed in the phase of development above described.

Longitudinal sections of still older but as yet closed archegonia (fig. 11), before they have become gorged with water, still display a central granular mass and groups of cells, from which the central tissue is progressively formed. When the section is thoroughly filled with absorbed fluid, this central tissue exhibits a homogeneous ellipsoidal mass, flattened at its two extremities; and whilst its base is enveloped by a cup-shaped lamina (derived from the modified cells of the archegonium) which is rather less porous than the cortical layer that surrounds the whole, its apex seems to be covered by large cells. The latter can no longer be detached. On tearing the preparation longitudinally, we ascertain that the large cells of the centre are conjoined with the adjacent layer of tissue, and that their apparently granular contents consist of long cylindrical cells, attached to the peripheral tissue, but free towards the centre.

These fibres are transitional forms in the development of spores and paraphyses; they have a mucilaginous appearance, are not quite uniformly cylindrical, but rather moniliform (fig. 13), as if the rudimentary spores were disposed in longitudinal rows next each other.

Moreover the archegonial cells (matrix) are now fibrous in form, like those of the cortical tissue, and are scarcely at all separable from the latter, or from the tubular layer, without laceration. All three varieties of the cells anastomose with one another, whence it happens that the tubes seem to be the ends of the cortical cells.

If this mode of development of the apothecium be compared with that of the sporangium of the foliaceous cellular Cryptogamia, we find that the at first free central cell of the archegonium of the latter, which becomes developed into the sporangium (whilst its downward-growing lower extremity, the future seta, coalesces with the receptaculum), presents an analogy with the cell from which the hymenium is developed, inasmuch as the peripheral ends of all its parts are united with the adjoining tissue.

The mother-cells of the spores are here retained after they are completely transformed into sporothecæ, whereas in the Mosses they become absorbed before the complete development of the spores. Instead of the *elaters* of the Hepaticæ, we here find among the Lichens the paraphyses.

By prolonged maceration in water the outer cortical layer becomes dissolved, and the young apothecia are resolved into endogenous cells, which are seen like rows of "daughter-cells" on the free branches (figs. 2 *a* & 5 *a*).

These cells recall in appearance those structures remarked by Itzigsohn, and called *spermatia*; however, I have not been fortunate enough to witness the antherozoid movements in them which Itzigsohn and Rabenhorst observed in the spermatia.

The act of impregnation of *Cœnogonium* recalls that of the conjugation of the two different branches of *Vaucheria* (Pl. IX. fig. 23), from the intermingling of the chemically different contents of which the formation of a germ proceeded. This circumstance, too, affords still stronger evidence of a sexual act, since, under altered vital conditions of the same plant, the same organs carried out the second form of fertilization, which most closely coincided with the normal proceeding (Pl. IX. figs. 24 *a* and 26 *a* & *b*).

The product of one act of fertilization is here, as among the Mosses and Hepaticæ and also some genera of Algæ (*Saprolegnia* and *Achlya*), not a single germ, but several or many; and between the process of impregnation seen in the last-named Alga and that in the *Cœnogonium* the closest similarity obtains, inasmuch as the archegonium does not receive the fructifying material on one side only, but simultaneously in several parts, after the fashion of the conjugation occurring among the Confervæ.

This history of the development of the apothecium of *Cœnogonium* points out the course we must pursue in order to convince ourselves what is the function of Itzigsohn's spermatia, and whether it be, as Rabenhorst and Tulasne imagine, sexual. It certainly cannot be the mother-cells of the spores which receive the fructifying material, but the original mother-cell of the entire hymenium contained in the archegonium. Where are we to seek for the archegonium? the history of the development of the apothecium will inform us.

Speerschneider has probably seen it in *Ramalina calicaris,* the walls of the gonidia of which, he says, he frequently saw beset with cell-like masses. To me, at least, it does not seem improbable that the archegonial cell of *Cœnogonium* has its equivalent in the gonidia of the Lichens with a foliaceous thallus; indeed this view is not supported by Speerschneider's observation, that gonidia also are developed into Lichens; but even this phenomenon, interpreted as a metamorphosis, is not in complete antagonism with that notion.

Similar laws of development hold good more surely in the case of the Fungi, which are so very similar to the Lichens in their organization. But here again we are not to expect to witness a fertilization of the *basidia* and *asci,* but have rather to seek it in the first rudiments of the pileus.

Ehrenberg has probably seen the fertilization of the *Amanita rosea,* and has described the conjugation of *Syzygites*; still, carried away by the idea that there must be one *single* germ as the immediate product of this process, he has not pursued the study of the further development of the plant.

That many of the structures described hitherto as species of Fungi are not actually plants at all, but only abnormally developed cells from the tissues of various plants and animals, is an assertion long since made by Reissek and myself.

I proved first the development of the yeast-plant from such cells of tissues and from the mycelium of Fungi, and I pointed out the necessity of instituting similar inquiries in various ways and on a large scale, so that we might ascertain the lowest limits which the specifically different multiplied plant-forms may reach by reproduction, and learn to distinguish these from diseased redundancies of elementary organs derived from the abnormal conditions in which plants are placed.

Bail and Hoffmann have in some measure corroborated these views; and I have myself often repeated these observations and extended my conclusions.

That the segments, separating in a spore-like form, of the pollen-tube developed in the form of a filamentous Fungus, are developed, not in the same, but in quite a different form, and consequently are not the members of a species of plants, was shown by me by that investigation; and it was proved by Hoffmann, Bary, Bail, Caspary, and others, that branches with differently formed spores are produced on one and the same mycelium. The signification of this fact is, at the present time, not understood: it is not known if those varieties in form are produced by variations in the mode of nutrition, and so far referable to those noticed by me as varieties or morbid productions, or if, as is possible, they are organs of dissimilar purpose, belonging to a particular species of Fungi and intended to carry out a sexual conjugation. In this latter case, it might be presumed that *Syzygites* is the prothallium of a more perfect form of Fungus.

The result of all these inquiries is, that all known species of plants possess, besides an asexual multiplication of individuals by cell-division or gemmation, a means of preserving the species by sexually developed germs, and that in these special reproductive organs a normal germ is never formed without the operation of a fertilizing material,—that, consequently, *parthenogenesis never occurs in plants.*

XXI.—*Description of a new Species of* Branchipus (B. eximius), *from the Pool of Gihon in Jerusalem.* By W. Baird, M.D., F.L.S.

[Plate XII.]

In the 'Annals and Magazine of Natural History' for Oct. 1859, I described five new species of Entomostraca, from the Pool of Gihon in Jerusalem. In that paper I mentioned that, in addition to those species forwarded to me alive by my friend Mr. Denny of Leeds, a pair of a species of what I then thought to be a *Chirocephalus*, from the same habitat, were kindly sent, but that they had died and become decomposed before I had the satisfaction of examining them. Since then, Mr. Denny has forwarded to me several specimens of the same Crustacean, also alive, reared from mud taken from the same pool at Jerusalem. A careful examination has proved them to belong to the genus *Branchipus*; and very elegant and beautiful little creatures they are. In their habits they closely resemble the *Chirocephalus diaphanus* found in this country, swimming chiefly on their back, and gracefully moving along, their numerous branchial feet being in constant motion. The females had their ovarian sacs full of ova, but they all died before these eggs were hatched. The following is a description of this interesting species:—

Branchipus eximius.

Body of a white colour. Tail fully the length of the body, and terminating in two lobes, which are beset with finely plumose setæ on their inner sides only. Outer edge showing a few (about twelve) short teeth near the base.

Male. About an inch long. Cephalic horns large, two-jointed; basal joint stout, of considerable length, and (as seen by a power of $\frac{2}{3}$rds of an inch) roughened all over with very short sharp prickles; terminal joint shorter, and bent in form of a hook. Antennæ rather long, terminated by two or three short setæ. Sessile eye small, somewhat lunate-shaped; compound eyes rather large and pedicelled. Mandibles largely developed. Caudal portion of body formed of seven segments. Male organ largely developed, composed of two portions: the basal portion having a strong tooth on its inner edge; the terminal portion straighter, and terminating in a flattened point with some toothed appendages attached to it.

Female. Cephalic horns much shorter than in the male, and consisting of only one joint. The basal portion is broad and flat; the terminal portion suddenly becoming narrow, and ending in a sharp point. Antennæ rather shorter than in the male.

In other respects the two sexes are nearly alike, except that the female is about a fifth smaller. Ovarian sac cylindrical and of considerable length. Eggs of an orange colour.

Hab. Pool of Gihon, Jerusalem.

EXPLANATION OF PLATE XII.

Fig. 1. Male.
Fig. 2. Female.
Fig. 3. Head of male.
Fig. 4. Head of female.
Fig. 5. Mandible.
Fig. 6. Antenna.
Fig. 7. One of the branchial feet.
Fig. 8. Tail.
Fig. 9. Male organ.
Fig. 10. Terminating teeth of male organ.

XXII.—*Descriptions of two new Species of Coleoptera from the Canary Islands.* By the Barão do Castello de Paiva, Professôr de Botannica na Academia Polytechnica do Porto.

Fam. **Galerucidæ.**

Genus Calomicrus.

(Dillwyn) Steph., Ill. Brit. Ent. iv. 293 (1831).

Calomicrus Wollastoni, Paiva.

C. oblongus, subopacus, subtilissime alutaceus, subtus pubescens, supra flavo-testaceus, capite (præsertim postice) rufescentiore, oculis, interdum mento, prosterno, mesosterno, metasterno abdomineque nigris; prothorace brevi, in medio transversim impresso (impressione in disco plus minus interrupta); elytris dense punctulatis; antennis testaceis, apicem versus paulo infuscatis; pedibus pallido-testaceis.

Long. corp. lin. $1\frac{2}{3}$–$1\frac{3}{4}$.

Habitat in floribus foliisque *Cistorum* (sc. *vaginati*, Linn., et *Mons-*

peliensis, Linn.) in ins. Teneriffa, Palma, et Hierro, inter 1500′ et 3000′ s. m. crescentium, una cum *Hispa occatore*, Br., degens; in pinetis locorum editiorum præcipue vivit.

In honorem peritissimi Entomologici T. Vernon Wollaston necnon viri præstantissimi hanc speciem certe novam, ob quamplurimas gratias mihi amicissime oblatas, grata mente libenter nuncupavi.

C. sat angustulus, oblongus, subopacus et oculo valde armato subtiliter sed distincte alutaceus, subtus pubescens, supra pilis omnino carens, pallide flavo-testaceus, capite (præsertim postice) paulo rufescentiore. *Corpus* subtus (sc. sterna abdomenque necnon interdum etiam mentum) nigrum. *Oculi* magni, prominentes, nigri. *Prothorax* brevis, transversus, antice truncatus, postice leviter rotundatus, lateribus fere rectis, ad latera et basin anguste marginatus, in medio transversim impressus, impressione in disco plus minus distincte interrupta vel divisa. *Elytra* dense sed leviter punctulata, concoloria. *Alæ* amplissimæ. *Antennæ* ad basin testaceæ, apicem versus paulo magis infuscatæ, ad apicem articuli ultimi ipsissimum sæpius nigræ. *Pedes* pallido-testacei, tarsis vix obscurioribus.

This large and distinct *Calomicrus* (which is remarkable for being pale yellow above, but black and pubescent beneath) appears to be principally (if not entirely) attached to the flowers and foliage of the two mountain *Cisti*, under which circumstances it is not uncommon on the *red* species (the *C. vaginatus*, Linn.), in company with the *Hispa occator* of Brullé, at the Agua Mansa, and in the Pinal above Icod de los Vinhos, of Teneriffe. It likewise occurs, in similar positions, though more rarely, in the pine-regions of Palma; as also, on the *C. Monspeliensis*, at the edges of the Vueltas leading down from the Cumbre into the district of El Golfo, on the western side of Hierro.

Fam. **Hylesinidæ.**

Genus Hylastes.

Erichson, in Wiegm. Archiv, ii. 47 (1836).

Hylastes Lowei, Paiva.

H. cylindricus, niger, subnitidus; capite sat dense punctulato; prothorace vix parcius punctulato (punctis in disco paulo magis remotis); elytris vix picescentioribus, dense transversim rugulosis et longitudinaliter subpunctato-striatis; antennis rufo-piceis, capitulo obscuriore; pedibus piceo-nigris, tarsis clarioribus.

Long. corp. lin. $1\frac{2}{3}$–$1\frac{3}{4}$.

Habitat locos editiores ins. Teneriffæ et Palmæ, in pinetis, sub cortice laxo, lignum emortuum *Pini canariensis*, una cum *Tomico* quodam magno inedito, destruens: in arboribus antiquis ad Agua Mansa Teneriffæ crescentibus tempore æstivo abundat.

In honorem Reverendi R. Thomas Lowe, scientiæ naturalis perscrutatoris laboriosissimi et etiam virtutibus ornati, hanc novam speciem, gratiis mihi amicissime oblatis, animo grato sponte dedicavi.

H. angusto-cylindricus, niger, subnitidus et fere calvus. *Caput* sat dense et rugose punctatum; rostro brevi, in medio longitudinaliter carinato necnon ad apicem ipsum pilis pallidioribus obsito. *Prothorax* longiusculus, postice vix angustatus, paulo magis nitidus sed vix parcius leviusque punctulatus, punctis versus latera densioribus profundioribus et subconfluentibus, in disco linea lævi impunctata longitudinali instructus. *Elytra* paulo magis (præsertim postice) picescentia ac minus nitida, dense transversim rugulosa, sat profunde subpunctato- (fere subcrenato-) striata, interstitiis minutissime punctulatis, ad apicem integra sed ibidem parce et breviter pilosa. *Antennæ* rufo-piceæ (fere piceo-ferrugineæ), capitulo solido, obscuriore. *Pedes* piceo-nigri, tarsis pallidioribus; *tibiis* latis, compressis, extus fortiter spinoso-dentatis.

The present *Hylastes* seems to be closely related, at first sight, to the European *H. ater*, Payk., of which it may be regarded as the Canarian representative. It is certainly, however, distinct from that species, being smaller, and with the punctation *much* finer and closer; the longitudinal impunctate line on its prothorax is also more evident. Like the *H. ater*, however, it has the longitudinal keel down the middle of its rostrum well developed, and also two large deep impressions at the base of its antennæ. It appears to be distinct from all the cognate species, as yet described, from more northern latitudes.

It is found in the old Pinals of Teneriffe and Palma, and therefore at a high elevation above the sea. It appears to be confined exclusively to the rotten wood of the *Pinus canariensis*, where it may often be found in great numbers, beneath the loose bark, in company with the *Eremotes crassicornis*, Brullé, and a large (though hitherto unpublished) species of *Tomicus*. At the Agua Mansa, in Teneriffe, it occasionally abounds during the summer months.

Lisboa, 15 de Julho de 1861.

XXIII.—*Contributions to an Insect Fauna of the Amazon Valley.* COLEOPTERA: LONGICORNES. By H. W. BATES, Esq.

[Continued from p. 152.]

Genus ACANTHODERES, Serv.

Serville, Ann. Soc. Ent. Fr. iv. 29.

Char. emend. Body oblong, more or less depressed, narrowed posteriorly. Head rather broad, muzzle transverse-quadrate, much depressed, its anterior angles distinct, front plane; antenniferous tubercles not prominent, consequently there is no concavity between the antennæ: mouth projecting; mandibles long and flattened: eyes wide apart. Antennæ slightly hairy, never fringed beneath as in *Oreodera*; the basal joint always pyriform clavate, smooth, considerably shorter than the third. Thorax with a simple large conical tubercle on each side, generally ending in a spine. Femora strongly clavate; tarsi moderate, claw-joint short; fore tarsi in the ♂ broadly dilated and ciliated.

The above are the only characters that I find tolerably constant in the thirty-eight species which I have examined. The forms are very variable in most of the parts of structure from which generic characters are derivable, and exemplify well the difficulties which the Longicorn family offers to the classifier. No definition has yet been given founded on a large number of species. That of Leconte ("Attempt to classify, &c.," Journ. Ac. N. Sc. Philad. ii. n. s.) is probably the best; but, relating only to the two or three North American species, it is not applicable generally. The rounded outline of the anterior acetabula, which he gives as a character of the section to which *Acanthoderes* belongs, is very variable. In *A. varius*, the European species which may be considered typical of the genus, they are angulated; in other species the acetabular sutures are gaping along their whole length; in a few, however, they are closed. Although they differ in species otherwise closely allied, yet they are more constantly closed in those which approach *Steirastoma*. The head is generally plane in front, the muzzle prolonged considerably below the eyes, the lower lobe of the latter being very small; in some few species, however, the eyes are rather more voluminous below the antennæ, thus reducing the breadth of the forehead and the length of the muzzle. The palpi are always elongated, with the terminal joint obtusely pointed. The ligula has its sides dilated and rounded; the lobes, however, are widely divergent in some species (*A. thoracicus*), and nearly united to their tips in others (*A. bivitta*). The antennæ are very variable in length, thickness, and shape of the joints, being in some species no longer than the body, in others twice the length: the third joint is generally very long, and the fourth considerably longer than any of the following; sometimes the two are as long as the remaining taken together; both are generally filiform, with a longitudinal furrow above, but they are occasionally dilated and produced beneath at their apices, and in a few aberrant species furnished with tufts of hairs: the terminal joints are generally filiform, sometimes short, thickened, and ciliated in the ♂, and sometimes dilated and serriform in both sexes. The thorax has the lateral tubercles, in rare instances, very obtuse; the dorsal surface is uneven, sometimes tuberculated, occasionally furnished with three very prominent tubercles, but generally tricostate. The elytra are generally trigonal, at times oblong, depressed or slightly convex, their surface sometimes even, but generally furnished with a ridge on each at the base, which often projects forwards, and in many species is prolonged posteriorly to the apex: the latter is generally briefly and obliquely truncated, but it is sometimes whole, and at other times largely truncated, with the external angles projecting into a tooth or spine. The pro- and mesosterna are moderately broad, but variable in this respect; the former never very narrow, the latter not contracted between the haunches nor extremely short, but always of a quadrangular shape. Both are plane on their surface in some species, but they are more generally tumid or tuberculated, ridged on the sides, and projecting: in a number of cases the mesosternum is projecting, whilst the prosternum is simple; in many species, however, both project and have their opposing faces steeply inclined. They vary greatly in species otherwise closely allied, although they are similarly constructed in all those species which approximate to *Steirastoma*. The tibiæ are, in one section of the genus, strongly dilated and compressed. The terminal ventral segment is sinuate-truncate in the ♂, and entire in the ♀.

The flattened shape of the muzzle distinguishes this genus from the preceding. There is no character to separate it from *Dryoctenes*, Serv. The shape of the sterna distinguishes it from *Polyrhaphis*. From *Steirastoma* it differs at once in the simple, conical, lateral thoracic tubercles; and from *Alphus* by the pyriform basal joint of the antennæ. I have incorporated with it the genus *Pteridotelus*, White,—with some hesitation, however, as I think *Pteridotelus* might probably form a natural group if the generic definition were modified so as to include all those species which have the terminal joints of the antennæ shortened and thickened in any degree, or thickened and ciliated in the ♂. The species on which it is founded (*Pteridotelus laticornis*) cannot be generically separated from *A. pupillatus*, Chevrolat, which, again, is closely allied to *A. spectabilis*, n. sp., and *A. pilicornis*, Chevr.*, all four most diversified in ornamentation of the antennæ, but agreeing in the thickening in some way or other of the terminal joints. These species have in common also rounded anterior acetabula, slender fore tibiæ, and steeply inclined sterna. As a genus, however, it would not be sharply limited from *Acanthoderes*: other species have the terminal antennal joints somewhat shortened and ciliated, without

* To these may probably be added *A. antennatus* of Guérin-Méneville (Ins. Recueillis par Osculati, Verh. des Z. B. Verein in Wien, 1855, p. 599). *A. pupillatus* is from Venezuela, and *A. pilicornis* from Mexico; both are undescribed. *A. spectabilis* belongs to the Amazonian fauna.

agreeing with *Pteridotelus* in other characters (*e. g. A. maculicollis*); others have the joints in question ciliated in the ♂ and at the same time elongated (*A. lateralis*); and many species agree in the shape of the sterna, whilst resembling typical *Acanthoderes* in all other characters. I have thought it best on this account to treat *Pteridotelus* as a subgenus or section of *Acanthoderes.*

Acanthoderes and its allies (*Steirastoma, Myoxinus,* &c.) are not, perhaps, so closely allied to the preceding genera as *Polyrhaphis*; it would therefore in some respects be better to place the latter genus after *Ægomorphus,* followed by the Anisocerinæ, with which group it has also an evident connexion; whilst *Acanthoderes* leads through *Alphus* naturally to the Acanthocinitæ. This, however, would be presenting only one suite of affinities amongst several which these insects present: the Acanthocinitæ, for instance, have a certain similarity to *Oreodera* and *Ægomorphus.* It seems almost hopeless to detect the true lines of affinity, and quite so to represent them in a scheme of arrangement when detected.

§ 1. Antennæ with the terminal joints filiform, slender.

a. Fore tibiæ widely dilated and compressed.

1. *Acanthoderes hebes,* n. sp.

A. oblongus, convexiusculus, postice rotundatus, supra tomento fusco, subtus pilis griseis sparsim vestitus: thorace tuberibus lateralibus obtusis, dorsalibus tribus magnis: elytris apicibus parum truncatis, fuscis, fascia abbreviata pone medium nigra velutina, prope apicem ochreo maculatis. Long. 5 lin. ♂ ♀.

Head and thorax sooty-brown, with deep scattered punctures. Antennæ about the length of the body, black; base of each joint (from the third) and centre of the third with a pale testaceous ring. Thorax with the lateral tubercles obtuse; three dorsal ones—two anterior very large and prominent, and one posterior smaller and acute. Elytra rounded at the sides, towards the apex very briefly truncated, with a short, tuberculated, longitudinal, slightly elevated ridge in the middle of each near the base; punctured throughout, the punctures accompanied by granulations towards the base: the ochreous spots near the apex are few and irregular. Under surface shining black, with a scanty grey pile. Legs shining black, middle of the tibiæ on the edge, tips of same, and basal joints of the tarsi above greyish; tarsi beneath yellow, claw-joint pallid. In the ♂ the fore tarsi are black beneath, and densely fringed with black hairs. The fore tibiæ are abruptly dilated from the middle in the ♂, more gradually so in the ♀.

On boughs of dead trees in the forest, Ega. Rare.

2. *Acanthoderes Egaensis*, White.

Scleronotus Egaensis, White, Cat. Long. Col. in Brit. Mus. ii. p. 364, pl. 9. f. 3.

The third to the sixth antennal joints are produced and acute at the apex beneath, the fourth to the eleventh are very slender. The extreme tips of the elytra are distinctly truncated. All the tibiæ are compressed, the anterior pair gradually dilated (wider in the ♂ than in the ♀) from the base to the apex.

This species has a peculiar facies, arising from its short figure, black colour, and the slenderness of its antennæ. Owing to this, probably, it was placed in a different genus by Mr. White. The genus to which he referred it (*Scleronotus*, Dejean, at that time a mere catalogue name) has since been characterized by M. Thomson (Class. p. 340), and, from the diagnosis, appears to be very closely allied to *Acanthoderes*. M. Thomson places it amongst the Anisoceritæ, regardless of the shape of the anterior acetabula, which he gives as rounded in *Scleronotus* and angulated in the definition of the group to which he refers it.

3. *Acanthoderes fuscicollis*, n. sp.

A. oblongus, fuscus, tomento luteo (capite thoraceque sparsim) vestitus: elytris breviter transverse truncatis, seriatim nigro punctatis, utrinque maculis duabus suturalibus duabusque lateralibus fuscis notatis. Long. 5 lin. ♂.

Head and thorax dusky, with specks of ochreous clay-coloured pile, very scanty on the disk of the latter. Antennæ about the length of the body, the apices of the third to fifth joints produced beneath; black, the base to the middle of the third joint speckled with ochreous atoms; the basal half of the fourth and the base of the remaining joints pale testaceous. The lateral tubercles of the thorax are large and slightly pointed; the disk has a longitudinal smooth line and a large obtuse elevation on each side. The elytra have a few coarse punctures at the base, a few small round black spots arranged in lines, and on each four larger blackish spots, namely two near the suture (one before, one after the middle) and two on the side beyond the middle; there are also two irregular transverse patches of a paler ochreous colour. Under surface of the body black, shining; sides of the metasternum and second to fifth ventral segments ochreous. Legs black, shining, speckled with ochrey pile; middle and hind tibiæ paler, their apices dusky. The fore tibiæ are gradually and widely dilated.

Ega; on branches of dead trees in the forest. The species has much resemblance to *A. fascialis*, White.

4. *Acanthoderes fascialis*, White.

Acanthoderes fascialis, White, Cat. Long. Col. in Brit. Mus. ii. p. 361.

The external angles of the truncature of the elytra are slightly produced. The fore tibiæ (in the ♀) are moderately and gradually dilated.

Ega. This and the preceding are nearly allied to *A. semigriseus*, a Rio-Janeiro species common in collections*.

5. *Acanthoderes minimus*, n. sp.

A. ovalis, nigricans cinereo irroratus, elytris sinuato-truncatis angulis externis acutis. Long. $3\frac{1}{4}$ lin. ♀.

Head and thorax blackish, sprinkled with greyish pile. Thorax short, rather narrow, the lateral tubercles not prominent although pointed, punctured on the disk, and with two distinct dorsal tubercles. Elytra with the centro-basal ridge indistinct, granulate-punctate at the base, punctured along the sides to the apex. Body beneath and legs black, sprinkled with grey hairs; claw-joint of the tarsi testaceous. The fore tibiæ (in the ♀) are widely, but not abruptly, dilated from the middle.

Para.

6. *Acanthoderes maculicollis* (Dej.), n. sp.

A. ovalis, tomento variegato vestitus: antennis curtis, articulo tertio maxime elongato apice dilatato, quarto elongato, reliquis abbreviatis: thorace tubere laterali obtuso, fulvo-griseo, maculis magnis lateralibus duabus atro-brunneis velutinis: elytris trigonis apicibus sinuato-truncatis, fulvo-griseis, utrinque pone medium macula elongata transversa discoidali atro-brunnea, fasciisque duabus macularibus, altera ante medium altera subapicali, flavo-griseis. Long. $4\frac{1}{2}$ lin. ♂ ♀.

Head fulvous mixed with grey, and with scattered brown points. Antennæ about as long as the body, first to third joints pitchy, the third black at the tip, the rest pitchy, with their bases testaceous; the terminal joints are ciliated beneath in the ♂.

* This species is undescribed; therefore the following diagnosis will be useful:—

Acanthoderes semigriseus (Cat. Dej.).

A. oblongo-ovatus, dimidio anteriore tomento fuliginoso, dimidio posteriore cinereo vestitus. Antennæ fuliginosæ, articulis ad basin griseis. Thorax fuliginosus grosse punctatus linea dorsali lævi. Elytra sensim attenuata, apicibus breviter sinuato-truncatis, angulis obtusis, ad basin granulato-punctatis, quarta parte basali fuliginosa coloris margine posteriore retrorsum arcuata, reliquis cinereis utrinque fascia interrupta undulata pone medium maculaque laterali prope apicem fuscis. Subtus niger nitidus, postpectoris lateribus abdominisque apice luteis; pedibus luteis femorum dimidio basali tibiarum tarsorumque apicibus fuscis. Long. $4\frac{1}{2}$ lin. ♀.
Hab. Rio Janeiro.

The disk of the thorax on each side is very convex, the middle is depressed, with a raised dorsal line; on each side is a large, rounded, velvety, dark-brown spot, which is impunctate, the rest of the surface being punctured. The elytra are grey-fulvous, the suture and some indistinct lines on the disk light grey, covered with small rounded brown spots, confluent in places; the disk behind the middle is crossed by an elongate dark-brown spot, besides which there are two transverse macular lines of a yellowish colour. Body beneath black, scantily clothed with grey; the second to fourth ventral segments have a spot of yellow hairs on each side. Legs pitchy, clothed with grey; the tarsi yellowish, the middle and hind tibiæ ringed with yellowish at the middle and the apex. The fore tibiæ in the ♂ are widely and abruptly dilated from near the base.

Para and Villa Nova. It is found also at Cayenne, and exists in many collections under the name I have adopted.

7. *Acanthoderes alboniger*, n. sp.

A. oblongus, niger; fronte, thoracis vitta mediana, elytrorum plaga magna elongata basali communi fasciaque magna maculari subapicali tomentosis ochraceo-albis; ipso apice ochraceo. Long. 7 lin. ♀.

Head black, front ochreous punctured. Antennæ shorter than the body, black, the basal half of the third and the bases of the remaining joints light grey. Thorax with the lateral tubercles prominent, acute; the disk depressed, longitudinally punctured, a broad central stripe and a lateral one below the tubercle ochrey white. Elytra oblong, their sides rounded posteriorly, their apices sinuate-truncate, outer angles produced: the centro-basal ridge is strongly pronounced, and produced forward towards a corresponding sinuation in the hind margin of the thorax; it is smooth and shining, not reaching the middle of the elytra behind, and leaving a broad depression at the base: the elytra are punctured, partly in lines, most thickly so on the sides near the base; black, a broad, basal, common stripe, including the scutellum, notched in the middle externally, and a broad, macular, uneven belt before the apex, not touching the suture, ochrey white; the extreme tips are yellowish brown. The black parts are nearly naked, and have a few grey specks. Body beneath and legs black, thinly covered with grey hairs; tarsi grey. There is a row of ochreous points on each side of the abdomen. The fore tibiæ are widely dilated. The prosternum is produced behind, and the mesosternal tubercles are very prominent.

Santarem. This species bears a superficial resemblance to certain Curculionidæ of the genus *Heilipus*, inhabiting the same district.

b. Fore tibiæ compressed, not dilated.

[To this section belongs the European *A. varius.*]

8. *Acanthoderes maculatissimus*, n. sp.

A. curtus, subdepressus, tomento ochraceo-fulvo vestitus: elytris lituris nonnullis griseis, punctis innumerosis lineaque transversa undata pone medium brunneis. Long. 6 lin. ♂ ♀.

Head punctured, fulvous varied with brown. Antennæ brown, spotted and ringed with grey. Thorax with the lateral tubercles produced and pointed at the apex, and with two obtuse dorsal elevations and a shining central line; the interstices punctured; in colour minutely variegated with fulvous and brown. Elytra subtrigonal, briefly sinuate-truncate at the apex, the external angles produced; punctured throughout, the centro-basal ridge apparent only at the extreme base, ochrey fulvous, silky, studded with small brown spots, which everywhere cover the punctures: there are a few light-grey marks, and behind the middle a transverse dark-brown zigzag line. Body beneath ashy brown. Legs variegated with ashy, dusky brown, and fulvous. The fringe of the male fore tarsi is black. The prosternum is simple, the mesosternum subvertical in front.

At Santarem; on hanging woody climbers in new plantations.

9. *Acanthoderes thoracicus*, White.

Acanthoderes thoracicus, White, Cat. Long. Col. in Brit. Mus. ii. p. 359.

To the description quoted above I will add that the third to the sixth antennal joints are acutely produced at their apices beneath, as in *A. Egaensis* and other species; the body is depressed; the elytra are subtrigonal, with the apices slightly truncated, and have always an oblique dark-brown streak on the disk; the centro-basal ridges are narrow, disappear about the middle of the elytra, and leave a depressed space between them. The prosternum is simply rounded behind, the mesosternum vertically inclined in front. Long. 6–7½ lin. ♂ ♀.

This is a common species, on branches of felled trees, in the forest throughout the Amazon region. It is also found, I believe, at Cayenne.

[To be continued.]

XXIV.—*On the History of the 'Maté' Plant, and the different Species of* Ilex *employed in the Preparation of the 'Yerba de Maté,' or Paraguay Tea.* By John Miers, F.R.S., F.L.S. &c.

Notwithstanding the seemingly authoritative evidence we have on record concerning it, I have entertained a doubt for many years past in regard to the plant which produces the celebrated

Paraguay Tea, the favourite beverage of the Spanish South Americans. I will here detail the results of my investigations into this subject, and will preface the inquiry by a short history of the events which had great influence on the production and trade of this article of commerce: these events are the more interesting as they are in some degree connected with the biography of the celebrated botanist Bonpland, to whom I am indebted for the knowledge of the true plants which produce the Yerba.

In the settlements of the Indians in Paraguay and along the borders of the River Paraná, under the dominion of the Spanish government, administered as they were at that period by the Jesuits, the preparation of the Yerba constituted the principal branch of industry of the country. The plant from which the Maté is prepared was first mentioned by Azara, as growing wild in many parts of Paraguay. It is found in great abundance in all the moist valleys of the ramifications that branch from the main chain of mountains called Maracajú, which, rising in that part of Paraguay bordering upon Matto Grosso, in lat. 19° S., and tending S.E., divides the northern half of the country into two distinct watersheds—the rivers flowing westward running into the river Paraguay, and those eastward into the Paraná. This chain, after a length of 150 miles, suddenly takes a more easterly course, and is soon cut through by the latter river at a place called Sete Quedas (seven cataracts or large rapids), in lat. 24° S.; it then crosses into the Brazilian province of San Páolo, through which it runs nearly due east for 300 miles, as far as Curitíba, where it becomes blended with the main chain of the Serra do Mar, that skirts the coasts of the southern provinces of Brazil. The Yerba-tree is found more or less abundantly in all the valleys that branch out of this extensive range of mountains, but principally, as before mentioned, in the northern portion of Paraguay. Wilcox, in his 'History of Buenos Ayres,' mentions three kinds of Yerba known in commerce—"the *Caácuy*, *Caámini*, and *Caáguazú*:" the first is there said to be prepared from the young leaves recently expanded from the buds; the second is from the full-grown leaves, carefully picked and separated from the twigs; and the third from the older leaves, carelessly broken up with the young branchlets: all being half-roasted by a crude process. But I have always been of opinion that these several qualities were prepared from different species of *Ilex*. The Guarani general term, *Caá*, signifies a leaf or branch; and in the Missions, the names of *Caá-riri* and *Caá-úna* or *Caúna* are given to the different kinds of *Ilex*. The prepared leaves have always borne the name of *Yerba* among the Spaniards, its infusion being made in a peculiar kind of cup called a *Maté*. In the Portuguese Missions the Yerba is called *Caúna*, and in most of the Brazilian provinces it is known by the name of *Congonha**.

Under the Spanish government, the principal harvests of Yerba were made in the valleys bordering upon the river Ypané, a tributary of the Rio Paraguay,—the produce there collected being conveyed to the town of Villareal, at its mouth, in lat. 23° 30′ S., and thence transported down the River Paraguay, in large pontoons, to the metropolitan town Assuncion. Although the largest harvests were obtained in Paraguay, considerable quantities in addition were raised in the various settlements of Indians founded by the Jesuits beyond its limits. These were called Missions, and were thirty in number, twenty-three being situated between the rivers Paraná and Uruguay, and seven on the left bank of the latter river, in the province of Entrerios. These, as well as all the extensive settlements in Paraguay proper, were at their greatest prosperity at the period of the expulsion of the Jesuits in 1768; but, owing to the defective management of the Indians under the subsequent rule of the Spanish authorities, the commerce in Yerba languished considerably. In 1810 the quantity raised was supposed to amount to five millions of pounds; but Mr. Robertson states that in 1812 (two years after Paraguay became independent) the exports of Yerba still amounted to eight millions of pounds, or 3750 tons, from the port of Assuncion alone, at which period, too, its cultivation in the Missions had become almost annihilated. In all these Missions, during the devastating wars then raging throughout the Argentine provinces, the Indian settlers were robbed of all their cattle and horses, their farms were destroyed, the men forced to become soldiers, and otherwise were so oppressed, that the greater number sought a refuge in Paraguay. Some idea of the extent of this depopulation may be formed from the records preserved of the seven Uruguay Missions, which in 1768 had a population of 30,000, nearly all Indians; in 1801, when taken by the Portuguese, they numbered only 14,000; by the subsequent wars they were further reduced, in 1814, to 6395; and in 1821, at the census taken when St.-Hilaire was there, they scarcely amounted to 3000 individuals of all ages. This celebrated botanist remarks concerning them—"En un mot, la province des Missions, naguère si florissante, offre aujourd'hui le tableau de toutes les misères qui affligent notre espèce, et dans peu, l'on y chercherait vainement des Indiens." Owing to political causes subsequent to 1812, the trade with Paraguay became in great measure suspended; so that the Yerba from the Curitíba Mountains was much sought for, and

* Pronounced *Congonia*.

conveyed to the nearest port of Paranaguá, on the Brazilian coast; and hence the Yerba de Paranaguá (though considered inferior in flavour to the Yerba de Paraguay) commanded a ready sale: but the quantity obtained from this source was inconsiderable in comparison with the amount that still found its way from Paraguay.

At this period, Paraguay was governed by the renowned Dictator, Doctor Francia. That country had been one of the earliest of the Spanish provinces in assuming its independence: this occurred in 1810, when Francia was one of the Junta deputed to frame a constitution after the republican model, with the executive power confided to two consuls chosen by the people. At the end of the second year he was elected one of the consuls; but soon after, his colleague was superseded, and all the power became vested in his hands. His government, in most respects, proved well suited to a race of Indians still imbued with the highest respect for the paternal rule of the Jesuits, under whom they were accustomed to an implicit obedience to one superior head. The population everywhere spoke the Guarani tongue, and only the more educated men in authority and the few settlers from the mother country could understand the Spanish language; on the other hand, the Indian language was not spoken in any of the Argentine Provinces. The system of government adopted in Paraguay was completely at variance with that followed in all the Argentine Provinces, where the rule was based upon the more democratic model of the North American States, which enjoined the annual election of the municipal officers, whose executive power was always supposed to be controlled by a representative and legislative assembly triennially chosen by universal suffrage. The Paraguayans, however, preferred their own system, and were so fully confident in the talents and integrity of Dr. Francia, and so well satisfied with his rule, that he was soon afterwards, by universal consent, elected perpetual Dictator, with the most ample powers to act as he judged best for the interests of the country. His government was quite patriarchal: he required no large standing army to overawe the people, who were only too willing to follow his injunctions; his military force was not larger than was necessary to form a sort of custom-house guard round the coast, as well as to prevent the ingress of the many adventurers and partisans from the adjoining provinces who sought to disturb the system he had established. He had previously followed the legal profession, and, as a civilian educated under the Jesuits, his policy was based on a desire for peaceful quiet; and in all his measures he sought to prevent the contagion of that military turbulence which agitated the surrounding states, and which kept them in a constant state of anarchy. Paraguay, when under the Spanish rule, had been dependent upon those states for most of the necessaries of life, which they exchanged for its Yerba and its tobacco; and Francia's earliest efforts were directed so as to render the country independent of this foreign supply and to produce whatever was essential for its own requirements. The only persons who strove to thwart his measures were the old Spaniards, who clung to the hope of seeing the power of Spain restored, and also the many emissaries clandestinely sent from the neighbouring states to allure the people into another policy, and to restore the former state of trade, on which they had depended. Against these emissaries, acting in concert with General Artigas, Governor of Entrerios, who invaded Paraguay and laid waste parts of the country, the most stringent measures were employed: they were threatened with the extreme penalty of the law, if caught in their intrigues; and several daring adventurers, though forewarned of the consequences, were taken, and suffered the punishment of death as examples to others. The many tales raised against Francia for cruelty and murder are solely traceable to these severe measures, which he considered just and necessary. Towards the natives no such severity was required; for his administration of the law was simple, firm, and just: had it been otherwise, it would have been impossible for him to have maintained his authority for so many years without a standing army; and we have the strongest evidence of this truth in the fact that, during his long administration, notwithstanding the efforts of many foreign emissaries, no attempt was ever made among the people to revolt; no Paraguayan endeavoured to control his power, or change the system he adopted. We have the evidence of Mr. Robertson (one who suffered most from the suspension in the trade in Yerba, and who was in consequence one of the foremost among his detractors) that during his residence of two years in Paraguay, under Francia's rule, no instance of the punishment of death was known.

Under the Spanish rule, the Paraguayans had cultivated, besides the Yerba, little beyond a fine kind of tobacco (considered equal to that of Havanna, and much appreciated in Chile and Peru), and also some sugar and yucca (yams). They were soon induced by Francia to extend their agricultural pursuits, to cultivate rice, maize, and other vegetables, on a large scale, and to raise a sufficient quantity of yucca to satisfy the general consumption. Other vegetable products, hitherto scarcely known in the country, soon covered the plains: cotton, formerly procured from Corrientes, was now cultivated to some extent; more attention was paid to the rearing of cattle and horses, instead of importing them from Entrerios, so that in a few years they were able to export a considerable surplus above their own requirements; and they now made cotton cloths for their garments, in lieu of the woollen ponchos obtained from Cordova. The Dictator for many years was assiduous in his endeavours to establish permanently this system of industry, which necessarily supplanted in great measure the trade in Yerba; he even employed coercive measures in order to carry it into effect; and in 1829 he decreed that the possessor of every house or farm should sow a certain quantity of maize, upon the product of which every one was bound to contribute 4 per cent. to the state, no excuse being allowed; and those who sought to evade this obligation became subject to heavy penalties.

I had many opportunities, during my residence in Buenos Ayres in 1825–1827, of conversing with several persons who had been in Paraguay, but I never met with any one who had witnessed the atrocities currently ascribed to the Dictator: from all I could learn, I became convinced that the character so generally assigned to Doctor Francia was not founded in truth, and that, owing to political jealousy and personal dislike, he has been unjustly maligned. He ought, on the contrary, to be looked upon as a great benefactor to his country; and though he had recourse to a policy of restraint, which in a more advanced state of society would not have been tolerated, it was certainly one well calculated, in the actual state of Paraguay, to attain the objects he had so much at heart, and in which he gradually succeeded. The good results of these wise measures are well attested by the prosperous advancement of the country up to the present time. His success naturally raised up against him a host of irreconcileable enemies in all the Argentine Provinces, who strove to blacken his character and vilify his conduct. All these Provinces, suffering under the extinction of the trade in Yerba, were leagued against the policy of Francia; but their attention being too much occupied in their constant internecine wars, they had little time or force to spare in the attempt to revolutionize Paraguay. At length, however, the Governor-in-chief of Entrerios, having made peace with the other provinces, turned his attention to that object, and endeavoured at the same time to establish settlements at the former Jesuit Missions (then almost depopulated), with the view of cultivating the trade in Yerba. And we now come to a knowledge of the state of affairs that existed when the celebrated Bonpland visited the River Plate, and how the subsequent phases of his life became connected with the history of the trade in Yerba.

The fall of the emperor Napoleon and the re-establishment of the Bourbon dynasty in France were events most galling to Bonpland, and he resolved to seek an abode in one of the republican States of South America. Accordingly he reached Buenos Ayres in 1817, with a nominal appointment of Professor of Natural History in that capital. About the same time, a considerable number of his countrymen, from similar causes, settled themselves in the Argentine Provinces, at which period the internecine wars before alluded to were raging furiously. Many of these Frenchmen became active partisans in these quarrels, and, either by their direct or indirect interference, soon came under the ban of the several opposing chiefs. When I passed through Buenos Ayres, in 1819, I saw Bonpland; he was then under great excitement in consequence of the execution of two of his companions, who, having been detected in assisting the military chief Carrera, were accordingly sentenced to be shot. It was in the same year that Bonpland established himself near Candelaria, one of the old Jesuit Missions on the left bank of the Parana, contiguous to Paraguay, where he formed a considerable establishment, chiefly, as I understood, with a view to the production of and trade in Yerba, under the special auspices and protection of the Governor-general Artigas, who, as I have before mentioned, intended ultimately to carry out his designs against Paraguay. In the following year, General Ramirez, who commanded Artigas's forces, being bought over by the rival Presidents of Buenos Ayres and Santa Fé, revolted against his chief. Artigas, being hard pressed and deserted by his supporters, knowing also that if he fell into his enemies' hands he would be immediately sacrificed, resolved to beg an asylum in Paraguay; and he obtained this permission, in 1820, from Doctor Francia, for himself and a thousand of his faithful followers, who were distributed in different parts of the country, and to whom portions of land were assigned, upon condition of cultivating them. The Dictator generously gave his rival a monthly pension, together with a house and lands in the village of Caragaty, eighty-five leagues N.E. of Assuncion, where he resigned himself to peaceful agricultural pursuits, and lived in much enjoyment till the period of his death, ten years afterwards.

In 1821, Ramirez, being then at peace with the other Argentine provinces, turned his attention to the invasion of Paraguay, with which view he collected a considerable body of troops, in order to force that country to adopt his policy. While these preparations were going forwards, political considerations of greater moment induced Ramirez to suspend his project: he now marched his forces to the southward, to wage war against the Governors of Buenos Ayres and Santa Fé; and after a severe campaign, he was at last defeated, taken prisoner, and executed. Francia, thus relieved of his fears for a while, proceeded to adopt such precautionary measures as he conceived would place his country for the future in greater security; and in these measures Bonpland became deeply concerned.

This celebrated botanist Doctor Francia suspected of being in concert with General Ramirez, knowing also that he had previously been the friend of General Artigas. Francia was well informed of all the combinations making against him; and his conviction that Bonpland was implicated in these measures appears to have been heightened by the formal application which the latter made to him, about this period, to be allowed to enter into commercial relations with Itapuan, on the opposite coast of Paraguay, presenting at the same time, in earnest of his intentions, a contract he had formed with an Indian cacique for the purpose in view. Had Bonpland abstained from meddling with political questions, it is probable he would never have been disturbed; but after Ramirez had given up his intended invasion, Francia availed himself of the opportunity by sending a force of 400 men across the Parana to Candelaria, near the place of Bonpland's residence, to destroy that post, which he considered to be the nucleus whence hostile demonstrations might at any future period be formed against his country: he likewise ordered them to make prisoners of certain persons, among whom was the former companion of Humboldt. These instructions were implicitly carried into effect, and Bonpland was conveyed a prisoner to Assuncion. The Dictator received him with every demonstration of respect and kindness, explaining the motives which justified him in the course he had taken, and offered him any place he might select in the interior, as he had previously done to Artigas. Bonpland chose to fix himself at Santa Maria, to the S.E. of Assuncion, where he enjoyed full liberty, and was subject to no other restraint than the obligation of remaining peaceably in its neighbourhood. Here he settled upon the farm assigned to him, and practised also as a physician. He appears to have lived there in great contentment for ten years, at the end of which time he received from Francia full liberty to depart whenever he pleased. The best proof that Bonpland was satisfied with the treatment he received, is that he never protested against his captivity, and that he refused (I believe, for a period of two years) to avail himself of the liberty given to him; and it is certain that he then declined the many pressing invitations from Buenos Ayres, sent to him by the foreign ambassadors and other distinguished persons, who had greatly interested themselves in his welfare. At length he made a visit to the River Plate, but remained there only a very short time, for he soon returned to the Missions, and finally established himself on his former estate of S. Anna de la Restauracion, not far from Candelaria in Corrientes, bordering upon Paraguay, where he lived, much respected by all, till his death in 1858.

From his long residence in the country, and his great experience in all that relates to the preparation of Yerba, no one had better opportunities than Bonpland to identify the real species from which that article of consumption is manufactured.

The system of the merchants in their agreement with the 'habilitadores' who undertake the quest of Yerba in the distant forests of Paraguay, the manner of hiring the Indian labourers for this work, the preparations for feeding them during their long bivouac, the mode of collecting and drying the branches, roasting and separating the leaves, pounding them, and packing the Yerba, thus prepared, in hide bags, are well described in Mr. Lambert's memoir on the *Ilex Paraguayensis*, and in Mr. Robertson's 'Letters from Paraguay, and Francia's Reign of Terror.' The same rude methods were employed in all the Spanish Missions, and also in the Brazilian settlements, up to a very recent period; but of late years more improved processes, upon a much larger scale, have been brought into use about Curitíba; but in the province of Rio Grande the old system is still continued. At Curitíba, I am told, the leaves are now roasted more equally, in cast-iron pans set in brickwork, much after the manner in which tea is prepared in China, except that the pans are much larger. When the leaves are sufficiently dried, they are pounded in stamping-mills worked by water-power or steam-engines, and packed in bags by means of presses. The quality of the Yerba has thus been much improved.

We owe to St.-Hilaire the first outline of the botanical features of the tree, growing about Curitíba, that yields the Yerba: it was only a short diagnosis, published in 1822 *, when he ascertained it to be a species of *Ilex*, which he considered identical with the Paraguay plant, and which was named inaccurately, through a typographical error, *Ilex Paraguariensis* †, a name he afterwards abandoned in 1824 for that of *Ilex Matte* ‡; he, however, resumed the former name in 1833 §. In the meanwhile, Mr. Lambert, in 1824 ||, gave a much fuller description of the plant, accompanied by a good drawing made from specimens sent from Buenos Ayres, and probably obtained from one of the Spanish Missions: he called it *Ilex Paraguensis*.

* Mém. Mus. ix. 351; Spreng. Syst. iv. cur. post. p. 48.

† Dr. Reisseck (Fl. Bras. 28. p. 115) thinks the word "Paraguariensis ita forsan rectius scribitur pro Paraguayensis;" but this cannot be. The word is unquestionably used adjectively for the country Paraguay. There is no place known by the name of Paraguari. St.-Hilaire found his plant near Paranagua, but that could never have suggested the word in question. It was at first, no doubt, a mere typographical error, which St.-Hilaire did not think necessary to correct afterwards.

‡ Hist. des Plantes remarq. de Brésil et Paraguay, i. Introd. p. xli.

§ Voy. Diamant, i. 273. || Lambert, Pin.

I had always been impressed with the conviction that the different qualities of Yerba brought to market were prepared from different species of *Ilex*; and hence the doubt occurred to me whether the plant described by St.-Hilaire from Curitíba be really identical with the true Paraguayan type. The grounds for this surmise were founded upon the dissimilar colour of the two Yerbas, the difference in their flavour, and the higher price always obtained for the Yerba de Paraguay compared with the Yerba de Paranaguá. The short diagnosis of St.-Hilaire answered equally to several species that I had seen. Sir Wm. Hooker, in 1842*, gave a very interesting account of the Yerba, describing also the *maté* or cup, formed out of a small calabash (*cuy*), in which the infusion is prepared, and out of which it is drawn into the mouth through a *bombilla*; he added the characters of the different varieties, which he considered identical with the *Ilex Paraguayensis*, and of these he gave two excellent figures with analyses. This memoir, instead of solving my doubts, only rendered the question still more enigmatical; for in it is classed, as a mere variety, a plant which I brought from Rio de Janeiro, which I found growing in the Botanic Gardens there, and which I was assured by the Rev. Frey Leandro, at that time Director of those Gardens, was the "Arbol do Maté," or 'Paraguay Tea-tree.' This plant, which is well figured in Sir Wm. Hooker's memoir †, appeared to me quite a distinct species, marked by very peculiar characters.

Anxious to remove this doubt, I applied to my friend Senr. Conselheiro Candido Baptista d'Oliveira, soon after I learned of his appointment as Director of the Botanic Garden, and begged of him to ascertain whether that plant was really identical with the tree which yields the true Yerba de Paraguay, as I had been assured twenty years before, or a different species, and to send me, if possible, authentic specimens of both. He most obligingly forwarded me a fresh specimen of the tree still growing in Rio de Janeiro, and at the same time transmitted my application to M. Bonpland, as the most competent authority on the subject, who, however, did not quite comprehend the object of my inquiry. This renowned botanist most kindly responded, and sent six different species, with their varieties, all collected in the Missions, and all alike used in the preparation of Yerba. This at once confirmed my suspicion that more than one species of *Ilex* is employed for that purpose; and as this fact is of some importance in the history of the subject, I will copy here *verbatim* the note of M. Bonpland which accompanied his specimens.

[To be continued.]

* Lond. Journ. Bot. i. 30.

† *Ibid.* i. 35, var. γ, tab. 3.

XXV.—*On the Nomenclature of the* Foraminifera.

By W. K. Parker, M. Micr. Soc., and T. R. Jones, F.G.S.

[Continued from p. 168.]

Part VII. *Operculina and Nummulina.*

Operculina.

The *Lenticulites complanata* of Defrance (Dict. Sc. Nat. 1822, vol. xxv. p. 453) is the *Operculina complanata* of D'Orbigny's Tabl. Méth. (1826) p. 281, no. 1; and Modèles, no. 80. Basterot refers to this shell in his 'Mém. Géol. sur les environs de Bordeaux,' prem. partie, 1825, p. 18. According to Defrance and Basterot, it is fossil at Dax, Leognan, Anvers, Pontoise, Boutonnet near Montpellier, in Italy, and common at Saucats in the green sands at the Mill of Bernachon. It occurs also in the Crag of Suffolk; and numerous varieties are known (under specific names) from the Eocene and other Tertiary beds of England, Europe, and Asia. Two or more also are known in the Cretaceous beds of France. It lives in the present seas in about 10 or 20 fathoms water, abounding on some parts of the Australian coast, in New Zealand, in the Philippines, and in the Indian Sea, at all which places it attains a relatively large size. In our northern and Arctic seas it is also of common occurrence, but of very small dimensions.

In 1781, Gronovius * figured and described a middle-sized specimen, one of many obtained from the sea-sand in the inside of a *Trochus Telescopium* from Bengal, naming it *Nautilus ammonoides*. In 1783, Schroeter † met with several small specimens among the roots of sponges from the Baltic, and, giving a figure and description, he named the shell *Nautilus Balthicus*. Hence there were already two names for this species previously to Defrance's time; and that of Gronovius (*Operculina ammonoides*) has necessarily the right of priority.

Nevertheless, since *Operculina* passes into *Nummulina* and loses its supposed specific distinctions (as Carter and Carpenter have demonstrated ‡), it cannot retain its separate binomial appellation on *zoological grounds*, however convenient it may be to the collector and the geologist to have in this case, as in others, distinct names for the several varieties that come to hand.

* Zoophylacium Gronovianum, exhibens Animalia &c. quæ in Museo suo adservavit &c. L. T. Gronovius. fol. Lugd. Batav. 1781, p. 282. no. 1220, and p. v (Tabularum Explicatio).

† Einleitung in die Conchylien-Kenntniss nach Linné, von J. S. Schroeter. 8vo, Halle, 1783, vol. i. p. 20, pl. 1. fig. 2. Also referred to in the 'Naturforscher,' 1782, vol. xvii. p. 120.

‡ See also Annals Nat. Hist. ser. 3. vol. v. p. 109.

In the 'Annals Nat. Hist.' 2nd ser. vol. xix. p. 285, we described a small variety from the Norway coast, and made some general observations * on the *Operculinæ*. Since then, Dr. Carpenter's Monograph on the genus has appeared in the 'Phil. Trans.' for 1859; and to this the student must refer for full information as to the structure and relationship of the *Operculina*.

We may remark that Prof. Williamson, in his 'Monograph on the Recent Foraminifera of Great Britain,' 1858, p. 35, renames the little northern *Operculina* "Nonionina elegans," objecting to its collocation with *O. complanata*, and grouping *Operculina*, as well as *Assilina*, with *Nonionina*. That the common *Nonioninæ* pass into the *Polystomellæ* we have shown when critically examining Fichtel and Moll's *Nautilus Faba* and *N. striatopunctatus* (Ann. Nat. Hist. 3rd ser. vol. v. pp. 102, 103); and they thus diverge from the true Nummuline type, although their plan of structure much resembles that of their more complex and larger ally; and although in some varieties (such as *Nonionina Limba*, D'Orb.) this usually simple shell puts forth an extra amount of exogenous growth and thickens its septa and edges until it much resembles the small limbate *Operculina complanata* in question, yet this condition does not prove the identity of the two, any more than the like structure in *Planulina Ariminensis* removes it from the group typified by *Rotalia farcta* and places it with either *Nonionina* or *Operculina*.

Nummulina.

We are greatly indebted to MM. D'Archiac and J. Haime for their conscientiously careful work on Nummulites †; their industrious and clear collocation of synonyms is admirable, and their hitherto unsurpassed illustrations of the Nummulites and their structure supply (taken with those illustrating Dr. Carpenter's paper in the Quart. Geol. Journ. vol. vi.) nearly all that can be required in that direction. Without this work the Nummulites would have remained in confusion; with its help we may hope to advance to the attainment of a more complete classification than even the authors of that noble monograph have given us. We have already expressed our views on this point to some extent ‡, stating that we recognize three chief groups (regarded provisionally as *specific*) of *Nummulinæ*, namely

* In this paper we erroneously treated *Planulina Ariminensis* as a synonym of the species under notice, misled by its great similarity of shape.

† Description des Animaux fossiles du groupe Nummulitique de l'Inde, précédée d'un Résumé Géologique et d'un Monographie des Nummulites. Par le Vicomte D'Archiac et Jules Haime. 4to, Paris, 1853.

‡ Ann. Nat. Hist. ser. 3. vol. v. p. 102, &c.

the *radiate*, the *sinuate*, and the *reticulate*, typified respectively by *Nummulina planulata*, Lam., *N. complanata*, Lam., and *N. lævigata*, Lam. The "granulate" and the "explanate" groups, also used by MM. D'Archiac and Haime, we do not recognize as essential,—the former being founded on a character common to each of the three above-mentioned groups (and misunderstood by our authors), and the latter also depending on a modification of structure occurring in two at least of the other groups.

What we have now to consider is—which of the *Nummulinæ* are, for the purposes of zoology, to be accepted as specific forms. As before stated, we regard as types those Foraminifers that present a fair average of the characters proper to the species, and are neither the simplest of the group, nor necessarily the largest and most richly provided with the peculiarities of structure found in the group.

We must once more remind the reader that we do not object to binomial appellations as distinctive terms for well-marked varieties of *Nummulinæ* or other Rhizopods. In this case, however, the subject of which we are treating is real specific relationship.

When we tabulate the fifty-five *Nummulinæ* described as species by MM. D'Archiac and Haime in their Monograph, we find six that are simply radiate: these are all of small size (6 millimetres and less in diameter); two of them are granulate (*N. Miscella* and *N. Lucasana*), and four are smooth (*N. Ramondi, N. Guettardi, N. variolaria*, and *N. Heberti*: the last two have the radii slightly curved).

There are two, *N. Rouaulti* (granulate) and *N. curvispira* (each less than 12 millimetres in diameter), that are simply radiate, but the septal lines are not quite straight. *N. mamillata* is an Assiline subvariety of *N. Rouaulti.*

N. striata, a small form, is simply radiate in some varieties, sinuo-radiate and sinuate in others.

There are four that are radiate with a slight sinuosity of the septal lines (*N. contorta, N. obesa, N. Vicaryi*, and *N. discorbina*: the first and the last are less than 12 millim. in diameter; the second attains a diameter of 12 millim., and the third of 18 millim.). These are all smooth.

There are five having sinuo-radiate septal lines: viz.

N. Vasca, not attaining	
N. planulata, attaining	
N. Viquesneli, attaining	a diameter of 12 millimetres.
N. Beaumonti, not attaining	
N. Biaritzensis, attaining	

The last-mentioned, however, exhibits both the radiate and sinuo-radiate style of growth in different individuals.

The following four are "sinuate" in the growth of the alar prolongations of their chambers: *N. Sismondi* (granulate), *N. Verneuili* (granulate), *N. obtusa,* and *N. perforata* (granulate). The last-mentioned shows a "radiate" arrangement of the septa in its young state—a condition obtaining probably in the other three, as well as in *N. Brongniarti* (granulate), *N. Defrancei* (granulate), *N. Meneghinii* (granulate), *N. Deshayesi* (granulate), and *N. Bellardii* (granulate), which appear to belong to the same group of stout, well-grown, medium-sized *Nummulinæ.* *N. Meneghinii* is the only one that does not measure 12 millimetres in diameter.

The "explanate" forms, *N. exponens, N. granulosa, N. Placentula, N. Spira,* and the little *N. Leymeriei,* are sinuo-radiate Assilines, certainly of no more than subvarietal value.

Of the flat or complanate "sinuatæ" there are ten named species in the Monograph: *N. complanata**, *N. Dufrenoyi, N. Puschi, N. latispira* (a dwarf), *N. Carpenteri, N. distans, N. Gyzehensis, N. Caillaudi, N. Lyelli,* and *N. Carteri.* The last-mentioned is (according to Dr. Carter's figure and description) a slightly granulated *N. complanata,* such as we have from Dax.

The little *N. Tchihatcheffi* is perhaps a dwarf of the "sinuate" group, in which D'Archiac and Haime have placed it.

N. Pratti, N. irregularis, and *N. Murchisoni* are, in all probability, extremely depressed forms of the same group.

Lastly, we have seven forms belonging to the "reticulate" group: namely, *N. lævigata, N. scabra* (granulate), *N. sublævigata, N. intermedia* (less than 12 millimetres in diameter), and the still smaller forms, *N. Garanensis, N. Molli,* and *N. Lamarcki.*

The little granulate *N. Fichteli* may belong to the "reticulate" group, as intimated in the Monograph.

Of the characters that appear to distinguish the several *Nummulinæ,* none have more value than the style of growth of the alar portions or lateral processes of the segments. We are, however, at the outset met with the difficulty, that even the existence of an alar prolongation of the segment is not a specific character. The "radiate" Nummulines afford instances of the variable growth of these alæ, and even of their becoming obsolete in individuals that have some segments well developed into alæ. Indeed the gradation from *Nummulina* to *Assilina* and to *Operculina* is, as Dr. Carter has already intimated (Journal Bombay Branch Roy. Asiat. Soc. vol. v. 1857, p. 124, &c.), well-marked, and indicative of specific unity. The *Operculina canalifera* of Varna, and the recent *Operculina* of Australia and other localities, take on the alar growth, converting themselves into *Nummulinæ*; or, *vice versâ,* we see "radiate" *Nummulinæ* lose their

* We have granulate specimens from Dax.

alar flaps and become *Operculinæ*. In the one case we have *Nummulinæ* with thin edges; in the other, *Nummulinæ* with thin centres. The difference in the width of the whorl, itself also a variable condition, is the chief feature distinguishing *Operculina* from *Assilina*.

Taking, however, the pattern of the alar growth of the segments as a feature of some value, we are further puzzled by finding the simple "radiate" plan combined in some *Nummulinæ* with a sinuous outline of the alæ, or passing so gradually into the "sinuate" plan that the distinction does not imply a difference. The same may be said of the relation of the "sinuates" to the "reticulates," although the gradation is not so common. The *N. complanata* of Dax, however, shows occasionally inosculations of the alar septa sufficient to support this statement.

We cannot accept the granulated condition of the surface as a specific character. It arises primarily from an increase of shell-matter either along the septa or on the points where the alar septa cross each other, and is concomitant with a good condition and stout growth of the shell. It is not limited, however, to the septa, but occurs in the interspaces of thin shell.

Still less can we take as an essential character the relatively large size of the primordial chamber. There is reason to suspect that certain Foraminifers commencing with a large chamber and growing more or less freely, but not attaining a large size, are varieties, or, rather, free-growing individuals soon arriving at their limit of growth. This holds good among *Nummulinæ*. With few exceptions, all the specimens under 12 millimetres in diameter that are figured in section in D'Archiac and Haime's Monograph have a large primordial chamber; for instance, *N. Garanensis*, *N. Molli*, *N. Lamarcki*, *N. latispira*, *N. Tchihatcheffi*, *N. Meneghinii*, *N. striata*, *N. Vasca*, *N. Rouaulti*, *N. curvispira*, *N. contorta*, *N. variolaria*, *N. Lucasana*, and *N. Guettardi*. The other small forms are *N. intermedia*, *N. Fichteli*, *N. Leymeriei*, *N. mamillata*, *N. Beaumonti*, *N. discorbina*, *N. Heberti*, *N. macella*, and *N. Ramondi*, in which the evidence of a large central chamber is wanting. None of these can we regard as worthy of specific rank, either for the reason above stated, or because they can easily fall into the suite of one or other of the thirty-two remaining; for we cannot accept as specific distinctions the differences in the proportions of chambers and whorls, diameters and thickness, which have been so strongly urged by other observers.

Of the simply radiate Nummulines, the simplest and perhaps the oldest-known is the *N. radiata*, Fichtel and Moll; but these forms are lost in the next grade, the sinuo-radiate.

Among the radiate and sinuo-radiate there are three that well represent the group—*N. planulata*, *N. Viquesneli*, and *N. Bia-*

ritzensis. These do not attain a large size: the third is in some respects the best of these three; it may be said to be a largish, flat, smooth *N. Rouaulti* passing into *N. planulata. N. planulata* is the feeblest in growth, but is little behind its fellows, and has been long known, owing to its plentiful occurrence in the Nummulitic rocks of Western Europe. *N. Biaritzensis* is its stronger representative in Eastern Europe and in Asia.

The next group are still more sinuate in their alar growth, though more or less simply radiate in the young state, and evidently must supply the type of a large proportion of, if not all, the *Nummulinæ*; for the simple forms above referred to are merged in them, and the great complanate forms are but the result of discoidally extended growth. To several varieties of these well-built sinuo-radiate forms D'Archiac and Haime gave binomial appellations in 1853; one was previously named (*N. obtusa*, Sow.); and to one they applied the name "N. perforata"—a highly objectionable term that De Montfort had given to a figure of a young individual in 1808. Copying Fichtel and Moll's engraving of a granulated *Nummulina*, De Montfort was puzzled whether to term the circular spots with which he disfigured his sketch *projections* or *tubes*; he applied both names, adopting the latter. In later years, MM. D'Archiac and Haime, examining sections of similar Nummulines under the microscope, adopted views (as others did also) that coincided with the notion of there being, or of there having been, perforations in the shell; and the term "perforata" was not objected to on the ground of illogicality, as it ought to have been.

Thus we have a *N. perforata* named on the "lucus à non lucendo" principle—not having the perforations which were thought to characterize it; and this *N. perforata* is a good type and the oldest-named of the group—and not only of the group, but probably of *Nummulinæ* in general.

That *N. complanata* is the best representative of the "sinuatæ" is not to be questioned: it reaches from Western Europe * to India; and several of the forms figured in the Monograph may be readily made to own its close relationship. *N. Gizensis*, its chief Egyptian variety, has had a name for a much longer time, but bears its varietal or subvarietal features strongly marked when compared with its more noble congener. How far it was right to ignore Bruguière's name "N. nummularia" for Lamarck's *N. complanata* we will not decide; expediency perhaps now justifies the current nomenclature in this case†.

There can be little doubt that *N. lævigata* and its granulate

* We erroneously stated, in Ann. Nat. Hist. ser. 3. vol. v. p. 296, that t was characteristically oriental in its distribution.

† See D'Archiac and Haime's Monogr. pp. 87 & 126.

variety *N. scabra* well represent the "reticulatæ" throughout the Nummulitic rocks. Between *N. lævigata*, *N. Dufrenoyi*, and *N. complanata* we believe there are steady gradations which render the multiplication of specific names unnecessary.

It results, then, that, in our opinion, although it is expedient to have binomial terms at hand wherewith to name the more important varieties of *Nummulinæ*, recent and fossil, yet for the purposes of philosophical zoology *Nummulina* may be recognized as a genus with but a single species, which, for our part, we should consider to be typified by that unhappily named creature *N. perforata*, one of the stoutest and solidest of the whole group.

To render more apparent the successful results of MM. D'Archiac and Haime's labours in elucidating the bibliographical history of the Nummulites and in reducing their confused nomenclature to order, we append the lists of Nummulites named and figured by several of the old authors, in chronological order, with remarks on the probable identifications of subspecies or varieties. In this we have largely availed ourselves of the information given by D'Archiac and Haime. We believe also that these correlations will be found to be of considerable value to students, even if only in saving them time in hunting up the references to antiquated works.

Forskål. 1775.

Forskål. Descriptiones Animalium &c. in itinere orientali, &c. 4to, Copenhagen, 1775. This is a posthumous work; it is appended to Forskål's 'Flora Ægyptiaco-Arabica,' and followed by 'Icones rerum' &c.

p. 125. no. 65. Nautilus pertusus*. This appears, from the description, to be a *Peneroplis*; and therefore the species should be termed *P. pertusa*, and not *P. planata*, according to right of priority.

p. 125. no. 66. N. Orbiculus. This is either *Orbitolites complanata*, Lam., or *Orbiculina adunca*, F. & M.; probably the former.

p. 140. Nautilus? Gizensis. This is the *Nummulina Gizensis* or *Gizehensis*.

p. 140. N. major. This probably is the *N. complanata*, Lam.

In the Berlin Acad. Transactions for 1838 (1839), p. 93, Ehrenberg refers to the presence of four species of *Nummulites* in the limestone near Cairo and Gyzeh; one of them he names *N. Gyzensis* (after Forskål), and another *N. Placentula*, which is Forskål's *N. major*, described by him as "placentæforma" and as "Nautilite placentule."

* This and the following synonym were overlooked by us when noticing the nomenclature of *Peneroplis* and *Orbitolites* in the Ann. Nat. Hist. ser. 3. vol. v. p. 179 & p. 291.

Bruguière. 1792.

Encyclopédie Méthodique. Hist. Nat. des Vers, par M. Bruguière, vol. i., 1792.

p. 399. Camerina lævigata. Afterwards named *Nummulites lævigata* by Lamarck.
p. 399. C. striata. D'Archiac and Haime (Monogr. p. 107 & p. 135) state that this includes the *N. scabra* of Lamarck.
p. 400. C. tuberculata. According to D'Archiac and Haime (Monogr. p. 107), this is probably the same as the *N. scabra* of Lamarck.
p. 400. C. nummularia. The *N. complanata* of Lamarck.

Lamarck. 1801.

(Ann. Nat. Hist. ser. 3. vol. v. p. 290.)

Nummulites lævigata = *Nummulina lævigata.*

Fortis. 1802.

Mémoires pour servir à l'Hist. Nat. et principalement à l'Oryctographie de l'Italie. 2 vols. 1802. Vol. ii. Mém. sur les Discolithes, pp. 1–137. The Abbé Fortis, in this Memoir on Discolites, treated of all the little fossils then known under the names of "pierres lenticulaires, numismales, frumentaires, hélicites, et dernièrement camérines." He refers to the notice taken of them by Strabo and Pliny, and by Mercati and Lancisi; and he quotes the opinions held of them by Bourguet, Scheuchzer, Bruckmann, Bromell, Stobæus, Linnæus, Gesner, Walch, Guettard, Targioni-Tozzetti, Strange, Fichtel, De Saussure, Bruguière, Cuvier, Lamarck, and G. A. Deluc. He then describes all the forms that he knew, but does not give them binomial appellations. The irregularities of form in nearly all are next noticed; conjectures as to the animal to which they belonged are offered; and their different modes of fossilization and the chief places where they have been found form the subject of the last chapter.

Pl. I. fig. *a, b.* Discolithus I. *α.* [*Nummulina Lamarcki* (?), D'Arch. & H., p. 98, and possibly *Amphistegina Lenticula*, Defr.]
c, d. Disc. I. *β.* [*N. planulata* (?), Lam.], p. 98.
e, f, g. Disc. I. *γ.* [*N. planulata*, Lam.], p. 98.
h, i. Disc. I. *δ.* [*N. Biaritzensis*, D'Arch.], p. 99.
j. Disc. I. *ε.* [?], p. 99.
k. [?], p. 100.
l, m. Disc. I. *ζ.* [*N. Lucasana* (?), Defr.], p. 100.
n, o. Disc. I. *η.* [*Orbitoides media* (?), D'Arch.], p. 101.
p., *q, r, s.*, *t.* Disc. I. *θ* & Disc. I. *ι.* [*Nummulina Brongniarti*, D'Arch. & H.], [*N. lævigata*, Brug.], [*N. Brongniarti*, D'Arch. & H.], pp. 101, 102, 103.
u, v, x, y, z. Disc. I. *κ* & Disc. I. *λ.* [*N. lævigata*, Brug.], p. 102.
* Disc. X. [?], p. 112.
** [Nummulina.]

Pl. 2. fig. A., B, C. Discolithus II. { [*Nummulina complanata*, Lam.], [*Orbitoides dispansa* (?), Sow.], } p. 102.
D, E. Disc. III. [*Nummulina Gizensis*, Forsk.], p. 103.
F, G, H. Disc. IV. [*Orbitoides dispansa* (?), Sow.], p. 104.
J. Disc. IV. *a*. [*O. papyracea* (?), Boub.], pp. 105, 126.
K, L, M. Disc. IV. *b*. [*Nummulina lævigata*, Brug.], p. 105.
N, O. Disc. V. [*Orbitoides media* (?), D'Arch.], p. 106.
P. Disc. VI. [*Nummulina Spira*, Roissy], p. 106.
Q. Disc. VII. [*N. granulosa*, D'Arch.], p. 106.
R. Disc. VII. *a*. [*N. Lucasana*, Defr., var. *a*, D'Arch. & H.], p. 107.
S, T, U, X. Disc. VIII. *a*, *b*, *c*, *e*. [*Calcarina radiata*, Roissy], pp. 107, 108.
V. Disc. VIII. *d*. [*Orbitoides*?], p. 108.
Y. Disc. VIII. *f*. [*Nummulina Biaritzensis* (?), D'Arch.], p. 108.
Z. Disc. IX. [*Fabularia ovata*, Roissy], p. 109.

Pl. 3. fig. 1. [*Nummulina Gizensis*, Forsk.], p. 103.
2. [*Lunulites*.]
3. [*Coral*.]
4, 5. Disc. X. [*Orbitolites complanata*, Lam.], pp. 111, 112.
6, 7. Disc. XI. [*Alveolina Melo*, F. & M.], p. 112.
8, 9. Disc. XI. *a*. [*A. ovoidea*, D'Orb.], p. 113.
10, 11. Disc. XI. *b*. [*A. sabulosa*, Montf.], p. 114.
12, 13, 14. Disc. XII. *a*, *b*, *c*. [*Orbitolina concava*, Lam.], p. 115.
15–18. [*Nummulina lævigata* (?), Brug.], p. 119.

Pl. 4. fig. 1. [*N. Ramondi*, Defr.], p. 130.
2. [*N. Biaritzensis*, D'Arch.], p. 130.
3. [*N. Brongniarti*, D'Arch. & H.], p. 132.
4. [*Alveolina Melo*, F. & M.], pp. 60, 113.
5. [*Nummulina lævigata* (?), Brug.], p. 68.
6, 7. [*Orbitolina concava*, Lam.], pp. 72, 112, 136.
8. [*Nummulina Biaritzensis*, D'Arch.], pp. 132, 133.

On account of several of the figures of *Foraminifera* by Fortis being the first published in illustration of the species, we have included in the above list those of *Orbitoides*, *Alveolina*, *Fabularia*, *Orbitolina*, and *Calcarina*, completing (with some indeterminable objects) the list of Fortis's *Discolithi*. To his figures of *Alveolina* and *Fabularia* we have made frequent allusion in the Ann. Nat. Hist. ser. 3. vol. viii. p. 162.

Fichtel and Moll. 1803.

(Ann. Nat. Hist. ser. 3. vol. v. pp. 105–111.)

Nautilus Mamilla .... *Nummulina Ramondi*, var. *d*, D'Arch. & Haime, Monogr. p. 129.
—— lenticularis, *a* ...... *N. Tchihatcheffi*, D'Arch. & H. Monogr. p. 98.
—— —— β .... *N. Lucasana*, var. *a* .... *ib.* p. 125.
—— —— γ .... *N. Molli* .... *ib.* p. 102.
—— —— δ .... *N. Biaritzensis* .... *ib.* p. 131.
—— —— ϵ .... *N. perforata* .... *ib.* p. 115.
—— radiatus, —— venosus .... { *N. radiata*, var. of *N. planulata*, Ann. Nat. Hist. ser. 3. vol. v. p. 106.

Lamarck. 1804.

(Ann. Nat. Hist. ser. 3. vol. v. pp. 295, 296.)

Nummulites planulata	*Nummulina planulata.*
—— variolaria	—— ——, var.
—— globularia.....................	*N. lævigata*, var.
—— scabra	—— ——, var.
—— complanata	*N. complanata.*

De Roissy. 1804.

Le Clerc (G. L.) Count de Buffon, Hist. Nat. générale et particul. &c. Nouv. édit. Sonnini. Paris, 1798–1802. Hist. Nat. gén. et partic. des Mollusques. Ouvrage faisant suite &c., continué par Félix de Roissy. Vol. v. (An 13) 1804.

Page.
55. Nummulites lævigata, *Brug.* pl. 51. fig. 9.
56. N. plana, *De R.*, Fortis, Mém. ii. pl. 2. figs. A, B, C. Fig. A is the *N. nummularia*, Brug., afterwards termed *N. complanata* by Lamarck; figs. B & C are most probably *Orbitoides.*
56. N. depressa, *De R.*, Fortis, *ib.* figs. D, E. This is the *N. Gizensis* of Forskål.
57. N. Mamilla, *De R.*, Fortis, *ib.* figs. H, J, K, L, M. Figs. H & J are *Orbitoides*; K, L, & M are *N. lævigata.*
57. N. convexoplana, *De R.*, Fortis, *ib.* figs. N, O. An *Orbitoides.*
57. N. Spira, *De R.*, Fortis, *ib.* fig. P.
58. N. verrucosa, *De R.*, Fortis, *ib.* figs. Q, R. Fig. Q is the granulose condition of *N. Spira* (the same as *N. exponens*, Sow., and *N. granulosa*, D'Arch.); fig. R is *N. Lucasana*, Defr.
58. N. radiata, *De R.*, Fortis, *ib.* figs. S, T, U, V. S, T, & U are stellate *Calcarinæ*; V is perhaps an *Orbitoides.*
58. ——, var. *a*, *De R.*, Fortis, *ib.* fig. X. A radiate *Calcarina.*
58. ——, var. *b*, *De R.*, Fortis, *ib.* fig. Y. Possibly *Nummulina Biaritzensis*, D'Arch.
59. N. ovata, *De R.*, Fortis, ib. fig. Z. This is a *Fabularia.*

De Roissy adds nothing to our knowledge of the *Foraminifera* in any way; yet, of the names proposed by him for the fossil specimens figured in Fortis's Pl. 2, there are some that must be retained (*N. Spira, C. radiata, F. ovata*) on account of their priority to names given by other authors. Besides these, the *Orbitoides* may probably require "Mamilla" and "convexoplana" to be retained.

De Montfort. 1808.

(Ann. Nat. Hist. ser. 3. vol. vi. p. 342.)

Nummulites denarius.........	*Nummulina lævigata*, Lam.
Lycophris lenticularis	*N. lenticularis*, β, F. & M. *N. Lucasana*, var. *a*, D'Arch. & H.
Rotalites radiatus	*N. lenticularis*, δ, F. & M. *N. Biaritzensis*, D'Arch. & H.
Egeon perforatus	*N. lenticularis*, ε, F. & M. *N. perforata*, D'Arch. & H.

XXVI.—*On some new Genera and Species of Mollusca from the North of China and Japan.* By Arthur Adams, F.L.S. &c.

My observation of the marine Mollusca of North China extends over the whole of the Yellow Sea, from the deep bight between the Yang-tsze-Kiang and the Shan-tung Promontory on the west, and the coast of Korea on the east. The water of this sea is muddy and of a yellowish colour, especially near the land. It is also shallow, the greatest depth not usually exceeding 36 fathoms. The nature of the bottom is very unfavourable for molluscous and indeed any other kind of life, on account of the enormous quantity of mud which comes down the rivers, and which subsides, and destroys nearly all marine life. In "races" and tideways, off points of land, and in the deep sandy bays, many species of interest may, however, be met with; but, on the whole, I should say that the mere collector of shells could not proceed to a worse field for his labours than the shores of the Yellow Sea and the Gulfs of Pe-chili and Lian-tung.

Genus Eulima, Risso.

1. *Eulima gibbosula*, A. Adams.

E. testa pyramidali-subulata, alba, semipellucida, apice roseo tincto; spira lateraliter inclinata; anfractibus circa 11, planis, suturis marginatis; anfractu ultimo magno, gibboso, ad basin rotundato; apertura subcirculari.

Hab. Lian-tung (Hulu-Shan Bay); 3 fathoms.

This curiously-shaped little species is something like *E. pinguicula*, A. Ad., with a subcircular aperture; it resembles also in some respects *E. clavula*, A. Ad., but that species is more pyramidal and flat at the base.

2. *Eulima subula*, A. Adams.

E. testa subulata, spira subtortuosa, alba, semipellucida, apice roseo tincto; anfractibus circa 11, planis, ultimo ad peripheriam rotundato; apertura acuminato-ovata; labio antice vix everso; labro in medio producto.

Hab. Gulf of Pe-chili; 4 fathoms (mud).

Genus Leiostraca, H. & A. Adams.

1. *Leiostraca Ariel*, A. Adams.

L. testa subulata, alba, tenui, pellucida; anfractibus $6\frac{1}{2}$, planatis, suturis obliquis; anfractu ultimo magno, ad peripheriam rotundato, ad basin producto; apertura acuminato-ovata.

Hab. Shan-tung (Kala-hai).

2. *Leiostraca Oberon*, A. Adams.

L. testa parva, pyramidali-subulata, alba, opaca, quasi pruinosa; anfractibus circa 8, planis, ultimo magno, ad peripheriam rotundato, ad basin producto; apertura ovata, antice subeffusa; labio recto, subincrassato.

Hab. Shan-tung (Kala-hai).

3. *Leiostraca Titania*, A. Adams.

L. testa parva, subulato-pyramidali, sordide alba, semipellucida; anfractibus circa 9, planis, suturis marginatis; anfractu ultimo ad peripheriam vix angulato; apertura ovata; labro in medio subangulato.

Hab. Shan-tung (Kala-hai).

4. *Leiostraca Maria*, A. Adams.

L. testa recta, subulata, solida, vix opaca, lactea; anfractibus circa 11, convexiusculis, varicibus obsoletis instructis, suturis subirregularibus; anfractu ultimo elongato, ad peripheriam rotundato; apertura ovata, antice producta; labio calloso.

Hab. Gulf of Pe-chili; 3 fathoms (mud).

5. *Leiostraca Constantia*, A. Adams.

L. testa subulata, tenui, sordide alba, semiopaca; anfractibus circa 9, planiusculis, suturis marginatis; anfractu ultimo subventricoso, antice producto; apertura lanceolato-ovata, postice acuminata, antice dilatata; labio incrassato.

Hab. Lian-tung (Hulu-Shan Bay); 3 fathoms (sand and shells).

6. *Leiostraca casta*, A. Adams.

L. testa recta, tenui, subulata, alba, semipellucida; anfractibus circa 11, planiusculis, suturis marginatis; anfractu ultimo elongato, ad peripheriam rotundato; apertura ovata, postice acuminata, antice vix effusa; labio subincrassato.

Hab. Shan-tung (Hwang); Lian-tung (Hulu-Shan Bay); 3 fathoms.

7. *Leiostraca lentiginosa*, A. Adams.

L. testa lanceolato-pyramidali, compressiuscula, semipellucida, sordide alba, maculis parvis rufo-fuscis numerosis irregularibus confertis ornata; anfractibus $6\frac{1}{2}$, planis; apertura elongato-ovata; labio incrassato.

Hab. Shan-tung (Lo-shan-kow).

Genus Rissoella, Gray.

1. *Rissoella sinensis*, A. Adams.

R. testa helicoidea, profunde umbilicata, alba, semiopaca, nitida, obsolete striata; spira elata; anfractibus $3\frac{1}{2}$, rotundatis, suturis profundis; apertura subcirculari; peristomate vix continuo.

Hab. Gulf of Pe-chili; 7 fathoms.

2. *Rissoella consobrina*, A. Adams.

R. testa helicoidea, profunde umbilicata, ventricosa, alba, tenui, lævi, pellucida; spira brevi, acuta; anfractibus $3\frac{1}{2}$, convexis, ultimo magno, suturis mediocribus; apertura subcirculari; peristomate vix continuo.

Hab. Shan-tung (Lo-shan-kow).

Genus Stylopsis, A. Adams.

Stylopsis sulcata, A. Adams.

S. testa subulata, alba, opaca; anfractibus normalibus 13, planulatis, sulcis duobus transversis instructis, suturis profundis, exaratis; anfractu ultimo ad peripheriam rotundato, sulcis tribus transversis instructo; apertura subquadrata; labio recto, simplici; labro margine regulariter arcuato.

Hab. Sea of Okhotsk; 17 fathoms.

This is a second species of *Stylopsis*, a genus most like *Syrnola*, but wanting the columellar fold. The present species may be known from *S. typica*, A. Adams, by the last whorl being rounded, and not angulated, at the periphery, and in being furnished with three transverse grooves. The other whorls have two grooves each.

Genus Leucotina, A. Adams.

Leucotina sulcata, A. Adams.

L. testa alba, solida, ovato-conica, umbilicata; anfractibus $3\frac{1}{2}$, planiusculis, transversim valde sulcatis, sulcis obsolete punctatis; apertura oblonga; labio rectiusculo, plica evanida instructo.

Hab. Korea Strait; 46 fathoms.

L. niphonensis, A. Adams, is the nearest to this species, from which, however, it differs in being more conoidal, shorter, and broader; the transverse obscurely punctate grooves, moreover, are very deep, and the umbilicus is conspicuous and open.

Genus Myonia, A. Adams.

1. *Myonia elegans*, A. Adams.

M. testa subulata, tenui, semiopaca, gracili; anfractibus 6, convexiusculis, transversim sulcatis, sulcis obliquis, distantibus, punctatis;

apertura ovata, postice acuminata; plica parietali tenui, mediana, obliqua; labro simplici.

Hab. Gulf of Pe-chili; 5 fathoms.

Most like *M. punctigera*, A. Adams, but more slender and transparent, with longer whorls, and with a thin inner lip; the transverse grooves, moreover, are not so coarsely punctate.

2. *Myonia scitula*, A. Adams.

M. testa subulato-ovata, alba, opaca, nitida; anfractibus 4, planiusculis, transversim sulcatis, sulcis distantibus, concinne punctatis, suturis impressis; anfractu ultimo magno, elongato; apertura ovata, antice dilatata, postice acuminata; plica parietali conspicua, obliqua; labro simplici.

Hab. Mino-Sima; 63 fathoms.

A small species, somewhat similar in appearance to *M. punctigera* from the Gulf of Pe-chili, but shorter and more ovate.

Genus Vanesia, A. Adams.

Testa subulata, rimata, tenui; anfractibus numerosis, planis. Apertura ovata, postice acuminata, antice rotundata, integra; labio tenui, subreflexo; labro margine simplici, acuto.

This shell closely resembles a thin *Melania*. The only known marine genus which it appears to approach is *Mesalia*, from which, however, the general character of the shell and the form of the aperture at once distinguish it. There is no river near this part of the coast, nor have I detected any species of *Melania* in Manchuria.

Vanesia trifasciata, A. Adams.

V. testa rimata, subulata, tenui, corneo-lutescente; anfractu ultimo fasciis tribus transversis rufo-fuscis ornato; anfractibus 9, planatis, rugosis, erosis, lineis longitudinalibus et transversis subtiliter decussatis; apertura ovato-acuminata, antice integra, rotundata; labio tenui, subreflexo; labro simplici, acuto.

Hab. Sunday Island, coast of Manchuria; dredged from 20 fathoms.

Genus Diala,* A. Adams.

Testa imperforata, ovato-conica, sæpe semiopaca, varie picta; anfractibus simplicibus. Apertura ovata, antice integra; labio rectiusculo; labro simplici.

This is an ill-defined, though natural, group, allied to *Alaba*, H. & A. Adams, and might form a portion of a family to include *Litiopa* and *Planaxis*. They are found between the Coralline and Laminarian zones. By some they would be called *Hydrobiæ*.

1. *Diala varia*, A. Adams.

D. testa tenui, rufo, fusco nigroque varie picta, elevatim conica; anfractibus 7, planulatis, ultimo ad peripheriam subangulato, basi convexa, sulcata; apertura oblonga; labio arcuato; labro in medio subangulato.

Hab. Lo-shan-kow; Shan-tung; also not uncommon in the Korea and Japan.

2. *Diala cornea*, A. Adams.

D. testa ovato-conica, semiopaca, cornea, transversim substriata; anfractibus $4\frac{1}{2}$, convexiusculis, suturis rufescentibus, apice rufo tincto; apertura oblonga; columella rectiuscula, rufo tincta; labio sæpe rufo tincto.

Hab. Hulu-Shan Bay; 3 fathoms. Lo-shan-kow; Shan-tung.

3. *Diala leucosticta*, A. Adams.

D. testa ovato-conica, solidiuscula, semipellucida, alba, ad suturas et ad peripheriam serie macularum lactearum ornata; anfractibus 6, convexiusculis, suturis marginatis, basi spiraliter striata; apertura oblonga; labio arcuato, subincrassato.

Hab. Lo-shan-kow; Shan-tung.

4. *Diala picta*, A. Adams.

D. testa ovato-conica, semiopaca, solidiuscula, anfractibus 6, vix convexis, apice violaceo, alba, lineis rufescentibus tribus (in anfractibus singulis) transversis et longitudinalibus concinne picta, basi concentrice rufo-lineata; apertura oblonga, antice subangulata; labio recto; labro intus subincrassato.

Hab. Lo-shan-kow, Shan-tung.

Genus Liotia, Gray.

Liotia armata, A. Adams.

L. testa turbinata, alba, solida; spira elata, conica, late umbilicata; anfractibus convexis, longitudinaliter corrugato-lamellatis, lamellis confertis undulatis; anfractibus carinulis transversis (in anfractu ultimo quatuor) et seriebus duabus spinarum instructis, spinis muricato-squamulosis.

Hab. Korea Strait; 46 fathoms.

Most like *L. muricata*, Humph., but with two series of squamose spines, and the form of the shell turbinate instead of conical; it is also devoid of colour, and the spines are longer and more aculeate than in that species.

Genus Cynisca, H. & A. Adams.

In our 'Genera of Recent Mollusca,' vol. i. p. 406, my brother and myself proposed a subgenus of *Cyclostrema* under the name of *Cynisca.* This was founded on a shell in Mr. Cuming's collection, which I described, under the name of *Cyclostrema granulata,* in the 'Proc. Zool. Soc.' 1853, p. 183. The great peculiarity consists in the aperture, which is something like that of *Stoastoma,* the inner lip being straight, and the outer lip being continued posteriorly on the penultimate whorl beyond the inner lip. A second species, as far as I can make out by the figure and brief description, is *Delphinula australis* (Kien., Spec. Gén. p. 8, tab. 4. fig. 7, copied in Reeve, Conch. Icon. sp. 20, and by Philippi, Conch. Cab. tab. 5. fig. 13). I now add the description of a third species from Japan.

Cynisca japonica, A. Adams.

C. testa turbinata, anguste umbilicata, alba, solida, transversim lirata, liris elevatis confertis, ad suturas vix granulatis; anfractu ultimo ad peripheriam rotundato; umbilico parvo, profundo, callo plicato marginato; apertura circulari; labio recto; labro incrassato, intus lirato.

Hab. Korea Strait; 46 fathoms.

This species differs from *C. australis,* Kien., in the margin of the aperture not being reflexed, and from *C. granulata,* A. Ad., in the umbilicus being small, and not wide and perspective, and in the liræ of the whorls not being granulated. In not being pearly within, and in their white colour, these shells resemble *Cyclostrema,* while in the peculiar callus which surrounds the umbilicus and the sulcate style of sculpture they remind one of *Monilea.*

Genus Adeorbis, Searles Wood.

The genus *Vitrinella* of the late Prof. C. B. Adams is composed of a somewhat incongruous assemblage, having one feature only in common, namely transparency. If form be considered, many species must be arranged under *Adeorbis.* The little shells I now describe are more or less pellucid, but they have all the characters of *Adeorbis.* The small shells described by D'Orbigny as species of *Rotella,* namely *R. striata, pusilla, carinata,* and *anomala,* are species of *Adeorbis.* The type of *Pseudorotella,* Fischer (*R. semistriata,* D'Orb.), which has the umbilicus nearly covered by a thick callus, I consider to belong to *Ethalia,* a subgenus of *Umbonium.* I may here observe that the *Omphalogyra* of Jeffreys, founded on *Skenea nitidissima,* is a synonym of *Spira,* Brown. The very remarkable shell described by me as *Cyclostrema spirula* is neither a *Spira* nor a *Serpularia,* and the name of the subgenus may therefore be changed into *Daronia.* M. Fischer has recently endeavoured to throw some light upon these little obscure genera; but he seems to have given up his original intention, and to have grouped the species geographically—a comparatively easy task. If Dr. Gray or M. Mörch would take them up where M. Fischer laid them down, we should perhaps find the species arrange themselves in a more orderly manner.

1. *Adeorbis clausa*, A. Adams.

A. testa discoidali; spira depressa, albida, subdiaphana, striis incrementi radiatim ornata; anfractibus rapide crescentibus, ultimo ad suturas vix angulato, ad peripheriam rotundato; umbilico callo tenui vix clauso; labro producto.

Hab. Tabu-Sima; 25 fathoms.

2. *Adeorbis orbella*, A. Adams.

A. testa discoidali; spira planata, alba, subporcellana, nitida, semiopaca, radiatim striata; basi transversim confertim sulcata; anfractibus regulariter crescentibus, ultimo ad peripheriam rotundato; umbilico patulo, perspectivo, margine rotundato; labro subproducto.

Hab. Mino-Sima; 63 fathoms.

3. *Adeorbis prominula*, A. Adams.

A. testa discoidali; spira elatiuscula, alba, subdiaphana, nitida, striis incrementi ornata; anfractibus rapide crescentibus, ultimo ad peripheriam rotundato; umbilico mediocri, margine carinato; labro producto.

Hab. Korea Strait; 46 fathoms.

4. *Adeorbis depressa*, A. Adams.

A. testa discoidali; spira planata, alba, vix opaca, radiatim striata; anfractibus rapide crescentibus, ultimo ad peripheriam rotundato; basi rugulis radiantibus ornata; umbilico patulo, margine valde rugoso-crenato; labro mediocri.

Hab. Korea Strait; 46 fathoms.

5. *Adeorbis patruelis*, A. Adams.

A. testa ut in *A. japonica* discoidali, sed spira elatiuscula, alba, nitida, semipellucida, radiatim striata; anfractibus regulariter crescentibus, convexiusculis, ultimo ad suturam vix angulato, ad peripheriam rotundato; umbilico angusto, margine carinato; labro mediocri.

Hab. Mino-Sima; 63 fathoms.

6. *Adeorbis corniculum*, A. Adams.

A. testa ovato-discoidali, tenui, nitida, subdiaphana, radiatim minutissime striata; anfractibus rapide crescentibus; umbilico angusto, margine valde carinato; labro producto.

Hab. Mino-Sima; 63 fathoms.

7. *Adeorbis suturalis*, A. Adams.

A. testa ovato-discoidali; spira prominula, albida, tenui, semipellucida, striis incrementi radiatim ornata; anfractibus rapide crescentibus, prope suturas subcarinatis, ultimo ad peripheriam subangulato, suturis canaliculatis; umbilico angusto, margine rotundato; labro mediocri.

Hab. Tsu-Sima; 26 fathoms.

8. *Adeorbis japonica*, A. Adams.

A. testa discoidali; spira depressa, alba, nitida, tenui, semidiaphana, radiatim striata; anfractibus regulariter crescentibus, convexiusculis; umbilico patulo, margine valde carinato; labro mediocri.

Hab. Mino-Sima; 63 fathoms.

9. *Adeorbis nanula*, A. Adams.

A. testa ovata, subconvexa, tenui, semidiaphana, nitida; anfractibus rapide crescentibus, convexiusculis, ultimo subventricoso, ad peripheriam angulato; umbilico angusto, margine rotundato; labro mediocri.

Hab. Mino-Sima; 63 fathoms.

Shanghai, China,
January 1, 1861.

XXVII.—*On the Structure of the larger* Foraminifera. By H. J. Carter, Esq., F.R.S.

In a paper on the Structure of the larger Foraminifera, read before the Bombay Branch of the Royal Asiatic Society (April 11, 1861), the author sums up his observations on the discoidal Foraminifera as follows:—

Test.—The test is situated in the substance of the animal, and (in *Operculina*) consists of the spiral or horizontal lamina and the marginal cord. The spiral lamina, again, is divided into the parts which cover the chambers and those which cover the interseptal spaces: the former are pierced with close-set vertical tubuli, and the latter with more or less scattered minute branches of the interseptal canals. Besides this, there are non-tubular spaces or puncta, more or less regularly scattered over the chambers and interseptal spaces, which answer to the external ends or bases of conical columns of condensed shell-substance, intended apparently for strengthening the test; and these are accompanied, in some species of *Nummulites*, by a horizontal branch-work of the same material, which gives them very much the appearance of the lacunæ and their canaliculi in bone; yet they present no appearance of channelling, but, on the contrary, a heterogeneous composition, as regards size, of small pillars and pellets of condensed shell-substance respectively. The marginal cord, on the other hand, is composed of spicules, an interspicular substance, and canals, which are more or less arranged in layers respectively, radiating from the centre of the base of the cord (which is straight) to its circumference (which is semicircular). The spicules overlap each other longitudinally, and the canals form a densely reticulated structure throughout the substance of the cord, whose branches open in all directions upon its surface. As the test arrives at its full growth, the marginal cord is bent down over the last chamber to meet its preceding turn, to which it becomes attached, and the *Operculina* is thus hermetically sealed. Hence D'Orbigny's original statement that the test is without an opening like that of Nautilus and the Ammonites, and without a siphon.

Canal-system.—The canal-system consists of—1. Two great spiral canals, one in each horizontal half of the test, which run from its commencement to its termination, and are situated respectively on each side of the marginal cord, at its point of junction *externally* with the spiral lamina, in which line also it opens externally by fine ramusculi, like those of the interseptal canals. 2. The interseptal canals, two in each interseptal space, which arise respectively from the great spiral canals of the preceding turn, and terminate on the *inner* aspect of the cord, close to the chamber, where they divide into branches which join the marginal plexus, the great spiral canals, and open externally on the surface of the cord, respectively. 3. The marginal plexus, which occupies the marginal cord, and is formed of an intricate network of canals derived chiefly from branches of the great spiral and interseptal canals, which network is spread throughout the cord, and, as before stated, opens in all directions over its surface. 4. A system of small canals, which open on the surface along the lines of the great spiral canals and interseptal spaces, and are in connexion with the spiral and interseptal canals respectively.

Animal.—This, as was discovered by Dujardin, is a Rhizopod, which fills more or less all the chambers and canals of the test, besides spreading over its surface externally: hence M. D'Orbigny was not far wrong when he stated, or M. De Férussac did for him (Ann. des Sc. Nat. t. vii. p. 100, 1826), "que le test de ces petites coquilles était entièrement renfermé dans le corps," though he was wrong for the time in taking the rhizopodous extensions for the arms of a Cephalopod, as he subsequently admitted. The chambers consist of cavities of this sarcode, which are more or less filled with propagative spherules, &c., as will be more particularly mentioned directly. They communicate by short branches with the great spiral and interseptal canals, the marginal plexus, and with each other through the interseptal spaces, besides opening on the surface through the tubuli. The sarcode of the canal-system is also more or less tubular, and thus affords a transit for the contents of the chambers externally; probably, however, not "tubular" as the word is generally understood, but sarcodal, *through* the *substance* of which the materials for excretion are transmitted, as in *Amœba.*

Besides the propagative spherules, the chambers contain starch, in grains and amorphous, which still more nearly allies the Foraminifera to *Spongilla*, and probably to all the Sponges; for as starch abounds in the former, it may be assumed to be present also in the latter. Whether the chambers contain any other than the propagative organs remains for future research to determine. It is not improbable, also, that they have each a *nucleus.*

As regards nutriment, this may be enclosed by the sarcode, and a stomachal cavity extemporized for digestion at any part; while the egesta may be ejected through the sarcode direct, or through the larger tubes of the canal-system. Lastly, the smaller canals which open over the great spiral canals and interseptal spaces may be for the purpose of admitting water into the larger canals, and thus afford a water-circulation.

Propagative Spherules.—These are produced in the chambers, and are of two kinds, viz. large and small. The small spherule is composed of a homogeneous sphere of matter, slightly tinged yellow by iodine, which is enclosed in a delicate transparent spherical capsule, and attached in massive groups to branched stems, like grapes; while the large spherule consists of a sphere of granular substance, equally tinged yellow by iodine, and sometimes also surrounded by a transparent delicate spherical cell. The former are about 1-5400th and the latter 1-1800th of an inch in diameter. The chambers may be more or less filled with both kinds of spherules, together or separately, and the smaller may be the earlier stage of the larger, if they be not sperm-cells; while they may also be observed, on their transit to the exterior, in *all* parts of the canal-system, even to the vertical tubuli, where their elongation in the fossil species (*Nummulites*) at once points out their softness and adaptation in this respect to the canal through which they may have to pass; but, from being of different sizes below the largest, above mentioned, they for the most part take the largest or smallest tubes for outlets, according to their size. This variation in size may also account for the variation in size of the primary cell of the full-grown species, which is sometimes as small nearly as the smallest spherule, and at others much larger than the largest. Those which are observed about the test externally are white when dry, so that they already contain calcareous matter. Sometimes the spherule or primary cell begins to develope a second while still in the parent-chamber (I have seen this in one of the chambers in the outer turn of *Nummulites Ramondi*; indeed, I have the section showing it); and then the young one evidently becomes too large for passage through the ordinary chambers. In this case it would seem that a special opening is formed for their exit through the spiral lamina; for holes exist here and there in this part of the test, which, from their rounded edges, indicate that they were made by the animal. Not unfrequently these are formed opposite the great spiral canals.

Mode of Development.—The spherule, having left the parent, becomes the primary cell of the new being, and putting forth a stolon, produces another chamber, and so on until a certain number are formed, which are arranged horizontally around the first, and the *Operculina* is developed. The stolon therefore forms part of the canal-system, and the chambers are in this manner developed from it. As development progresses, the chambers which bud from the *margin* of the cord attain their largest size, and then begin to diminish again, until they end in almost nothing, and are closed in, as before stated, by the bending-down of the marginal cord and its union with the preceding turn, when the test is thus hermetically sealed and its form completed. The union between the chambers at their bases is probably only filamentous; for the chambers do not *here* communicate with each other, while the calcareous septa which divide them are frequently united to the marginal cord; and if not in direct contact, they are always more or less scolloped, indicating a round filamentous layer of the sarcode which previously existed between them and the cord. Besides, we shall see presently that the development of the test is frequently continued without the presence of the chambers; so there can be no question that all other structures are developed from the sarcode of the canal-system, or from the filamentous sarcode, connected, of course, originally with a nucleated cell. Hence the filamentous sarcode becomes analogous to the mycelium of Fungi, and being rhizopodous, is united, through the Sponges, to the fungal parasitic animals which inhabit the cells of Algæ and are propagated by monociliated Amœbæ, and, through the latter, to the true Fungi, which are propagated by defined sporules.

Nummulites is nothing but a more complicated form of the *Operculina* type. The chambers bud from the margin of the cord, and extend outwards and inwards until they reach the level of the margin of the last turn and the umbilicus of the test respectively,—the last three, four, or more, being of successive sizes up to the last of all, which is least developed.

The same principle obtains in the formation of the test and propagation of *Orbitoides dispansa* and *Orbitolites Mantelli*, Cart. (*Orbitoides Mantelli*, D'Orb.); but the canal-system is different, and there are no columns of condensed shell-substance in the latter. In *Orbitoides dispansa* each chamber is united to the two in front and the two behind it by stolon-processes, as in *Cycloclypeus*, Carp.; and there is an annular canal behind each row, which is united, by straight, transverse, interseptal or intercameral branches, with that in front and behind it in each half of the test. The latter system also exists in *Orbitolites Mantelli*; but the stolon-processes are represented by oblique canals which radiate from the centre to the circumference, and here in this manner also unite each chamber with the two in front and two behind it; while, as the chamber becomes vertically elongated towards the circumference, the oblique canals are increased to two, four, and six in number in the outer rows, one above another, so as to resemble their disposition in *Orbitolites*, as shown by Dr. Carpenter's diagram. In the annular canals we cannot help seeing the analogues of the great spiral canals in *Operculina* and *Nummulites Ramondi*, &c., if not in all *Nummulites*; while in the stolon-processes of *Orbitoides dispansa* and the oblique canals of *Orbitolites Mantelli* and *Orbitolites complanata*, we seem to have a combination of the marginal plexus and interseptal canals; for they both open ultimately at the margin or circumference of the tests respectively. The columnar chamber-structure, on the other hand, in both, which corresponds with the vertical development of *Nummulites* (that is, the extension of the chambers to the umbilicus on each side the horizontal plane), has its parts united by ascending and horizontal stolon-processes, which indirectly give existence to the propagative spherules throughout, for the same kind of spherules are developed both in the chambers of the horizontal plane and in the columnar chambers, even to the very centre of these fossils, as in *Nummulites* and *Operculina*.

The tests of *Conulites* (n. gen.) and *Orbitolina lenticularis* are developed upon the same principle as the rest, and both present the same kind of propagative spherules in the chambers. *Conulites*, however, has the same columnar chamber-structure and columns of opake shell-substance as *Orbitoides dispansa*, but with a *helical* layer of chambers externally, something like the horizontal layer of *Nummulites*; while *Orbitolina lenticularis* has no columns of opake matter in its columnar chamber-structure, and has a *cyclical* arrangement of the rows of chambers externally, like *Orbitoides dispansa*, *Orbitolites Mantelli*, and *Orbitolites complanata*.

Alveolina meandrina (n. sp.), and therefore *A. elliptica,* are developed upon the same principle as *Nummulites* elongated vertically. The former has an interseptal system and marginal plexus of canals; and the latter too, probably. In *Alveolina elliptica* the greater part of the test is often without chambers, so that its development is as often wholly carried on by the sarcode of the canal-system; and the same is frequently the case with the last turns of the globose forms of *Nummulites,* e. g. *N. perforata,* &c.; while in *Alveolina elliptica* also, the chambers sometimes disappear and reappear at intervals, leaving the spire to go round by itself between them, as exemplified also in the annular canals of *Orbitolites Mantelli* and *Orbitoides dispansa.* These are the instances to which I have before alluded as evidencing a development of the chambers upon the sarcodal filaments of the canals.

The new genus for which the term "Conulites" above-mentioned is proposed has the following generic characters:—

"Conical, compressed, discoidal; consisting externally of a spiral layer of rhomboidal chambers extending from the apex to the circumference; filled up internally with convex layers of compressed columnar chambers interspersed with white columns of condensed shell-substance; white columns opake, conical, their sharp ends resting on the inner aspect of the spiral layer, and their large ones terminating at the base of the cone, which presents a slightly convex granular surface."

XXVIII.—*A Catalogue of the Zoophytes of South Devon and South Cornwall.* By the Rev. Thomas Hincks, B.A.

[Continued from p. 161.]

[Plates VII. & VIII.]

Order **SERTULARIDÆ**, Huxley. Fam. **Sertulariadæ**, Johnst.

1. Halecium, Oken.

1. *H. halecinum,* Linn.

Very common; abundant and of great size amongst the trawl-refuse.

2. *H. Beanii,* Johnston.

Very common; dredged abundantly all along the coast. Very fine in Salcombe Bay and Torbay. I have a specimen which stands 5 inches high, while the spread of the branches measures 6 inches.

[Lamlash, Arran; Filey, Yorkshire; Llandudno, N. W.; Ramsay, Isle of Man.]

3. *H. tenellum*, n. sp. Plate VI. figs. 1–4.

Polypary of extreme delicacy; stem simple or very slightly branched, smooth, zigzag, bearing a cell at every bend, running out at the extremity into long tendril-like fibres, which give off a few short ramuli; cells gracefully everted at the margin, often of considerable length,—in most cases a number (frequently four or five) rising one from within another, and marking the successive generations of polypes. Gonothecæ sometimes broadly ovate, sometimes elongate and pointed, borne on short pedicles and occurring singly. Height of fine specimens about $\frac{1}{4}$ of an inch.

Abundant on *Salicornaria farciminoïdes*, Salcombe Bay.

This very beautiful species is remarkable for its extreme tenuity and delicacy. The character of the stem is peculiar: it is made up of a number of straight portions, each terminating in a cell, which spring one from the other at the base of the cells, and bend alternately to opposite sides. There is a slight crenation of the stem just above each cell. A simple cell is rarely met with on mature specimens. Generally the polype protrudes from the uppermost of a pile of little cups with prettily everted rims, which fit one into the other and form a branchlet of some length.

The gonothecæ are of two forms, one somewhat broadly ovate, the other slender and tapering. The former contains a large sporosac, in which a single (?) ovum is produced. The latter is probably the male capsule*.

2. Sertularia, Linn.

1. *S. polyzonias*, Linn.

Very common: on rocks near low-water mark; dredged, on other zoophytes, Ascidiæ, stones, &c., in 15–20 fathoms; amongst the trawl-refuse. It presents many varieties of size and habit. When living, it is of a bright straw-colour, and is certainly one of the prettiest, as it is one of the commonest and most widely-distributed, of the Sertularian Hydrozoa.

2. *S. Gayi*, Lamouroux, Expos. Méth. 12. pl. 66. figs. 8, 9.

Not uncommon in the Coralline zone: amongst the refuse of the Plymouth trawlers, fine; on *Pinna* from a depth of 60 fa-

* I have already pointed out that the male and female capsules are of different form in *H. halecinum* and *H. Beanii* (Rep. of Brit. Assoc. for 1858). In the latter species the sperm-capsules are elongate-ovoidal, the calceoliform capsules producing the ova. In *H. halecinum* the male gonothecæ are simply ovate, wanting the tubular process at the top which distinguishes the female. The same difference seems to exist in the present species.

thoms off the Deadman. One specimen in my possession is more than 4 inches high, and measures not less than 6 inches across. The main stem is of great thickness, and the whole bears a striking resemblance to an aged tree.

The *S. Gayi* of Lamouroux is the *S. polyzonias*, var. *β*, of Johnston ("caulescent, pinnate"). Its very distinct habit, compound stem, and pinnate branching seem to entitle it to specific rank.

3. *S. tenella*, Alder, Northumb. & Durham Cat. pl. 2. figs. 3–6.

Between tide-marks; probably not uncommon.
[Filey, Yorkshire.]

4. *S. fusiformis*, n. sp. Plate VI. figs. 7, 8.

Minute; stem slender, slightly zigzag, generally unbranched, annulated at the base and below each cell; cells alternate, bent in opposite directions, elongate, somewhat flask-shaped, smooth,—aperture quadridentate, with an operculum composed of four pieces; each cell and its internode of a fusiform figure. Gonothecæ elongate, slender, tapering above and below, ribbed across, produced at the upper extremity into a short neck and toothed, springing here and there just below a cell. Height about a quarter of an inch.

Between tide-marks.

This species presents the appearance of a single series of fusiform pieces, springing one from the side of the other about midway, and bending alternately in opposite directions. Its nearest ally is the *S. tenella* of Alder, from which it differs in the shape of the cells and capsules.

It was first detected by Mr. Alder, who noticed it amongst some Devon zoophytes which I had sent him for examination.

5. *S. rugosa*, Linn.

Generally on *Flustra foliacea*; not so common as in the North.

6. *S. pumila*, Linn.

Universally distributed, on weed and rock between tide-marks.

7. *S. gracilis*, Hassall.

Torbay, between tide-marks.

Nearly allied to the preceding, from which, however, it differs in the minute characters. It is also of much slenderer habit.

8. *S. rosacea*, Linn.

Very common; parasitical on other zoophytes.

9. *S. Margareta*, Hassall.

Devonshire (*Mrs. Griffiths*).

I have never obtained this species myself. It must be rare, or it would have turned up amongst the large quantities of trawl-refuse which I have examined from time to time. Are not *S. pinaster* and *S. Margareta* different sexes of one and the same species ?

In the case of *S. tamarisca*, the researches of Prof. Allman have shown that the male and female capsules are dissimilar*.

10. *S. nigra*, Pallas.

Not uncommon at certain points off the Devon and Cornish coasts, in deep water. From Mr. Laughrin of Polperro I have received many fine specimens (one from 40 fathoms, ten or twelve miles from shore) either of this or the next species. In the absence of the reproductive capsules, I confess myself quite unable to distinguish the one from the other, and strongly suspect that here, again, the difference in the form of the gonothecæ merely denotes a difference of sex. This point can only be settled by an examination of living specimens; and meanwhile the two names must be retained.

Off the Deadman, rare; a few miles west and north-west of the Eddystone, common (*R. Q. Couch*).

11. *S. pinnata*, Pallas.

I have specimens of the form with spinous capsules, from Torbay or the neighbouring sea.

Dr. Johnston received a Devonshire example from Mrs. Griffiths.

12. *S. tamarisca*, Linn.

Common in the Coralline zone : abundant amongst the Brixham trawl-refuse ; dredged on stone, Torbay.

13. *S. abietina*, Linn.

Deep water, very common. This species is taken up in immense quantity by the trawlers.

14. *S. operculata*, Linn.

Common, investing the stems of *Laminaria* ; Brixham trawl-boats occasionally.

15. *S. argentea*, Ellis & Solander.

Very abundant, Coralline zone : one of the principal elements of the trawl-refuse ; sometimes in large clusters on mussel-

* *Vide* paper on the "Reproduction of *S. tamarisca*," in the Report of British Assoc. for 1858.

shells. At Exmouth it occurs on the sides of rocks near low-water-mark, but of small size, simply pinnate and plumose. In such situations it does not seem to attain its full growth; at least I do not recollect to have met with any perfectly-developed specimens between tide-marks.

16. *S. cupressina*, Linn.

Not very common: Brixham trawl-boats; dredged in Salcombe Bay, rare.

[Filey, Yorkshire; extremely abundant and of great size.]

Dr. Johnston speaks of this species, on the authority of Mr. Peach, as "plentiful in Devon." I certainly have not found it so. Amongst the produce of the trawl it occurs but sparingly as compared with its congeners *argentea* and *abietina*.

3. Thuiaria, Fleming.

1. *T. thuia*, Linn.

Devon (*Turton & Kingston*).

This species is included in the 'Natural History of Torquay, Dawlish, and Teignmouth,' by the above authors. I have never seen a Devonshire specimen, and Mr. Couch speaks of it as "very rare" on the coast of Cornwall. I presume therefore that it must be of very uncommon occurrence in the west, as its peculiar form would readily attract attention.

[Exceedingly abundant on the coast of Yorkshire. It is a prevalent northern form, and ranges to the North Cape.]

2. *T. articulata*, Pallas.

Not uncommon: Torbay, Exmouth, on *Pinna* from 60 fathoms off the Deadman.

[Filey, Yorkshire.]

4. Antennularia, Lamarck.

1. *A. antennina*, Linn.

Very common, Coralline zone.

2. *A. ramosa*, Lamx.

Common: off the Deadman, in 60 fathoms, &c.

5. Plumularia, Lamarck.

1. *P. falcata*, Linn.

Very abundant in the Coralline zone.

2. *P. cristata*, Lamk.

Very common on rocks between tide-marks, of small size;

Laminarian zone, especially on *Halidrys siliquosa*, large masses of which are often thickly covered with its graceful plumes. It occurs in great profusion and beauty under the rocky shores of Salcombe Bay, and of Berry Head, Torbay. The plumes sometimes attain a great size. On specimens procured at Exmouth they are 2½ inches in height, and bear about a dozen of the pod-like cases (*corbulæ* of Allman), which protect the reproductive capsules, set along the rachis. In other examples the plumes are of great width (three-quarters of an inch across), beautifully curved, and also bearing the corbulæ in a single line upon the main stem.

The tall, slender and branched variety, figured by Dr. Johnston (pl. 24. fig. 1), occurs on the South-Devon coast.

3. *P. tubulifera*, n. sp. Pl. VII. figs. 1, 2.

Plumose, simple, pinnæ alternate. Cells cup-shaped, slender, elongate, not expanded above; margin minutely denticulate; a large ear-like process on each side, springing from the rachis on a level with the rim, and a projecting process in front, supporting a small cup-like cell, with a crescentic opening at the extremity.

On *Gorgonia verrucosa*, from deep water, coast of Cornwall.

The plumes of this species are of a delicate habit, and about an inch, or a little more, in height; they bear a strong general resemblance to those of *P. cristata*, from which, however, they are readily distinguished on examination. The cells of *P. tubulifera* are slender, somewhat elongate, gracefully incurved in front, and are not expanded above like those of *P. cristata*, which are shorter and have a very patulous opening. The marginal denticulation is delicate, and very much finer than in the latter species, in which the rim is cut into very large and prominent spines, which are somewhat everted. The lateral processes, which in *P. cristata* are very slightly developed and inconspicuous, constitute a striking feature in the present species, and give a very peculiar appearance to the pinnæ when viewed in front; and instead of the short and stout spine which in *P. cristata* projects in front of the cell, we have in *P. tubulifera* an anterior process which supports a cup-like body with a crescentic orifice at the top.

There are also differences between the two species in the structure of the main stems, the joints of which are dissimilar.

The variety of *P. cristata* mentioned by Dr. Johnston as "imitating the habit of *P. pennatula*," and which is also noticed by Mr. Couch, is probably identical with this species; but the figure of it in the 'British Zoophytes' (p. 94, fig. 16) does not give any true idea of *P. tubulifera*.

4. *P. pennatula*, Ellis & Solander.

Very rare: first recorded as a Devon species by Montagu, in a letter to Dr. Fleming, in 1808.

A single plume, given to me by a friend, which was obtained at Teignmouth, is the only Devonshire example which I have seen. It is a peculiar variety, measuring about three-quarters of an inch across, and much less delicate and feather-like than the ordinary form.

Cornwall, from the Corwich Crab and the stems of *Laminaria digitata* (*C. W. Peach*).

5. *P. myriophyllum*, Linn.

Not common: occasionally amongst the trawl-refuse; Plymouth Sound (*Bellamy*).

6. *P. pinnata*, Linn.

Common: dredged in moderate depths; trawled off Budleigh-Salterton, of large size, &c.

7. *P. setacea*, Ellis.

Very common between tide-marks, and dredged in moderate depths. The large, branched variety, several inches high, is obtained on the coast of Cornwall.

8. *P. echinulata*, Lamk. Pl. VII. figs. 5, 6.

Very abundant in tide-pools and the Laminarian zone; showing a predilection for *Zostera marina* and *Chorda filum*.

9. *P. similis*, n. sp. Pl. VII. figs. 3, 4.

Plumose, pinnæ alternate, one to each internode, internodes long. Cells large, curving outwards towards the top, entire, separated by two joints; a single tubule a little below each cell. Gonothecæ elongate, smooth, many-lobed.

Abundant: on weed in the Laminarian zone.

[Isle of Man.]

This species is most nearly allied to the *P. echinulata* of Lamarck, from which, however, it differs in size and general habit as well as in the minute characters.

The plumes attain a height of about an inch and a half, and are of much laxer habit and less graceful than those of *P. echinulata*. Each of the internodes into which the stem is divided bears a pinna, which originates a little below the joint. The internodes are long, about half as long again as those of *P. echinulata*. The joints of the two species present a very different appearance (Pl. VII. figs. 3, 6). In *P. similis* the internodes are of about equal width throughout; in *P. echinulata* they are somewhat attenuated below. The pinnæ have two joints just above the junction with the stem, the upper one of which is oblique; and *two are always present between the cells.* In *echinulata* there is (normally) only one, so that the cells are comparatively crowded.

The cells of *P. similis* are large, curving gracefully outwards towards the rim, with a wide circular opening, and present a decided contrast to the small basin-shaped cell of the allied species. Below each cell there is a single tubule, as in *P. echinulata,* but of larger size. In the latter species there is an additional tubule behind and above the cell. The gonothecæ are elongate, tapering towards the base, smooth, and divided into six or seven lobes; they are produced in great numbers both on the creeping fibre and on the stems. Several sporosacs are, I believe, present in each capsule.

In size *P. similis* much exceeds its congener, but is inferior to it in delicacy and grace.

10. *P. Catharina,* Johnston.

On *Pinna* from 60 fathoms, Cornwall.

[Mr. Barlee has supplied me with very fine specimens dredged off the Arran Islands, on the west coast of Ireland, where the species seems to abound.]

11. *P. obliqua,* Saunders.

Syn. *Laomedea obliqua,* Johnston.

At Sidmouth, on *Rhytiphlœa* (*Miss Cutler*).

I follow Mr. Alder's suggestion (*in lit.*) in referring this species to the present genus. There can be no doubt as to its true position. The mode in which the cells are placed, the jointing of the stem, and the presence of *tubules,* constitute a group of characters which connect it with the *setacea* section of *Plumularia.*

12. *P. frutescens,* Ellis & Solander.

Cornwall, from deep water.

[Redcar and Filey, Yorkshire.]

Fam. **Campanulariadæ**, Johnst.

1. Laomedea, Lamx.*

1. *L. dichotoma,* Linn.

Common: generally parasitical on other zoophytes.

* Lamouroux's *Laomedea* is merely retained for the sake of convenience. There is no real generic distinction between it and *Campanularia.* In this view I am supported by M. Sars, who says, in his account of *Laomedea gracilis,* "These two genera (*Laomedea* and *Campanularia*) are hardly

2. *L. longissima*, Pallas.

Syn. *L. dichotoma*, var. β, Johnston's Brit. Zooph. p. 102.

Very abundant in the Coralline zone: in great masses amongst the refuse of the trawl-boats.

Mr. Alder, in his Catalogue (p. 32, pl. 3. fig. 4), has represented the cell of this species as deep and narrow, and strongly denticulated. The examination, however, of adult specimens, on which the cells had been well preserved, enables me to state with confidence that this is not the case. The cell of *L. longissima* is of moderate depth, and has a wide mouth, the margin of which is cut into *shallow and blunt crenations*. Mr. Alder's figure represents a distinct form, which he at one time believed to be the *young* of *longissima*, not having had the opportunity of examining the cells on mature specimens of this zoophyte.

There can be little doubt that Lieut. Thomas's note on *L. dichotoma* (Johnston, Brit. Zooph. p. 466) refers to the present species; and he there rightly describes the crenulations of the margin as shallow, and resembling those of Van Beneden's *Campanularia volubilis*.

3. *L. gelatinosa*, Pallas.

Exmouth; rare.

This is the most beautiful of the British Campanulariadæ, from its graceful habit of growth and extreme delicacy. Dr. Johnston speaks of it as sometimes attaining a height of 8 or 10 inches. I have a specimen from Exmouth which is about 6 inches high, and consists of an exquisite cluster of as many as ten shoots.

The cells are of the thinnest texture, and it is a matter of the greatest difficulty to distinguish the crenature of the margin. Dr. Fleming describes the rim as plain, and conjectures that Pallas may have seen the tips of the tentacles showing above the edge of the cell, and mistaken them for crenations! The Russian naturalist, however, was right.

Milne-Edwards has made a new species out of Fleming's *L. gelatinosa*, which he supposes to be distinct from the *gelatinosa* of Pallas, and has given it the name of *L. Flemingii*. It is very desirable that this name, which has found its way into some of our lists of British zoophytes, should be expunged from the roll of species, commemorating as it does a mere mistake.

4. *L. geniculata*, Linn.

Very common on weed, especially on the broad fronds of *Laminaria digitata*, its chosen habitat.

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separated by any essential distinctions, and the species under consideration really seems to constitute a transition-form between them" ('Middelhavet's Littoral-Fauna').

Specimens of this species are often coloured red. The colour is due to a very minute Alga, which covers the surface with a network of chain-like vegetation.

L. geniculata is a phosphorescent species, and the sudden illumination of a whole forest of it on some dark frond is a truly beautiful spectacle. If it is agitated in the dark, a bluish light runs along each stem, flashing fitfully from cell to cell.

5. *L. flexuosa*, Hincks.

Syn. *L. gelatinosa*, var. *a*, Johnston, Brit. Zooph. pl. 25. figs. 3, 4.

Extremely common: on rocks and stones between tide-marks. This species and *L. neglecta* are the prevalent littoral forms. In some of the Torbay coves almost every stone is profusely covered with *L. flexuosa*. It also clothes the sides of rocks with its miniature forests, which are left beaten down and half-dried during the recession of the tide.

In some situations the stems have a tendency to run out at the extremity into tendril-like fibres.

There has been much blundering about this well-marked species, and it is still often carelessly confounded with *L. gelatinosa* by writers on natural history. It may be known at once by its flexuose habit, its large broad cells with long pedicle and even rim, and its much-elongated truncate capsules with their numerous sporosacs.

6. *L. Lovéni*, Allman.

Syn. *Sea-thread Coralline*, Ellis, Corall. pl. xii. c and 38 B.
Campanularia dichotoma, Lister, Phil. Trans. 1834.
—— *geniculata*, Lovén, Wiegmann's Archiv, 1837; Schulze, Müller's Archiv, 1851.

On *Fucus*, at Dartmouth and Torquay.

This species, the reproduction of which has been studied with more or less completeness by several eminent naturalists, was first defined by Prof. Allman, in one of his valuable papers on the Hydroid Zoophytes ('Annals' for August 1859). His description, however, is inaccurate in one important particular. He speaks of the hydrothecæ as having an *even rim*, whereas the margin of the tall and slender cells is cut into about ten shallow and flattish crenations. So hyaline and delicate, however, is the edge, that it requires very careful manipulation to bring them into view.

There are sometimes as many as four or five of the fixed Medusoids attached at once to the gonotheca; but commonly they are less numerous.

The *Laomedea gracilis* of Sars, figured in his 'Middelhavet's Littoral-Fauna' (tab. 2. fig. 5), is a second species which is propagated by means of fixed extra-capsular Medusoids.

7. *L. angulata*, n. sp. Pl. VIII.

Stem zigzag, much angulated, the spaces between the cells very long, simple or slightly branched, often running out at the extremity into long tendril-like claspers. Cells alternate, rather deep and slender, even-rimmed, set on long ringed pedicles which spring from each bend of the stem—three or four rings above the origin of each pedicle. Gonothecæ on short ringed stalks (three or four rings), produced on the creeping fibre, irregularly ovate, terminating above in a short broad neck, which is somewhat truncate at the top, with a few obscure wrinkles, and occasionally one or two projecting points. Polype with twenty-four to twenty-six remarkably long and slender tentacles.

On *Zostera marina*, Torbay.

This species presents some striking peculiarities. The general habit is very distinctive. The main stem is strongly zigzagged, the long internodes forming a series of obtuse angles. The upper extremity commonly runs out into a tendril-like prolongation, which is often of great length, much thickened above, and strongly annulated towards the lower end: this clasper is sometimes half an inch long. The pedicles which support the cells are generally long, and taper slightly upwards; they are composed of from nine to twelve rings. Sometimes there is a smooth portion about the middle of the pedicle. The cells themselves are rather deep and slightly made, with an even margin. The gonothecæ are produced, as in *Campanularia*, on the creeping stem; and this is the only species of *Laomedea*, so far as I know, in which they are thus placed. The *axillary* position of the capsules has hitherto been accounted an essential character of this genus. All the specimens which I have hitherto obtained are parasitic on the *Zostera*. The creeping fibre runs along the leaf just within the edge, giving off stems at short intervals; and between these the milk-white capsules occur, generally in twos or threes. They spring, in my specimens, from the *side* of the fibre, and are therefore recumbent on the surface of the leaf. The gonothecæ contain sporosacs.

The height of *L. angulata* is from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch. Specimens occur in which the *stem* is only about $\frac{1}{8}$th of an inch in height, bearing two or three cells, while the *tendril* is fully $\frac{1}{2}$ an inch in length.

I first met with this species in the Isle of Man, where it also occurs on the *Zostera*.

EXPLANATION OF THE PLATES.

Plate VII.

Figs. 1, 2. *Plumularia tubulifera*: portion of a plume and two cells magnified.

Fig. 3. *Plumularia similis*: portion of a plume magnified.
Fig. 4. The same: gonothecæ magnified.
Figs. 5, 6. *Plumularia echinulata*: portions of plume magnified.

PLATE VIII.

Figs. 1–5. *Laomedea angulata*, of the natural size and magnified.

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

April 23, 1861.—John Gould, Esq., F.R.S., V.P., in the Chair.

DESCRIPTION OF A NEW SPECIES OF THE FAMILY CAPRIMULGIDÆ. BY JOHN GOULD, ESQ., F.R.S., ETC.

CHORDEILES? PUSILLUS.

Crown of the head, back, and lesser wing-coverts dark brown, mottled with grey and rufous, produced by each feather being crossed by interrupted bars of grey on the basal three-fourths, and with rufous near the tip; the greater wing-coverts, tertiaries, and scapularies are similarly marked, but the bands are larger and more freckled, and are mingled grey and rufous, these feathers are also largely tipped with rufous; primaries very dark brown, the three outermost crossed at about two-thirds from their base with a broad band of white, which on the fourth feather assumes the form of a large oval spot; the remaining primaries are marked near their bases with buffy white; upper tail-coverts brown crossed by irregular bands of buffy grey, and encircled with rufous at the tip; two central tail-feathers the same, the lateral ones brown, crossed by bands for three parts of their length from their base, and the two on each side next the central ones with a large spot of white at the tip; on the throat a large arrow-head-shaped mark of white; feathers of the chest brown, tipped with buff, forming a band across this part of the body; under surface crossed by numerous narrow, blackish-brown and greyish-white bars, which latter become larger and whiter as they proceed towards the vent; under tail-coverts white; tarsi naked and, with the feet, mealy-brown.

Total length $5\frac{1}{2}$ inches; wing 5; tail $2\frac{1}{2}$; tarsi $\frac{1}{2}$.

Hab. Supposed to be Bahia.

Remark.—This is by far the smallest Goatsucker I have ever seen, the size of its body not exceeding that of a common Sparrow (*Passer domesticus*). Its gape is entirely destitute of bristles. I believe I have placed it in the right genus; at the same time I may observe that the wings are more curved, and the primaries less resistant, than in the other members of the genus *Chordeiles*. It is doubtless a fully adult male.

Note on the Egg of the Piping Crow or Magpie of New South Wales (Gymnorhina tibicen). By George Bennett, M.D., F.Z.S.

It is not uncommon for eggs of the same species of bird to vary so much both in form and colour, as to cause doubts to arise in the minds of ornithologists as to the possibility of their being produced by the same species. This has been well exemplified in the case of the Red-tailed Tropic Bird (*Phaëton phœnicurus*) more particularly, as well as in others. On examining a number of eggs of the Piping Crow (*Gymnorhina tibicen*), at Sydney, N. S. Wales, I was surprised to observe in how many instances they differed, both with respect to their form as well as in the markings of colour, so as to appear to belong to distinct species, although those differing so much both in form and colour were procured from the nest of the same bird.

The eggs I had so recently an opportunity of carefully examining were collected by two zealous young naturalists, Mr. Edward Ramsey and Mr. Henry Norton. The former gentleman has sent me his notes on the eggs of the Australian Magpie, from which I have collected the following information. He states that "the Piping Crow (*G. tibicen*) lays eggs differing from one another in the same nest, both in form and colour,—some being long and others round, and the coloured spots varying very much. On August 25th, 1860," he says, "the first Magpie's eggs were taken this season. I have six varieties of the eggs of this bird; and so much do they differ from each other, that, had I not taken them from the nest, I could not have believed they were the eggs of the same bird. All the young birds I have taken from the nest have had the breast of a dull-brown colour; and a young bird brought home from the nest in 1859 is now (1860) changing the plumage of the breast from the dull-brown colour to black."

Note on the Genus Basilornis. By G. R. Gray, F.L.S., etc.

The genus *Basilornis* was established some years back by the late Prof. Temminck on a bird from Celebes. Since then Mr. Wallace has met with another species in his wanderings in Ceram. As there exists some confusion with regard to these two species, I have thought it right to address to the Society a few remarks on them, with a view of pointing out their distinctive characters. They are easily distinguished from one another by the form of their crests. That of Celebes possesses a short, compressed, keel-like crest, which extends from the culmen to behind the head, and is composed entirely of scale-like and convex feathers; whilst that of Ceram has an occipital, erect and elongated crest, which, when viewed sideways, assumes somewhat of a subtriangular form, and is composed of truncated, rather broad and lax plumes. It also differs in having the nostrils exposed and a naked space round each eye. In the species of Celebes the nostrils are covered by the frontal plumes, and there is scarcely any naked space round the eyes.

Wagler in 1827 described a bird from Java (?) under the name of *Pastor corythaix*, the characters of which agree with the Ceram and not the Celebes species, with which it has been confounded by Pr. Bonaparte and other writers.

The specific characters of the two species are subjoined—viz.

Basilornis corythaix (fig. 1).

Top of the head rich glossy purplish black; crest bronzy black; nape, back, and beneath the body glossy chalybeous; wings fuscous, paler at the base of the inner web; tail bronzy black, with the outer

Fig. 1.

feathers black with green edges; spot below each eye, a patch on each side of breast, and some scattered hairs on the throat, white.

Pastor corythaix, Wagl. Syst. Av.
Basilornis corythaix, Pr. B. Consp. Av. p. 420.
Hetærornis corythaix, G. R. Gray, Gen. of B. ii. p. 335.
Hab. Ceram (*Wallace*).

Basilornis celebensis (fig. 2).

Head rich glossy steel black; crest rich glossy purplish black; back, breast, and abdomen chalybeous; quills fuscous black; tail bronzy black, with the outer feathers greenish black; a spot beneath each eye, and a patch on each side of breast, white, partly tipped with buff; throat with some scattered white plumes, hair-like at base and dilated at the tip of each; nape and upper part of back furnished with a few scattered buff plumes.

Basilornis celebensis, Temm. MS.

Basilornis corythaix, p., Pr. B. Consp. Av. p. 420 (descrip.).

Hab. Celebes (Menado, Makassar) (*Wallace*).

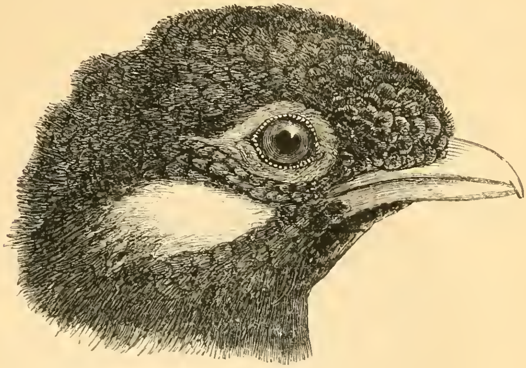

Fig. 2.

On a New Species of the Genus Copsychus from Borneo. By P. L. Sclater, M.A., Ph.D., Secretary to the Society.

Copsychus suavis.

Nigro-sericea, alis extus fuscescentioribus; abdomine saturate castaneo; dorso imo et caudæ rectricibus lateralibus candidis, harum quatuor mediis et proximæ utrinque pogonio interiore nigris: rostro nigro, pedibus pallide fuscis.

Long. tota 9·0, alæ 4·0, caudæ 4·5.

Hab. In Borneo meridionali.

Obs. Affinis *Copsycho macruro*, sed statura majore, cauda breviore et rectricum pictura diversus.

I have selected two examples of this pretty species of *Copsychus* out of a small collection of bird skins from Banjermassing in Southern Borneo, now in the hands of Mr. S. Stevens. Its nearest ally is that well-known beautiful songster the *Copsychus macrurus* of India, from which, however, it is readily distinguished by its larger size, shorter tail, and the three lateral rectrices, as well as the outer web of the next pair, being wholly of a pure white. There are, however, blackish edgings at the base of the inner web of the second and third pair in one of the specimens, which I take to be a male. In the other, which is probably the female, these are absent, and the three external pairs of rectrices are wholly white, the belly is paler chestnut, the plumage above more dusky, and the size smaller.

I think this species having the tail of *Copsychus* and the colours of the so-called genus *Kittacincla*, justifies us in uniting these two groups, which, as far as I can see, only differ in the elongation of the tail in the latter.

Second List of Siamese Reptiles. By Dr. Albert Günther, For. Mem. Zool. Soc.*

Having examined the Saurians, Ophidians, and Batrachians of M. Mouhot's collection, lately transmitted from Chartaboum, on the coast of Siam, to this country, I shall first describe the new species, and then add a complete list of the whole series. Typical specimens of them have been retained for the British Museum.

1. Draco tæniopterus.

Tympanum not scaly; nostrils above the face-ridge, directed upwards; a low longitudinal fold on the neck. Scales on the back of equal size, obscurely keeled. Gular sac covered with large smooth scales, uniformly coloured. Wings dark-greenish olive, with five arched black bands, not extending to the margin of the wing, some being forked at the base.

2. Acanthosaura coronata.

The upper orbital edge serrated, without elongate spine posteriorly; a short spine on each side of the neck; a yellowish-olive band, edged with black across the crown, from one orbital edge to the other; an oblique, short, yellowish band, broadly edged with brown, from below the orbit to the angle of the mouth.

This and the following species belong to the genus *Acanthosaura*, as defined by Dr. Gray (Catal. Liz. p. 240). The tympanum is distinct; a short spine between it and the dorsal crest, which is rather low. No femoral or præanal pores. A short spine behind the orbital edge, and separated from it by a deep notch. Back and sides covered with small, smooth scales, slightly turned towards the dorsal line, and intermixed with scattered larger ones, which are keeled; belly and legs with larger, keeled scales. Tail slightly compressed at the base, the rest being round and without crest; all its scales are keeled, those on the lower side being oblong and provided with more prominent keels. Throat without cross-fold and without distinct longitudinal pouch; a slight oblique fold before the shoulder.

3. Acanthosaura capra.

The upper orbital edge not serrated, terminating posteriorly in a long moveable horn; no spine above the tympanum or on the side of the neck. Nuchal crest high, not continuous with the dorsal crest, which is elevated anteriorly. Crown and cheek without markings.

The tympanum is distinct; no femoral or præanal pores. Back and sides covered with small, smooth scales, which become gradually

* I take this early opportunity of remarking that I have convinced myself of the correctness of Messrs. Duméril and Jan's observation with regard to the dentition of *Herpeton* (see 'Annals,' ser. 3. vol. vii. p. 195). The groove of the posterior maxillary tooth can be distinctly seen even in the transparent teeth of fresh specimens, like those in the British Museum, when viewed with a strong magnifier from the front of the mouth.—*Günther*.

larger and more distinctly keeled towards the belly; no large scales intermixed with the small ones, only a few appear to be a little larger than the rest. Tail slightly compressed at the base, surrounded by rings of oblong, keeled scales. Throat expansible; a very slight fold before the shoulder.

4. Dilophyrus mentager.

Dorsal crest not interrupted above the shoulder, interrupted above the hip; caudal crest as high as that on the back; no large scales on the side of the neck; sides of the throat with large convex or tubercular scales.

This species belongs to the genus *Dilophyrus*, Gray (Catal. Liz. p. 238). A high crest, composed of sabre-shaped shields, extends from the nape of the neck to the second fifth of the length of the tail, being interrupted above the hip. Scales on the back and the sides of equal size, very small, with an obscure keel obliquely directed upwards; those on the belly smooth, on the lower side of the tail rather elongate, strongly keeled. Tympanum distinct. Throat with a cross-fold. Orbital edges and sides of the neck without spines. Tail transversely banded with black.

One stuffed specimen is 30 inches long, the tail occupying 21.

5. Tropidophorus microlepis.

Snout rather narrow and produced. Scales on the back strongly keeled, the keels not terminating in elevated spines. Back of the tail with two series of moderately elevated spines, the series not being continuous with those on the back of the trunk. Scales of the throat smooth, or very indistinctly keeled. Tail with a series of plates below, which are much larger and broader than the scales of the belly. Three large præanals. A single anterior frontal (internasal)*.

6. Simotes tæniatus.

Scales in nineteen rows. Brownish-olive, with a brown longitudinal dorsal band enclosing an olive-coloured line running along the vertebral series of scales; another brownish band along the side of the body; belly whitish, chequered with black.

One loreal shield; one anterior and two posterior oculars; eight

* This is the third species of *Tropidophorus*. The two others are:—

1. Tropidophorus cochinchinensis (Cuv.): Dum. Bibr. v. p. 556. pl. 57. f. 1.—*Tropidosaurus montanus*, Gray in Griffith, Anim. Kingd. ix. App. p. 35.

Snout rather obtuse. Scales on the back strongly keeled, the keels terminating in slightly elevated spines. Two series of moderately elevated spines along the middle of the back of the tail, the series being continuous with those on the back of the trunk. Tail with a band of large hexagonal plates below; two large præanal scales. Two pairs of anterior frontal shields. Cochinchina.

2. Tropidophorus Grayi, n. sp. (T. *cochinchinensis*, Gray, not Cuv.).

Snout rather narrow and produced. Scales on the back as well as those on the tail with an exceedingly strong, lamelliform keel, elevated and spinous posteriorly. Two series of spinous keels on the back of the tail, continuous with those on the back of the trunk. Tail with rhombic scales below, which are not much larger than those of the belly. Scales of the throat strongly keeled. Three large præanal scales. Two pairs of anterior frontal shields.

Philippine Islands. Three specimens in the British Museum.

upper labials, the third, fourth and fifth of which enter the orbit; 155 ventral plates; anal entire; 44 pairs of subcaudals. Head with the markings characteristic of the genus; each half of the dorsal band occupies one series of scales and two halves; the lateral band runs along the fourth outer series, touching the third and fifth.

We were previously (Proc. Zool. Soc. 1860, p. 113) enabled to enumerate 25 species of Siamese Reptiles, which number is raised to 42 by the following list.

Those which have been mentioned in the account of the first collection are marked with an asterisk.

1. *Dracunculus maculatus*, Gray.
2. *Draco tæniopterus*, Gthr.
3. *Bronchocela cristatella*, Kuhl.
4. *Acanthosaura armata*, Gray.
5. —— *coronata*, Gthr.
6. —— *capra*, Gthr.
*7. *Calotes versicolor*, Daud.
8. *Dilophyrus mentager*, Gthr.
9. *Leiolepis Bellii*, Gray.
10. *Tropidophorus microlepis*, Gthr.
11. *Platyurus Schneiderianus*, Shaw.
12. *Hemidactylus frenatus*, Schleg.
*13. *Gecko verus*, Merr.
14. *Cylindrophis rufa*, Laur.
15. *Python reticulatus*, Schneid.
16. *Simotes tæniatus*, Gthr.
17. *Homalopsis buccata*, L.
*18. *Tropidonotus quincunciatus*, Schleg.
19. *Dendrophis picta*, Gm.
20. *Rana tigrina*, Daud.
*21. *Oxyglossus lima*, Tschudi.
*22. *Bufo melanostictus*, Schn.
*23. *Polypedates maculatus*, Gray.

May 14, 1861.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

Descriptions of Two New Species of Humming-Birds belonging to the Genus Hypuroptila. By John Gould, Esq., F.R.S., etc.

Hypuroptila urochrysa.

Head and upper surface dark green, becoming of a bronzy hue on the wing- and tail-coverts; wings purplish brown; tail rich golden-bronze both above and beneath; throat and breast grass-green; thighs, vent, and under tail-coverts pure white; upper mandible black; under mandible fleshy-red, with a black tip; tarsi yellow or flesh-colour.

Total length $4\frac{3}{4}$ inches; bill $1\frac{1}{8}$; wing $2\frac{3}{4}$; tail $1\frac{7}{8}$; tarsus $\frac{1}{4}$.

Hab. Panama.

Remark.—This species closely resembles the *H. Buffoni* in size and in the colouring of its body; but the rich golden bronzy hue of its tail at once distinguishes it from that and every other species.

Hypuroptila Isauræ.

Head, all the upper surface, wing-coverts, flanks, and abdomen coppery-bronze, inclining to purple on the lower part of the back and upper tail-coverts; wings purplish brown; tail very dark bronze, inclining to purple; throat and breast grass-green; under tail-coverts white; upper mandible black; under mandible fleshy, with a black tip; tarsi yellow or flesh-colour.

Total length $4\frac{5}{8}$ inches; bill $1\frac{1}{16}$; wing $2\frac{5}{8}$; tail $1\frac{3}{4}$; tarsi $\frac{1}{4}$.

Hab. Bocca del Toro, in Costa Rica.

Remark.—The specimen from which the above description was taken is somewhat immature; it is, however, sufficiently advanced to show that it would have, when adult, a fine green breast; but whether the green colour would extend over the abdomen I am unable to say. It is nearly equal in size to the *H. urochrysa*, *H. Buffoni*, and *H. cæruleigastra*; but it has a shorter wing and a more rounded tail than either of those species, and the under tail-coverts, although white, are less plume-like in form than in the typical *Hypuroptilæ.* It is just possible that it may be necessary to separate this bird into a new genus when we see it in its fully adult state; but it appears at present to be most nearly allied to the members of the group in which I have provisionally placed it. I received this bird from M. Edouard Verreaux, of Paris, many years ago, since which I do not remember to have seen another.

The specific name *Isauræ* was suggested to me by my late highly valued friend the Prince Charles Lucien Bonaparte, who wished thus to convey a compliment to Madame la Baronne de la Fresnaye, the niece of Montbeillard, the able coadjutor of the celebrated Buffon.

Note on the occurrence of Filaria sanguinea in the body of the Galaxias scriba, a Freshwater Fish from Australia. By W. Baird, M.D., F.L.S.

In the beginning of this year, some time in February, several freshwater fishes belonging to the genus *Galaxias* were brought over to this country, alive, from the Murray River, Australia. Though several survived the passage across the Atlantic, only one reached the hands of the importer, Mr. Lloyd, alive.

This little fish was then placed in the freshwater Vivarium in the Zoological Gardens, Regent's Park, but it only lived about a week there, dying in the beginning of March. Upon an inspection of the body after death, an intestinal Worm was discovered making its appearance through the skin near the left pectoral fin. A more minute examination discovered the existence of an abscess in that part of the body, upon opening which I took out five specimens of a small Worm which occupied the cavity of the abscess, and were apparently making their way through the integuments of the fish. The abscess communicated with the peritoneal cavity of the *Galaxias*, and had evidently caused its death. Upon examining the Worms, they appear to be identical with the species first described by Rudolphi as being found by him lodged under the integuments of the caudal fin of the *Cyprinus gibelio*, or Crucian Carp, and named by him *Filaria sanguinea.* This species has since been found by Creplin in the cavity of the abdomen of the *Leuciscus rutilus*, or common Roach, and by Siebold in the *L. erythrophthalmus*, the Red-eye or Rudd. The specimens taken from the *Galaxias* are from $1\frac{1}{4}$ to 3 inches in length, and, as Rudolphi has described them, they are thickish in form, obtuse at both extremities; and the larger ones were of a blood-red colour, which, however, has disappeared since they were placed in spirits. It was interesting to discover whether this was a new species or not, and whether it had existed in the body of the fish before it left Australia. A comparison with the specimen of *Filaria sanguinea* in the collection of Entozoa in the British Museum, transmitted to us by Mr. Siebold, leaves no doubt on my mind of its identity with that species; and therefore in all probability these Worms have been developed in the cavity of the abdomen of this little *Galaxias* since it was placed in the tank at the Zoological Gardens, or during its passage from Australia to this country.

MISCELLANEOUS.

Observations on the Existence of various Mollusca and Zoophytes at very great Depths in the Mediterranean. By Dr. Alph. Milne-Edwards.

In this memoir the author, who appears to be ignorant or regardless of the still more striking observations of Dr. Wallich, published in this Journal, communicates some instances of the occurrence of animal life at great depths in the sea. Two examples were communicated to him by M. Valenciennes,—one of *Voluta junonia*, Sch., taken by Capt. Letourneur, in the Gulf of Mexico, at a depth of about 70 fathoms; the other of *Lima excavata*, Müll., dredged from a depth of 264 fathoms, by M. Hoeg, on the coast of Greenland.

The other instances cited by the author were obtained by the examination of portions of the submarine telegraphic cable formerly laid between Sardinia and Algeria, and removed in consequence of some defect causing the interruption of the communication. The fragments examined by Dr. Milne-Edwards were brought up from the broad submarine valley, measuring from 1000 to 1500 fathoms in depth, between Bône and Cagliari; and amongst the foreign bodies adhering to them the author found several polypidoms and shells which were still living when removed from the water. One of the mollusks was a species of Oyster (*Ostrea cochlear*) which is met with abundantly in various parts of the Mediterranean, and is known to inhabit deep water, as it is frequently brought up by the coral-fishers, whose operations are generally carried on at from 50 to 75 fathoms. The animal had evidently attached itself to the cable when very young, and here attained its adult condition; for its lower valve, about $2\frac{2}{5}$ inches in diameter, had completely moulded itself upon the surface of the cable, and had become deformed in order to embrace one-half of its circumference. On another point there was also attached, although less firmly, a specimen of the common Mediterranean *Pecten opercularis*, Lamk., of the variety *P. Audouini*, Perrod. There was also another *Pecten* which is very rare in collections—the *Pecten Testæ*, of which the valves are marked with very fine striæ and elegantly trellised. According to Filippi, this shell is only met with at depths of 25 to 30 fathoms. With these three Acephalous Mollusks were associated two Gasteropods, which are very rare in the localities usually explored by zoologists : one of these is *Monodonta limbata*, the other *Fusus lamellosus*. The latter shell, which is remarkable for the fine striæ traversing the whorls of the spire, is extremely fresh : both contained the soft parts of the animal, from which the author concludes that they must have lived where they were found.

The Corals found fixed at the great depth above mentioned are of still greater interest. There were fourteen individuals, belonging to three species of the family Turbinolidæ. One of them appeared to the author not to differ from *Caryophyllia arcuata*, a very rare species, found fossil in the Upper Tertiary strata of Piedmont at Castel-Arquato, and which has also been met with at Messina. Another species, nearly allied to *Caryophyllia clavus*, for which the author proposes the name of *C. electrica*, appears to be much more common in the submarine valley in which the telegraphic cable rested ; for no less than ten individuals of it were found, all bearing evident traces of their having been developed upon it. This species does not appear to differ from a small fossil Coral, of Pliocene age, found by M. Deshayes at Douéra, in Algeria. A third species, of which the polypary is less than half an inch in height, does not enter into any established genus : the author places it between the genera *Ceratotrochus* and *Sphenotrochus*, and proposes to name it *Thalassiotrochus telegraphicus*.

Besides the above, the portion of the cable examined gave attachment to a small branch of *Salicornaria farciminioïdes*, to some Gorgonidæ, and to two *Serpulæ*, the large calcareous tubes of which were soldered to the iron wire for a considerable extent.

In his concluding remarks, the author dwells not only upon the fact that these animals, some of them of high organization, dwelling permanently at such great depths, are for the most part either rare in collections or quite unknown to naturalists, but also upon the circumstance that some of them are apparently identical with species found in a fossil state in the most recent strata surrounding the basin inhabited by them ; and hence infers that, by the investigation of the deeper parts of the sea, we may probably add to the existing fauna many other species now regarded as extinct.—*Comptes Rendus*, July 15, 1861, p. 88.

Transmutation of Grasses.

In the beginning of last year (Gard. Chron., p. 4) we drew attention to some extraordinary results said to have been obtained by Prof. Buckman in his cultivation of Grasses. He believed that he had proved that in the course of cultivation *Poa aquatica* and *Glyceria fluitans*, two widely different species, lost their distinctions and became identical ; that the same thing happened between the Fescues called *loliacea* and *pratensis*; and that the wild Parsnip had become ennobled under his hands in the same way as the wild Carrot was formerly, under the management of the elder Vilmorin.

M. Decaisne, the able Professor of Agriculture in the experimental department of the Garden of Plants in Paris, one of the most acute of living botanists, and an extremely cautious experimentalist, being engaged in the same line of inquiry, and having become desirous of seeing some of the living results of Professor Buckman's experiments, that gentleman readily acceded to a request that he would furnish them; and in the spring a small parcel was forwarded to Paris. [It is necessary to remark that although it passed through our hands we were prevented by other occupations from examining it.] We have now before us a report on the subject from M. Decaisne himself:—

"I was very much obliged to you for the specimens of *Glyceria* (*Poa*) *aquatica* which you were good enough to send over from Mr. Buckman. Thanks to this authentic information, the value of the experiments mentioned last year in the 'Gardeners' Chronicle' begins to appear. Towards the end of last year I myself had collected and sown seeds of *Glyceria fluitans* and *G. spectabilis* (*Poa aquatica*). At this moment *G. fluitans* sown in dry ground is in full flower, without having lost any one of its characters in the smallest particular. Each plant forms a close tuft, from which arise many flowering branches, which spread over the ground just as they do in water. We have therefore, in this instance, no transmutation.

"As to *Gl. spectabilis*, it is not as yet in flower, but its creeping rhizomes, thick yellowish-green shoots, and broad leaves with rough sheaths leave no doubt as to its identity with its type. My experiment shows therefore that *Glyceria fluitans* and *Gl. spectabilis* remain unchanged.

"The curious circumstance attending the account of transmutation related by Mr. Buckman is that it rests upon a palpable mistake. The two specimens he was so good as to send me in neither case belong to the genus *Glyceria*, but are in both instances *Poa sudetica*! This brings down the whole scaffolding with which his theory was constructed.

"If, however, Mr. Buckman has fallen into an error about *Poa*, I believe that others have done the same in the case of Carrots. That is to say, for four years past I have placed myself in the same conditions as were described by M. Vilmorin, and nothing has come to pass. Wild Carrots remain field Carrots still. I cannot but believe that when M. Vilmorin saw them changing to red, yellow, and purple, such changes must have been brought about by accidental crossing. Insects must have conveyed the pollen of cultivated Carrots to the wild ones, and thus intermediate conditions have been obtained.

"May I add that I have no confidence in the discovery of a Broccoli on the cliffs of Cornwall. I am perfectly acquainted with the wild Cabbage of our French coast, and I cannot bring myself to believe it the parent of our cultivated races. However we shall learn in time, for I have been engaged for several years in experimenting on the subject."—*From the Gardeners' Chronicle*, Aug. 17, 1861.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 46. OCTOBER 1861.

XXIX.—*Contributions to British Carcinology.*—I. *Characters of undescribed Podophthalmia and Entomostraca.* By the Rev. Alfred Merle Norman, M.A.

[Plates XIII. & XIV.]

Under the above title I propose to publish, from time to time, notes upon our rarer Crustacea, together with descriptions of such new species as may come into my hands. I regret to learn from Mr. Van Voorst that there is no prospect at present of a new edition or supplement to Bell's 'History of British Crustacea' being published; may I be allowed, however, through this channel, to express a hope that Dr. Baird may be induced to prepare a Supplement to his admirable 'Monograph of British Entomostraca.' Ample material is in existence; and such portion of it as is in my own collection would be most gladly placed in his abler hands for description, if such a supplement were undertaken.

Subclass PODOPHTHALMIA.

Fam. Paguridæ.

Pagurus ferrugineus, n. sp. Pl. XIII. figs. 1–3.

Pedes chelati ciliati, læves, neque spiniferi neque granulati (præter quod margo carpi interior spinosulus est); margo brachii dextri interior setarum scopas gerens. *Manus dextra* ovata; *sinistra* minor, angustior, lateribus subparallelis, supra haud angulata. *Oculorum pedunculi* elongati. Longitudo 1 unc.

The carapace in this species is somewhat depressed anteriorly, with the margin not rostrate and scarcely flexuous. The long and slender eye-stalks reach to the middle of the last basal joint of the external antennæ, and to about one-third the length of the last joint of the peduncle of the interior antennæ. The first pair of feet, which are very unequal, are clothed with fine silky hairs.

The right leg is furnished with a conspicuous brush of hair on the lower edge of the inner margin of the third joint; the wrist has spinose tubercles on the inner margin; the hand elongate-ovate, about equal to the wrist in length, not sculptured (neither spinose nor granular), clothed with scattered hair; fingers half the total length of the hand. Left hand very much smaller, with nearly parallel sides, and not angulated on the centre of the upper surface; fingers elongated, not toothed. Second and third legs slightly hairy, their upper margins not spinose. Colour reddish brown, uniform all over. Total length 1 inch.

The hairiness of the fore legs distinguishes this species from all its British congeners except *cuanensis* and *Thompsoni*; and from these, as well as, I believe, from *all* our species, it may be at once known by the smoothness of the hands, which have neither surface nor margins spinose or granular. The form of the fore legs in *P. lævis* approaches closely to that of *P. ferrugineus*; but the surface of the former is minutely granular, and never hairy, the wrist and fore-arm are also more spiny on the inner edge, and the hand is always pale in colour, with a bright crimson central stain, which bifurcates and extends up the fingers.

In July 1859, when dredging in Moulin Huet Bay, Guernsey, I procured two small individuals of the new species now characterized, which were at once laid aside for description. This summer, while dredging with my friend Mr. Jeffreys in the Shetland Isles, two larger specimens were taken in Dourie Voe; and while drawing up this description, and looking through my collection of Hermit Crabs, I found a fifth example, mixed with the young of *P. Thompsoni*, which was taken, in February 1853, in Lamlash Bay.

Fam. Palæmonidæ.

Subfam. Alphæinæ (Dana).

Genus Hippolyte (Leach).

Rostrum sat longum, plus minusve ensiforme, non mobile. *Abdominis segmentum tertium* pone productum. *Oculi* salientes. *Antennæ* internæ plerumque spina, externæ semper squama basali ornatæ; internæ duobus flagellis confectæ. *Maxillipedum articulus ultimus* compressus, pectinatus. *Pedes primi* maxillipedibus breviores, manibusque brevibus instructi; *secundi* multo longiores, carpum annulati.

Rostrum long, more or less sword-shaped, not articulated at the base. Third segment of abdomen produced behind, and the abdomen thence suddenly bent downwards. Eyes prominent. Internal antennæ generally with a spine externally at their base, ending in two filaments; external antennæ always furnished with a scale. Pedipalps with their last joint flattened and toothed on the edge like a comb. First pair of legs shorter than the foot-jaws, and having small hands; second pair longer, their wrists many-jointed, and hands smaller than those of the first pair.

I have drawn up fresh characters of this well-known genus, for comparison with those hereafter to be described.

Hippolyte producta, n. sp. Pl. XIII. fig. 5.

Forma gracilis atque attenuata. *Scutum* dorsale cylindricum, neque gibbosum neque crassitudine abdomen excedens. *Rostrum* horizontale, prælongum, acuminateque cultrellatum, squamam antennarum elongatam multo superans: dens marginis superioris unus prope basin supra oculos positus; marginis inferioris dentes quatuor omnes ultra dentem superiorem positi. *Margo scuti* anterior duobus aculeorum paribus munita, unum ad rostri basin (sicut in *varians*), alterum prope basim antennarum exteriorum situm. *Telson* aculeorum unum par gerens. *Oculi* approximati sub rostro positi, quod, quum, ut oculos desuper videamus, conamur, hos celat. Long. 1 unc.

This is by far the most slender member of the genus with which I am acquainted; every part is elongated, the body and all its members. The carapace is cylindrical; it does not present the slightest gibbosity on the back, nor at all exceed in size the first segment of the abdomen; the lateral margins are bent inwards below or wrapped round the body, instead of being produced downwards, as is usually the case. The rostrum is remarkably long, extending beyond the apices of the narrow antennal scales, which are themselves much produced; above, there is a single tooth near the base and over the eyes; below, there are four teeth, of which the last is the smallest, and is situated close to the apex. There is a tooth on the carapace on either side of the base of the rostrum, and another behind the origin of the external antennæ; the front margin of the carapace is also produced into two very minute spine-like expansions immediately below the eyes. The telson has one pair of minute teeth. The eyes, which are remarkable for their small size, are placed side by side, close together, and directly under the rostrum, so that, if looked at from above, they are almost entirely concealed.

From the above description it will be at once evident that, with respect to the armature of the rostrum, *H. producta* approaches both *H. varians* (Leach) and *H. viridis* (Otto)*. From

* This species is the *H. Whitei* and *H. Mitchellii* of Mr. William Thompson (Ann. Nat. Hist. ser. 2. vol. xii. p. 110, pl. 6). Mr. Adam White, in

the former it may be known by the larger number of teeth on the under side of the rostrum, from the latter by the presence of the tooth near the base of the rostrum above; from both by the single pair of spines on the telson. The remarkable elongation and slenderness of this species is, however, its most marked characteristic. It is quite a *Mysis* in form, and indeed, when I first took the species, I was under the impression that it belonged to that genus. The dredge came up one day in Lamlash Bay, Arran, full of *Laminariæ*, among which were hopping numerous *Hippolytæ* (*varians*, *Cranchii*, *pandaliformis*, &c.) and *Pandali* (*annulicornis* and *Thompsoni*): from these I at once singled out what I took to be a *Mysis* I had never seen before; the specimen was accordingly bottled, when, on reaching home, examination proved it to be the *Hippolyte* now described.

The colour, when alive, was a deep green (not so vivid as in *H. viridis*), with a black line down the back of the abdomen.

The species measures 1 inch from the extremity of the rostrum to the end of the telson; length of carapace $\frac{2}{10}$ inch, of rostrum $\frac{3}{10}$ inch; greatest depth of carapace $\frac{1}{10}$ inch.

Genus DORYPHORUS *, n. g.

*Rostrum, oculi antennæ*que eadem quæ in *Hippolyte*. *Abdominis segmentum tertium* pone non productum. *Spina* antennarum interiorum magna. *Maxillipedum articulus ultimus* cylindricus, ciliatus, spinulis (non in pectinis formam dispositis) paucis ad apicem instructus. *Pedes primi secundi*que inter se maxillipedibusque fere pares, manibus elongatis instructi; secundi carpum annulati.

Rostrum, eyes, and antennæ as in the genus *Hippolyte*; the spine at the base of the internal antennæ large. Last joint of pedipalps cylindrical, ciliated, ending in a few spines, which, however, are not disposed in the form of a comb. First pair of feet much longer than in *Hippolyte*, about equal to the pedipalps and second pair of feet; third, fourth, and fifth pairs of feet long and slender, exceeding the first two pairs. Wrist of

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his 'Popular History of British Crustacea,' quotes a note of mine, in which I stated my opinion that *H. Mitchellii* was a variety of *H. varians*. That opinion I now retract. I had then only seen two small specimens of "Mitchellii;" but having since taken that form as well as "Whitei" in considerable numbers at Jersey, Guernsey, and Bantry Bay, I am now satisfied that Mr. Thompson's *Hippolytes* are varieties of one species, which may always be known from *varians* by the absence of teeth on the upper side of the rostrum, as well as by its more produced form and larger size. The species would seem to be identical with *Hippolyte viridis* (Otto) (*Alpheus viridis*, Otto, Mém. de l'Acad. des Cur. de la Nat. de Bonne, lxiv. pl. 20. f. 4; *Hippolyte viridis*, Milne-Edwards, vol. ii. p. 372).

* Δορυφόρος, a spear-bearer, lancer.

the second pair not simple. Third segment of the abdomen not produced behind, nor differing from the other segments.

Doryphorus Gordoni (Spence Bate). Pl. XIII. figs. 6 & 7.

Hippolyte Gordoni, Spence Bate, Nat. Hist. Review, vol. v. p. 51 and woodcut. 1858

Scutum antice carinatum atque dentatum. *Rostrum* horizontale, ad apicem aliquantum resimum, longitudine oculos bis superans, squamam antennarum exteriorum quarta parte æquare deficiens. *Dentes* marginis superioris septem (rarius octo) ejusdem magnitudinis eodemque intervallo inter se separati, horum unus (rarius duo) in carina scuti positus: marginis inferioris unus prope apicem positus. *Margo scuti* anterior uno aculeorum pare armata infra oculos posito. *Telson* duo minuta aculeorum paria gerens. *Antennæ* internæ apicem squamæ exteriorum longe superantes. *Pedes primi* præter apicem squamæ antennarum multo extendentes, antennarumque interiorum longitudinem assequentes; dactyli pedum primi atque secundi parium elongati. *Carpus* secundi paris biarticulatus. Long. $\frac{3}{4}$ unc.

Rostrum moderately long, and very elegant from the fact of its being doubly bent; in the middle it inclines slightly downwards, and at the apex it again bends upwards. There are seven or eight equidistant and equal-sized teeth above, of which not more than two are situated posteriorly to the orbit; the apex is simple and bent upwards; the single tooth below is placed near the apex of the rostrum and opposite to the last tooth of the upper side. On either side of the carapace, below the orbit, is a single tooth. The interior antennæ are long, and considerably exceed the antennal scales in length. Two pairs of spines on the telson. The first feet are long, and, when directed forwards, project beyond the antennal scale by the length of the fingers, which in both the first and second pairs of feet are much larger than in the genus *Hippolyte*, elongated and curved. Colour reddish. Length, from the apex of the antennal scales to the end of the telson, $\frac{3}{4}$ inch.

I took two specimens of *Doryphorus Gordoni* in Lamlash Bay in 1853, and afterwards found it among some Crustacea sent to me from the Moray Firth by Mr. Edward—the same locality from whence Mr. Spence Bate subsequently described the species. The absence of any prolongation in the third segment of the abdomen, the large size of the first pair of feet, the elongated hands of the first two pairs, and the greater length of the first, third, fourth, and fifth pairs, as compared with the second, seem to afford ample grounds for raising this interesting species to generic rank; and I had already drawn up the characters of the genus in MS. when Mr. Spence Bate's description appeared in the 'Natural History Review.'

Genus Dennisia, n. g.

*Rostrum, abdomen oculi*que eadem quæ in *Hippolyte*. *Antennæ* et externæ et internæ squama basali ornatæ; internæ tribus flagellis confectæ. *Maxillipedum articulus ultimus* cylindricus, ciliatus. *Pedes* primi maxillipedibus longiores, manibus elongatis instructi.

Rostrum, abdomen, external antennæ, and eyes as in the genus *Hippolyte*; the internal antennæ have the basal joint compressed and flattened out into a scale similar in form to that attached to the external antennæ, but smaller; their filaments are similar to those of the genus *Athanas*, the thicker of the two ordinary filaments being divided and sending out a slender branch near its termination. The last joint of the pedipalps is cylindrical and ciliated, not spinose. The first feet are longer than the pedipalps, and have lengthened hands, as in the genus *Palæmon*. The second feet in my specimens are injured, and I am consequently unable to draw characters from them. The palp of the mandibles appears to consist of a single joint.

Dennisia sagittifera, n. sp. Pl. XIII. figs. 8–13.

Scutum antice dentatum atque carinatum. *Rostrum* horizontale, cultrellatum, squamam antennarum exteriorum paulo superans: *dentes* marginis superioris octo, quorum duo in scuti carina positi; marginis inferioris tres; dentes ciliati. *Margo scuti* anterior duo aculeorum paria infra oculos posita gerens. *Telson* duobus aculeorum paribus ornatum.

The fore part of the carapace keeled. Rostrum nearly straight, a little longer than the scale of the exterior antennæ, and deep in proportion to its length; of the eight teeth which are on the upper edge, two are on the carapace and six on the rostrum itself; below there are three teeth: all the teeth are ciliated. There is a spine at the origin of the external antennæ, and a second spine on the carapace behind and a little below the first. Third segment of the abdomen gibbous and produced behind, as in the genera *Hippolyte* and *Pandalus*. There are two pairs of spines on the telson.

The colours of this species were very vivid and extremely beautiful when alive. The carapace was pale green, delicately spotted and mottled with brown; the abdomen very pale lilac, elegantly painted on the third segment with a chevron of a bright lilac (from this mark the specific name is derived), and before this were two oval brown spots. The legs were prettily banded with violet.

Among many rare Crustacea which were dredged by the Rev. R. N. Dennis and myself at Jersey, in 1859, was the present species. It was found among Zostera from about 4 fathoms water in St. Catherine's Bay. I have named the genus after my friend and brother carcinologist, in remembrance of the happy hours which we have spent together, and as a tribute to an excellent field naturalist.

Subfam. II. Pandalinæ (Dana).

Genus Pandalus, Leach.

Pandalus Thompsoni, Bell. Pl. XIV. figs. 3–9.

Hippolyte Thompsoni, Bell, Brit. Crust. p. 290; White, Popular Hist. Brit. Crust. p. 123.

Pandalus Jeffreysii, Spence Bate, Fauna of Swansea; and Nat. Hist. Review, vol. vi. p. 100, with woodcuts.

Bell has described a *Hippolyte*, but figured a *Pandalus*, for this species. Any one looking at the woodcut in the 'History of British Crustacea' will see that the first feet are rightly drawn with "the terminal joint styliform and simple," which is the chief character of the genus *Pandalus*. *Hippolyte Thompsoni* is thus undoubtedly synonymous with Mr. Spence Bate's *Pandalus Jeffreysii*. Mr. Gosse was near discovering the truth. In his "Notes on some new and little-known Marine Animals" (Ann. Nat. Hist. ser. 2. vol. xii. p. 155), he remarked that the rostral spines of *Hippolyte Thompsoni* are not simple serratures, but "triangular spines articulated to the edge," as in *Pandalus annulicornis*; but there his observations appear to have ceased, and he failed to notice that the shrimp which he was examining was in all respects a true *Pandalus*.

Subfam. III. Palæmoninæ (Dana).

Genus Palæmon, Fabr.

Palæmon minans, n. sp. Pl. XIV. figs. 1 & 2.

Scutum dorsale vix carinatum. *Rostrum* haud longe ab origine subito resimum; squamam antennarum non superans. *Dens* unus in scuti tergo positus. *Rostri dentes*, marginis superioris nulli, inferioris tres, ciliati.

This *Palæmon* may be known at a glance from the other British species by the remarkable form of the rostrum, which, instead of being horizontal or nearly so, is suddenly bent upwards at a short distance from its base. There is a single tooth on the back of the carapace, but none on the upper margin of the rostrum. The under side of the rostrum is furnished with three large teeth, which are fringed with fine hairs.

Palæmon minans was taken at Guernsey in 1857. The specific name has reference to the "threatening" aspect of the rostrum —upraised, as it were, to strike.

Subclass ENTOMOSTRACA.

Fam. Cypridinidæ.

Genus Cypridina, Milne-Edwards.

Cypridina teres, n. sp. Pl. XIV. fig. 10.

Ovata, infra medium vix latior, lævis, alba; oris incisura stricta, descendens, recurvata. Animal incognitum. Long. $\frac{1}{15}$ unc.

Shell ovate, not produced, very slightly widening just below the middle, quite smooth, pure white, moderately and regularly convex. Oral slit narrow and somewhat semicircular in form. Length $\frac{1}{15}$ inch.

The nearest ally to this species is perhaps *Cypridina Mariæ* (Baird); but the form of the latter is more produced, narrower in proportion to its length, of more equal breadth throughout, and much more tumid.

Cypridina teres was kindly added to my collection by the Rev. R. N. Dennis, who found it among shell-sand which had been dredged at Oban.

Genus Philomedes, Lilljeborg.

The genus *Philomedes* is distinguished from *Cypridina* by the antennæ, which are furnished with a remarkable, long seta.

Philomedes longicornis, Lilljeborg. Pl. XIV. fig. 11.

Philomedes longicornis, Lilljeborg, Cladocera, Ostracoda, ock Copepoda i Skane, t. 26. figs. 4, 5 (1853).

Shell subquadrangular-ovate, slightly convex. Anterior margin generally retuse, but sometimes rounded; dorsal and ventral margins moderately arched; posterior margin obliquely truncate, the ventral angle being the lower. A short spine is frequently, but not always, present at the dorsal angle of the posterior extremity. Oral aperture wide, gaping, triangular. The surface of the shell seems to be always more or less excavated with large irregularly disposed circular or subcircular pits, which in aged examples are often confluent and form large scars. Length $\frac{1}{20}$ inch.

I met with this species, now first added to the British fauna, in some numbers among dredged stuff sent to me by W. Webster, Esq., from Plymouth Sound, on account of its containing *Chemnitzia fenestrata* and *Odostomia acuta* in great abundance. I am indebted to Dr. Baird for pointing out to me the identity of the Plymouth Entomostracan with Lilljeborg's species.

In concluding these descriptions, I must return my best thanks to my friend Mr. Hodge for the valuable assistance he has given me in illustrating the paper.

EXPLANATION OF THE PLATES.

Plate XIII.

Fig. 1. *Pagurus ferrugineus* (Norman), slightly enlarged.
Fig. 2. Right arm, side view.
Fig. 3. Right hand, front view.
Fig. 4. *Pagurus lævis* (Thompson); right arm.
Fig. 5. *Hippolyte producta* (Norman); rostrum.
Fig. 6. *Doryphorus Gordoni* (Spence Bate, sp.); rostrum.
Fig. 7. Telson of the same.
Fig. 8. *Dennisia sagittifera* (Norman), twice the natural size.
Fig. 9. Rostrum of the same.
Fig. 10. Carapace viewed from above, showing the structure of the antennal scales and filaments.
Fig. 11. Pedipalp.
Fig. 12. Leg of first pair.
Fig. 13. Telson.

Plate XIV.

Fig. 1. *Palæmon minans* (Norman), slightly enlarged.
Fig. 2. Side view of carapace of the same.
Figs. 3 *&* 4. *Pandalus Thompsoni* (Bell); two forms of the rostrum.
Fig. 5. Internal antennæ of the same.
Fig. 6. Pedipalp.
Fig. 7. Leg of the first pair.
Fig. 8. Right leg of the second pair.
Fig. 9. Left leg of the second pair.
Fig. 10. *Cypridina teres* (Norman), magnified 50 diameters.
Fig. 11. *Philomedes longicornis* (Lilljeborg), magnified 50 diameters: the spine *a* is often absent.

Sedgefield, county Durham,
August 15, 1861.

XXX.—*Notes and Corrections on the Organization of Infusoria, &c.* By H. J. Carter, Esq., F.R.S.

As time progresses, we make new observations and detect errors in preceding inquiries; and he who would still pursue truth will publish both indiscriminately, wishing to record the results of his labours for the benefit of those who may come after him, and thus make some little return for the pleasure he himself has derived from the investigations of others.

Spherical Cells.

In my "Notes on the Organization of the Freshwater Infusoria" (Ann. Nat. Hist. vol. xviii., 1856), I have mentioned "spherical cells or biliary organs (?)" in the list of their contents. This was a mistake, so far as the Infusoria are concerned; for I have since ascertained that the bodies to which I have referred, instead of being homologous with the ciliated cells lining the stomach of the *Planariæ* and Rotatoria respectively, were merely ejected portions of the "abdominal mucus" of *Otostoma*, which, assuming a spherical form, and containing round pellets of half-digested vegetable matter, which had in consequence become of a bright brown colour, so simulated the bile-cells of *Planariæ*, that, at the time, I set them down as identical. No such cells occur in the Infusoria that I have since been able to see; and therefore "spherical cells," in my list of the organs of the Infusoria, should be erased.

Vesicula.

At page 126 *ibidem*, I have described the "contracting vesicle" under the name of "vesicula," as being a more appropriate and more convenient term, and have assigned to it an excretory function; but this has been disputed, and therefore I would now add more to strengthen my inference.

In their 'Études sur les Infusoires, &c.' (p. 42 *et seq.*), MM. Claparède and Lachmann have come to the conclusion that the vesicula is not an excretory organ; and in Pritchard's 'Infusoria' (4th ed. p. 432, 1861) it is stated that Cohn, in *Brachionus militaris* (which has a sinus attached to the vesicula), has "decisively proved, by mingling colouring matter in the water and witnessing a current inwards during each dilatation, and one outwards on each contraction, alternately, that it not only opens into the cloaca, but that it is a respiratory organ."

As regards MM. Claparède and Lachmann's conclusion, I would observe that, throughout their excellent article on the subject, while they endeavour to maintain that the fluid of the vesicula is returned into the vessels on the systole or contraction of the vesicula because the sinuses and vessels become filled immediately afterwards, they never once allude to the possibility that this may take place from the closing of the valves between the sinuses and vesicula at the moment the latter is about to eject its contents externally, which, after careful re-examination, would be my explanation of the phenomenon: viz. the fluid, still flowing on towards the vesicula, like that of the blood towards the heart, is ponded back for the moment in the sinuses and vessels, while the vesicula empties itself, like the ventricles of the heart, in another direction.

If we watch the vesicula in *Paramecium aurelia* as this animal gradually rotates itself upon its long axis, we observe that it is situated peripherally; that when distended and uppermost (nearest the observer) it is spherical in appearance, and presents a small papilla in the centre; and that when it is lateral it is bottle-shaped, the neck communicating with the papilla. Further, we observe that the sinuses are attached round the shoulders of the bottle, and that when the diastole or dilatation takes place, the fundus of the bottle is forced into the interior of the *Paramecium*, while, when the systole takes place, the fundus moves towards the papilla, or externally. Now, if the vesicula was not for ejecting the fluid which it receives from the sinuses and their vessels, but, on the contrary, for returning it into them, why should it have a distensible neck, this neck be attached to a papilla on the *surface* of the body, and the line of direction in which the vesicula contracts be from the fundus to the papilla?

MM. Claparède and Lachmann state that no current can be seen to pass out at the papilla in the Infusoria, and in this they are right; but why? simply because it is impossible to see this without adding some colouring matter to the water, and then the particles are whirled off the surface of the animalcule by its cilia with such rapidity and confusion, that it is equally impossible to discover among them the drop of fluid which may be ejected from the vesicula. But let us take an organism closely allied to the Infusoria, and not covered with cilia, that we may see what takes place there. This brings me to Cohn's statement above mentioned.

I must now assume that the vesicula or contracting vesicle, its sinuses and its vessels, are the homologue of this system in the Rotatoria; but not having been able to get *Brachionus militaris*, I must take *Brachionus urceolaris*, which has no sinus connected with its vesicula, a matter of no consequence here.

The system in *B. urceolaris* consists of a vesicula connected with a set of vessels on each side, which are more or less branched and terminate in blinded extremities, and a few monociliated appendages which are attached to them. In *Paramecium*, where the system is double, each part consists of a vesicula, sinuses, and more or less branched vessels, which also end in blind extremities. Thus the monociliated appendages do not appear in *Paramecium*, nor the sinuses in *Brachionus*. With these exceptions, equally matters of no consequence here, there is such a similarity in every part of these systems in *Brachionus* and *Paramecium*, that it seems to me no reasonable doubt can be entertained that they are homologous.

Now, what is witnessed when we place *Brachionus urceolaris* in water with which colouring matter has been mixed (say fine Indian ink), under a slip of glass which so compresses the *Brachionus* as to keep it stationary and prevent the coloured fluid from getting between it and the eye of the observer? We see that the vesicula becomes filled with a transparent colourless fluid, and that this fluid, as the vesicula contracts, is suddenly forced out of the cloaca into the surrounding medium, where, for a moment or two, it remains unmixed with the coloured water, and then disappears, while, the vesicula dilating again, the same phenomena may be repeated sufficiently often for the observer to feel certain that the fluid which accumulates in the vesicula is uncoloured and that it is ejected externally.

If, then, the water with which the vesicula is refilled comes from the exterior, as Cohn's experiment goes to prove, those who support this view will be inclined to state that, as it passes into the vesicula of *Brachionus urceolaris*, it is strained clear, and as it passes into that of *B. militaris* it is not so. But the sudden way in which it is ejected in *B. urceolaris* indicates a very large opening, and one which would admit the finest colouring matter that can be used, and which was used on the occasion of the experiment above-mentioned, viz. fine China-ink (or, as it is termed, "Indian ink"), very easily. Similar results were obtained by using carmine with a large *Notommata*.

The assumption that it is strained in one instance and not in the other, then, is not sufficient to lead to the conclusion that the vesicula is filled from without; and therefore, disregarding Cohn's statement, I still assert that the fluid is gathered from the interior, conducted into, and expelled by, the vesicula.

Thus we have further confirmation of the vesicula being an excretory organ in the Infusoria, as well as the fact of its being so not only in *Brachionus*, but probably in the Rotatoria generally, so far established.

Besides the monociliated tassel-like bodies which are attached to the vessels of this system in the Rotatoria, the vessels are accompanied by a fine granular substance, which more or less envelopes them; and this is particularly well seen in the segments of the *Naidina* (worms), where there is an organ of this kind in each segment, called by Dr. T. Williams the "segmental organ." (See my description of this, and figure, Ann. Nat. Hist. vol. ii. p. 27, pl. 2, 1858.)

It is not my intention to allude further to this granular substance now; but, as regards the 'tassel-like' bodies, I cannot help observing that they are as much indicative of the excretory nature of this system as any other part. Witness them in one of the largest species of Rotatoria, viz. in *Notommata*, where they exist in scores on one long vessel on each side, while the other long canals have none at all, but are surrounded by the granular matter. Here some of the tassel-like bodies are provided with the usual single cilium running through them, while others are destitute of it, but have in lieu expanded mouths *fringed* with cilia. Does not the cilium act after the manner of a "spiral pump" in raising the water from the abdominal cavity into the tubes, and has not the ciliated border the same effect as the single cilium of *Euglena*, &c., and the fringe of cilia round the disk of *Vorticella* respectively? while the granular substance around the other longitudinal and more tortuous canals, which are wholly without tassels, may perform another excretory function. Lastly, in *Nais fusca,* where this organ becomes the ovisac (see *l. c.*), if I mistake not, the spermatophorous cells are introduced into it through the ciliated opening,—thus still further showing that the current of this system is outward.

The only view, then, that I can take of the vesicula and its vessels is that it is an excretory system corresponding with the renal apparatus in the higher animals; and if I should be right, then the term "vesicula," which I have adopted for "contracting vesicle," will be still more applicable. It is remarkable, too, that in the *Naidina* it should be so intimately connected with the generative system, like these two systems in the higher animals.

Acineta *and its Metamorphoses.*

At page 236 of my "Notes," I have stated, respecting Stein's assumption of the gemmiparous reproduction of *Vorticellæ* from Rhizopods, that "Stein has described it in *Acineta,* and I have since observed it in a Rhizopod undistinguishable from *Amœba Gleichenii.* I have also seen *Vorticellæ* developed singly from *Acinetæ.*"

With the latter part of this assertion I have now nothing more to do, since it was an assumption, taking for granted that Stein was right, and I contradicted it as soon as I had an opportunity of watching the gemmæ which are thrown off by *Acineta* sufficiently long to know what became of them. Thus I stated (Ann. Nat. Hist. vol. xx. p. 37, 1857) that, with Lachmann and Cienkowsky, I never could find that the gemma thrown off from *Acineta* passes into anything but *Acineta.* It swims about rapidly by means of its cilia for some time, then becomes stationary, the cilia disappear, and the capitate tentacula are thrown out for catching its prey or food.

But with the assertion that *Vorticellæ* are thrown off from *Amœbæ,* which, on my authority, has been quoted in Dr. Carpenter's work on 'The Microscope' (I think), and in Pritchard's last edition of his 'Infusoria' (p. 364), the case is different. This has not been contradicted by me, although I now believe it to be just as much deserving of contradiction as the assertion that the gemma of *Acineta* becomes a *Vorticella.* However, as I did witness *Amœba* throwing off young living *Vorticellæ,* a description of the fact should accompany the view I now take of it.

Under date the 27th of March 1854, in my private journal, is a full description of this occurrence (with drawings which were then carefully made for publication), which took place in the following way:—

Some clear water from the main drain of Bombay (which is brackish from admixture with the sea, which flows into it twice daily), having been placed in a basin for the purpose of examining the great development of the common *Amœba* and *Vorticella microstoma* (mihi) which, after standing two or three days, takes place in it, some of these were swept off from the side of the basin with a hair-pencil, and having been transferred to a slide, were covered with a slip of thin glass, and placed under the microscope, when it was observed that some of the *Amœbæ* contained young *Vorticellæ*, in globular transparent spaces respectively, which, by their sudden contractions according to their custom, showed that they were alive and vigorous. Some *Amœbæ* contained one, and others two; and they were apparently in all stages of development as regards size, up to one-fourth of that of a full-grown *V. microstoma*, at which period they were seen to be thrown off by the *Amœba*, and with such indifference that the *Amœba* continued its course, and the rent made in its body closed up as if it was a natural occurrence.

Under the influence of Stein's assumption that the gemma of *Acineta* became a *Vorticella*, and having seen this gemma thrown off by *Acineta*, I immediately concluded that what has just been described was a similar production of *Vorticella* from *Amœba*. There was the young *Vorticella* in all stages of development as regards size, manifesting vigorous life by the activity of the vesicula and its peculiar contractions in totality, apparently encysted in the *Amœba*, and when ejected (which only took place with those which were largest) trimming itself for a few moments and then swimming off.

It was not unlikely, then, that I should have come to the conclusion that *Vorticellæ* were thus being developed from *Amœba*, instead of being previously enclosed for food, and only those thrown off which were so large and powerful that the *Amœba* could not retain them comfortably, which I now believe to have been the case.

But it may be asked, when and how did they become thus enclosed? We have only here to remember with what degree of voracity Infusoria feed when they are brought into direct contact with their food under a slip of glass (e. g. *Stylonychia* and *Chlamydococcus*), and that when they are first placed in this position they are frequently comparatively empty, although they have been taken from water abounding with their food, to come to the conclusion that it is being placed between the two slips of glass which enables them to entrap their food so easily, and therefore that it was the transfer of the *Amœbæ* and *Vorticellæ* together in great numbers from the side of the basin to this position that placed the active *Vorticellæ*, as it were, in the jaws of the slothful Rhizopod. Besides, the fact that the gemma of *Acineta* does not pass into a *Vorticella* having now been determined leaves us without a single instance of probability that *Vorticella* should be in any way developed from *Amœba*.

Having made this explanation, let us for a moment turn our attention to the other point of Stein's theory, viz. the transformation of *Vorticella* into *Acineta*, also witnessed by Udekem (Ann. des Sc. Nat. ix. p. 321, Zool. 1858).

Respecting this metamorphosis, much doubt, and even denial, has been expressed; but although all have not had the good fortune to witness it, yet it seems to rest now on evidence too good to be questioned, although perhaps the right interpretation has not been given to it by those who have seen and described it.

Now, no one can have observed a number of spherical *Acinetæ* (*Podophrya fixa*, Ehr.) adhering to the surface of *Paramecium aurelia* and carried about with it, without connecting it with the parasitic Rhizopods, which, attaching themselves to *Chlamydococcus*, *Eudorina elegans*, and the like, in a globular form, already convey their germs into their interior, and begin to devour the substance of their host while the latter are yet actively swimming through the water, and without thus coming to the inference that both organisms are of the same nature.

Again, no one can at first witness the change which, almost like a "dissolving view," takes place in the protoplasm and chlorophyll of *Chlamydococcus*, *Eudorina*, and that of the cells of Algæ generally, during which these pass from their original form into that of a Rhizopod, without inferring that the form produced is merely another one of that which preceded it, and no absolute change. Hence my description of the fancied passage of the vegetable protoplasm into *Actinophrys*, to which I shall more particularly allude by-and-by (Ann. Nat. Hist. vol. xix. p. 259, 1857), and which at the same time also I classed with that of *Vorticella* into *Acineta*.

Seeing, then, the great analogy, if not real identity, that exists between the nature of these organisms, I would suggest that the transformation of *Vorticella* into *Acineta* may be of the same kind as the passage of the vegetable protoplasm into rhizopodous forms—that, in fact, the germ of *Acineta*, like the egg of the Ichneumonidæ among Insects, becomes encysted with the *Vorticella*, eats up its host, and comes out an *Acineta*, as the larva of the Ichneumon-fly, which is hatched in the chrysalis of one of the Lepidoptera, lives upon its host, and comes out of the cocoon, not a butterfly, but a wasp.

That the stalked *Acinetæ* upon *Epistylis* are parasitic can easily be seen, because they are not upon the ends of the dichotomous branches of their host, but fixed to them by single smaller stems of their own. Not only that, but in a pool here (Bombay) where *Epistylis* abounds, the same kind of *Acineta*, apparently, which accompanies it, abounds also on the web of the frog's feet which live in this pool—thus assuming the position of an epizoon; while the cases described and figured by Stein and Cohn, in which the globular form (*Podophrya*) has been developed singly or in great plurality in the interior of *Stylonychia, Nassula*, &c., may afford instances of entozoic *Acinetæ*.

Directing our attention to the phases presented by the globular *Acineta*, one of the most striking phenomena exhibited by it is the projection of cilia which takes place round the half which is to swim about, just before its separation from the other half, during duplicative division, since it affords us an instance in which cilia can be put forth and retracted by a previously unciliated Infusorium, the cilia disappearing on the protrusion of the capitate tentacula, unless the same material can be put forth under different forms. Be this as it may, the cilia are present, and their retraction, &c., take place also in the gemma, and their presence in both instances appears to be for enabling the *Acineta* to seek for some living Infusorium upon which to fix itself for food. The swimming away of one while the other half remains stationary, in the duplicative division, seems to show that, when this mode of reproduction takes place in Infusoria, there is always one half older than the other, which is, as it were, the stock, and therefore the young half the bud.

Pythium entophytum, Pringsheim*.

Not altogether unconnected with the foregoing subject is the development which I have described and figured in different parts of the 'Annals,' since 1855, in the cells of the *Characeæ, Spirogyra, Œdogonium*, &c., and in the bodies of Rotatoria and in the egg of *Nais fusca*.

This development I at first tried to prove to be parasitic; then I thought it was a simple transformation of the protoplasm from one form into another; and, again, now I am compelled to view all these developments as originating from germs previously existing in the midst of the protoplasm when not obviously introduced.

Nothing, however, has impressed me with this belief so much as Prof. Pringsheim's descriptions and illustrations of the conjugation which takes place between the sporangium and filaments of the other species of this genus, to which he has given the name of *Pythium monospermum* (*l. c.*), while at p. 366 (*l. c.*) he states that, although he had not seen the fecundation of *Py-*

* Ann. des Sc. Nat. xi. p. 354, pl. 7. fig. 1 (Bot.), 1859.

thium entophytum, yet the presence of utricles filled with little straight tubes like the seminal bodies of *Vaucheria* and *Saprolegnia* in company with the sporangia of *P. entophytum*, indicates, with great probability, that they are its antheridia. Pringsheim, however, like myself, mistook the nature of this organism formerly, as may be seen by reference to the 'Annals' (vol. xi. p. 294, 1853), where he contended that it was not a parasite, but a reproductive element of *Spirogyra*, in whose cells it occurs, while in 1859 he makes it a *Saprolegnia*.

It was this organism to which I alluded in my communication to the 'Annals,' in 1857, entitled "The Transformation of Vegetable Protoplasm into *Actinophrys*," where I described the contents of the sporangium as consisting of monociliated polymorphic cells which lost their cilium and put on the radiated form of *Actinophrys*; also that when within the cells of *Spirogyra*, they enclosed the protoplasm and its contents after the manner of *Amœba*. The *monociliated* bodies Pringsheim calls "zoospores;" and these would form the female, while his tubular cells ("tubes") would form the male element of the organism. Thus we have a being which brings us at once close upon the confines of the Animal, Algal, and Fungal divisions of organic life.

In the protoplasm of *Nitella*, as I have figured and described long ago, another form of these rhizopodous parasites abounds; and in the cells of *Spirogyra crassa*, circular nuclei may frequently be seen, which probably belong to *Pythium entophytum*. Thus for the future I would regard all those apparent transformations of the protoplasm as the development of parasitic germs previously existing in it (where they are not obviously introduced), which, under favourable circumstances, that is, where the specific vitality of the cell begins to ebb, begin to assimilate its protoplasm, &c., to their own form; for the protoplasm must be still fresh, as under sudden putrescency they do not appear, but probably as rapidly pass into decomposition as the protoplasm in which they have been living. It is difficult to realize the nature of these changes at first; for, like those of a "dissolving view," as before stated, they are inappreciable; but such, I am now persuaded, is the way in which they must be explained.

Eudorina elegans.

Lastly, at p. 10 of the 'Annals,' vol. iii. 1859, I have made a mistake in correcting what I fancied to be an error in my description of the "green cell" of *Eudorina*, viz. in trying to prove that what I had previously stated to be the "nucleus" was a "starch-cell." Subsequent observation has shown me that I was right in the first instance; for although, both in *Eudorina* and *Chlamydococcus*, the peripheral substance, and perhaps the interior of the nucleus itself, becomes purple and blue under the action of iodine, this cell must be considered the nucleus, while the "granules" in the protoplasm should be viewed as the analogues of the "starch-cell" in the plant-cell. Thus the "green cell" of *Eudorina* consists of the cell-wall with its two cilia, which contains the protoplasm and chlorophyll, the nucleus, the granules, or analogues to the starch-grains, the "red spot," and the two contracting vesicles. Such, too, is a list of the normal contents of *Chlamydococcus* and most of these green cells. The spore-cell of *Eudorina*, after impregnation (*Gyges*, Ehr. ?), I am led to think, has four cilia; but of this more hereafter.

Spongilla.

At p. 13 (*ibid.*) there is also a mistake made in a similar way, and arising from a similar cause, viz. a misgiving of the truth of an inference deduced from deliberate examination, corrected by a too short and hasty one. It is stated, respecting the "ampullaceous sac" of *Spongilla*, that it must have its cilia outside, instead of inside as in the first description. A still more recent examination compels me to state that the first description in this respect should stand as it is, and the cilia be considered *inside*, and not outside, the "ampullaceous sac."

XXXI.—*A Catalogue of the Zoophytes of South Devon and South Cornwall.* By the Rev. THOMAS HINCKS, B.A.

[Continued from p. 262.]

8. *Laomedea neglecta*, Alder.

Common: under stones between tide-marks; dredged on other zoophytes, &c., from in-shore to the Coralline region.

This species, in its Campanularian state, is very abundant on the stems of *Plumularia*, *Sertularia*, &c., from deep water. In such situations, so far as my experience goes, it is seldom and sparingly branched.

From a tide-pool at Meadfoot, near Torquay, I have it of large size (about an inch in height), much branched, and bearing capsules. The latter, which have not yet been described, are pyriform, and produced in the axils and on the pedicles which support the cells. The ova are developed into the perfect larval form within an external gelatinous marsupium.

9. *L. lacerata*, Johnston.

Not uncommon: Exmouth, in tufts of *Bowerbankia imbricata* (the erect form), and on weed; dredged in Slapton Bay on *Campanularia verticillata*, &c.

This zoophyte is most commonly found creeping like a *Campanularia*, and seems only under favourable circumstances to assume the arborescent form of the *Laomedeæ*. It was only known to Dr. Johnston in its humbler condition. I have met with it most abundantly in this state; but the cases in which it has occurred of larger and more luxuriant growth have been rare. The Exmouth specimens were of this kind, and were laden with gonothecæ, surmounted by the marsupial sacs, in which the ova complete their development.

The inner surface of a shell in my possession, which was dredged, I believe, in Torbay, is invested with this species in its Campanularian state; and in this specimen the reproductive capsules are produced *on the creeping stem amongst the polype-cells*. We have here, then, the case of a single species exhibiting, in different states of growth, the appearance and the essential characters of the two genera *Campanularia* and *Laomedea*.

[Filey; Ramsay, Isle of Man; St. Ives, Cornwall.]

2. Campanularia, Lamarck.

1. *C. volubilis*, Linn.

On zoophytes from deep water, occasionally.

This species is far from common. I have only met with it, in small quantity, on *Sertularia abietina* which had been taken up by the trawlers. As a deep-water form, it is more likely to escape notice than some other species; but there can be little doubt that it is comparatively rare.

[Filey, on *Halecium halecinum*.]

2. *C. Johnstoni*, Alder.

Extremely common, from between tide-marks to deep water. Like other *Campanulariæ*, it shows a predilection for the red weeds. The ribbon-like leaves of *Zostera marina* are sometimes profusely covered with it. Indeed it is generally distributed, and adorns with its crystal cups and ringed pedicels the most various marine substances.

The branched form, figured by Ellis and Solander (tab. 4. figs. E, F), has occurred on *Sertularia argentea* from Torbay. I have not seen more than a single branch in any case—an exact copy of the original stock, but generally bearing a small and imperfectly formed capsule. Sometimes, however, as I learn from Dr. Strethill Wright (*in lit.*), two or three branches spring from a little below the polype, and "these secondary stems in like manner give off tertiary stems," the capsules being often in such cases axillary. In the compound specimens of *Campanularia*, as I have before pointed out (Report of Brit. Assoc. for 1858), a near approach is made to *Laomedea*, the leading characters of which are here assumed. On the other hand, in the *L. angulata*, described in a previous portion of this catalogue, and in one state of *L. lacerata*, the capsules are no longer axillary, but are produced on the creeping stem.

The *Laomedea gracilis* of Sars is a species which exactly resembles, in habit and mode of branching, the compound form of *Campanularia Johnstoni*; and he seems to have had much difficulty in deciding under which genus to rank it. The branching of *Campanularia* is simply a form of luxuriant growth, due, no doubt, to favourable conditions of life.

In the 'Edinb. New Phil. Journ.' for April 1858, Dr. Wright has given an interesting account of the production of ova by the medusoid of this species. In the same year in which his paper appeared, I had made, but not published, similar observations. It will complete the history to mention that I noticed the *spermary* as well as the ovary. In some of the globular enlargements on the radiating canals, a rapid movement of extremely minute bodies (spermatozoa) was visible, whilst others contained the ova as described by Dr. Wright.

3. *C. Hincksii*, Alder.

Common: very fine on Sponge, &c., Salcombe Bay; Torbay, very abundant on other zoophytes, in moderate depths (8 to about 15 fathoms).

The cells of this species are remarkable for their size. Mr. Alder's otherwise excellent figure hardly does justice to this characteristic. The gonothecæ are elongate-oval and *smooth*.

4. *C. raridentata*, Alder, MS.

Not uncommon: between tide-marks, on Coralline and *Coryne*, Torquay; on zoophytes, amongst the Brixham trawl-stuff.

This species has not yet been published. The pedicles are short, and there is a curious enlargement at the base of them; the cells are elongate, narrow, and with six pointed crenations round the margin.

5. *C. verticillata*, Linn.

Very common in the Coralline zone: of great size amongst the refuse of the trawl-boats; dredged in Slapton Bay.

[Lamlash; Filey.]

3. Calicella (nov. gen.), Hincks.

Polypary filiform, creeping or erect; cells somewhat densely corneous, tubular, sessile or very slightly pedunculate.

Type-species, *C. dumosa*.

The reproduction of this section of the Campanulariadæ has been very little studied as yet. I have described the gonophore of *C. syringa*, and the structure of its reproductive organs (female), in the 'Annals' for August 1852; but I am not aware that similar observations have been made in the case of any other member of this genus. This is not a little remarkable, as the *C. dumosa* is widely distributed, and occurs in profusion. Amongst some thousands of specimens, examined from time to time, I have never met with anything that threw light on the history of its reproduction.

The gonophore of *C. syringa* resembles in structure that of *Laomedea lacerata, L. neglecta,* and some of the Sertulariadæ, the ova being matured in extracapsular marsupia.

I find that, in constituting a genus for *C. dumosa* and its allies, I have the support of Professor Reid, who, in his valuable paper entitled "Anatomical and Physiological Observations on some Zoophytes" ('Annals' for 1845, vol. xvi. p. 385), has remarked upon this species, that "the characters of the polypidom separate it from the genus *Campanularia*."

1. *C. dumosa*, Flem.

Very common in deep water: on *Pinna* from 60 fathoms, off the Deadman (the erect form); amongst the trawl-refuse, &c.

A slender and delicate variety occurs occasionally.

2. *C. fruticosa*, Sars, Beretning om en Zoologisk Reise i Lofoten og Finmarken, pp. 18, 19.

Syn. *Campanularia gracillima*, Alder, Catal. p. 39.

Mr. Alder has received specimens from Plymouth or its neighbourhood.

Sars's name has precedence. His description of the species appeared, many years since, in a paper which is now only to be obtained with difficulty, and which is written in Danish. It is very desirable that all new discoveries should be put on record in some journal which has a European circulation, and that there should be a freer and more spontaneous interchange of publications amongst those who cultivate the same branches of science. Much waste of time and perplexing multiplication of names might thus be prevented.

3. *C. syringa,* Linn.

Common, on other zoophytes, &c.

4. Reticularia, Wyville Thomson.

R. serpens, Hassall.

Very common: on the stems of the larger Sertulariadæ, especially of *S. abietina*; on the surface of bivalve shells.

The species presents a very different appearance in these two habitats *. When developed on shell, there is none of the crowding of the cells which makes it so difficult to distinguish their form and arrangement.

Reticularia is nearly allied to *Calicella dumosa.* Its reproductive organs have not been observed; but an apparently kindred Australian form, which I have lately described under the name of *Lineolaria* (Annals for April 1861), produces very large spinous capsules, which are decumbent and adnate, like the cells.

5. Coppinia, Hassall.

C. arcta, Dalyell.

Not uncommon in deep water, on the stems of *Plumularia falcata* and *Sertularia abietina.*

Order **HYDRIDÆ**, Huxley. Fam. **Hydriadæ.**

Hydra, Linnæus.

1. *H. viridis,* Linn.

In the neighbourhood of Exeter.

2. *H.* ——.

I can only state at present that a second species of *Hydra* occurs near Exeter; but whether it be the *vulgaris* or the *oligactis,* or whether both these species occur, I cannot say with confidence.

A very large and handsome *Hydra,* tapering (I think) towards the base, is met with on water-plants in the Exeter Canal, which may prove to be the latter of these two species. Another, found some years ago in pits at Exwick, I supposed at the time to be *H. vulgaris.* I must leave the point for future settlement.

* *Vide* "Note on *Reticularia immersa,*" &c., Ann. & Mag. Nat. Hist. for 1856, vol. xviii. p. 469.

Supplementary.

CORYNE, Gaertner.

C. vaginata, n. sp.*

Polypary branched, annulated; branches alternate, giving off polypiferous ramuli. Polypes fusiform, prolonged below into a slender neck, which is invested by a delicate, membranous, cup-like extension of the polypary. Tentacles 15–20, short, bent inwards when at rest; extremities rose-coloured. Gonothecæ spherical, produced on the lower half of the body, containing a single ovisac or sperm-sac.

Torbay, between tide-marks.

This well-marked form has hitherto been confounded with the *C. ramosa*. The *Coryne* mentioned by Mr. Lister (Phil. Trans. for 1834) must, no doubt, be referred to it. His figure (pl. 10. fig. 3) is an admirable representation of *C. vaginata*; and he makes special reference in the text to the "small cell" which protects the basal portion of the polype-body.

The Devonshire *Coryne* described by Dr. Johnston (2nd edit. p. 42), and represented on pl. 6. figs. 4, 5, I have no hesitation in identifying with the present form. He refers it to the *C. ramosa* of Ehrenberg; but his description—"polype oblong, freer than ordinarily from the tube, and separated by a narrow neck, with from ten to twelve or more short tentacula scattered over the surface"—applies not to that species, but to the *C. vaginata*.

The *Syncoryna Listerii* of Van Beneden (pl. 3. figs. 11, 12) appears to be the *C. ramosa*. Neither his description nor his figure agrees with Lister's species.

The *Coryne* beautifully figured in Gosse's 'Devonshire Coast,' under the name of *ramosa*, is also evidently the *C. vaginata*.

I feel more doubtful about the *Hermia glandulosa* of Hassall's Irish Catalogue (Annals for 1841, vol. vi. pl. 6. fig. 2); but his figure bears a closer resemblance to the present species than to any other with which I am acquainted.

Dujardin has described a species of *Syncoryna*, under the name of *S. glandulosa* (Ann. des Sc. Nat. sér. 3. Zool. vol. iv. p. 257, &c. pls. 14, 15), which presents some striking points of resemblance to *C. vaginata*. The polypes are represented as fusiform, and "the corneous covering of the stems" is said to "expand into the form of a transparent cup at the base of each head." But, besides other differences, it is propagated by means of medusoids (to which Dujardin has given the name of *Callichora*), and is therefore a distinct form.

* A figure of this species will be given hereafter.

The synonymy of the present species will stand as follows:—

C. vaginata, n. sp., Hincks.

Coryne, Lister, "Observat. on the Struct. and Functions of Polypi and Ascidiæ," Phil. Trans. 1834, pl. 10. fig. 3.
C. ramosa, Johnst. Brit. Zooph. 2nd edit. p. 42, pl. 6. figs 4, 5.
C. ramosa, Gosse, 'Devonshire Coast.'
?*Hermia glandulosa*, Hassall, Annals for 1841, vol. vi. pl. 6. fig. 2.

The polypes of *C. vaginata* are slender and fusiform, tapering off towards the mouth and downwards, and prolonged below into a narrow neck of some length. The upper extremity of the body is opake-white, and the central portion of a reddish-brown colour. The tentacles, which are less numerous than in *C. ramosa*, are commonly bent inwards, and have roseate tips. The slender base of the polype is surrounded by a membranous cup-like sheath or dilatation of the polypary, which extends nearly to the lowest tentacles. This is a very striking character.

There is always a small, definitely-shaped portion at the base of the *branches* which is not annulated. The capsules present no peculiarity. The ova are large, and have a conspicuous germinal vesicle.

This species attains a very considerable size. I find that the specimen from Torbay, mentioned under *C. ramosa* as being nearly four inches in height, and referred to that species, is in reality the *C. vaginata*.

[Common at Ilfracombe and along the neighbouring coast.]

Note on Coryne Cerberus, *Gosse.*

During the past summer I have enjoyed at Ilfracombe very favourable opportunities for the study of the *Stauridia producta* of Wright, and have satisfied myself that the *Coryne Cerberus* of Gosse is founded on an immature specimen of this zoophyte. The arms of the *Stauridia*, as of the Corynoids generally, increase in number with the age of the polype. The young are found with only two, three, or four of the capitate tentacles, placed a little below the oral aperture. After a time, the second verticil is developed, and then the third. The lower row of *filiform* tentacles seems to be produced contemporaneously with the first series of capitate arms. The *C. Cerberus* is, no doubt, a young *Stauridia* with only three of the latter developed. I have had a specimen of the last-named zoophyte which was quite undistinguishable from the species figured by Mr. Gosse. I may also mention that the habit of distending and flattening the mouth, which Mr. Gosse noticed in the case of his *Coryne*, is that of the *Stauridiæ*.

The *Stauridia producta* must therefore be added to the Catalogue, and the *Coryne Cerberus* withdrawn from it and from the list of British species.

Eudendrium insigne, Hincks.

Since the description of this species was published ('Annals' for August 1861), I have met with it in some abundance at Ilfracombe, and have had the opportunity of making a careful examination of the gonophores. They surround the base of the polype to the number of five or six, and present the same essential structure as those of *Eudendrium rameum*, described and figured by Dr. Strethill Wright (Edin. New Phil. Journ. for Jan. 1859). The ovarian sac contains a single ovum, which is partially enclosed by a looped process derived from the endoderm. This loop overarches the egg and surrounds it, with the exception of its lower extremity, which is in immediate contact with the wall of the sac. The gonophore is convex on both sides, and presents a narrow edge when viewed in front. It differs in form from that of *E. rameum*, which is oval, and in the size of the endodermic band, which in the latter species almost entirely encircles the ovum. The polype of *E. insigne* has the proboscis white and the rest of the body of a dark-red colour.

[To be continued.]

XXXII.—*Report of the Results of Deep-sea Dredging in Zetland, with a Notice of several Species of Mollusca new to science or to the British Isles.* By J. Gwyn Jeffreys, F.R.S., F.G.S.

To the Editors of the Annals of Natural History.

Gentlemen,

Many scientific friends, who did not attend the last Meeting of the British Association, wish to know the result of my dredging expedition to the "far North" of our coast-line; and as the Report will not be published for a long time, will you kindly allow me to satisfy their inquiries by inserting an abstract of the communication which I made to the Association? I am quite aware that I make this request at a late period, and that I can only hope to have a corner of your valuable publication.

I am, Gentlemen,
Yours faithfully,
J. Gwyn Jeffreys.

25 Devonshire Place,
Sept. 24, 1861.

The Report was submitted by the author, as one of the General Dredging Committee, not so much for the sake of announcing his discovery of new species, as of maintaining certain views which he had ventured to suggest on former occasions with respect to the geographical distribution of the marine fauna of Europe. A yachting excursion which he had taken in the course of this summer, accompanied by two scientific friends, to the northernmost part of the British Isles, together with an examination of the upper tertiaries in Suffolk and Norfolk which he had since made in company with Mr. Prestwich, gave the author a better insight into the scope of such distribution than had resulted from his previous researches, and confirmed his belief that the division into separate areas or "provinces," which had been proposed by so many systematists (all of whom held different opinions as to the extent and limits of such "provinces"), was erroneous, and that the present distribution must be referred to a state of things which has indeed passed away, but left a very distinct impress of its action. The author is inclined to take the Coralline Crag as a starting-point, and to consider the marine fauna of Europe, Northern Asia, the Cis-Atlantic zone of Africa, and part of North America, as having been closely related at a comparatively recent epoch, and as forming one common area of origin. Many species of Mollusca once existed at both extremities of this vast district: *e. g. Mya truncata* and *Buccinum undatum*; and other species hitherto supposed to be restricted to the Mediterranean (viz. *Monodonta limbata* and *Cerithium vulgatum*, with its variety *C. calabrum*) have lately been discovered by Professor Sars on the coasts of Finmark. It is also probable that the recent exploration of the Greenland seas by Otto Torell and others may reveal further instances of a similar kind. Very little has hitherto been done towards the investigation of the Arctic fauna. It by no means follows that an extremely rigorous or "arctic" temperature prevailed in those places where we find the remains of some mollusca which now inhabit only the seas of colder regions, or *vice versâ* that the presence in these regions of fossil shells belonging to species which now inhabit only more southern seas indicates the former prevalence of a warm climate. The temperature of the sea at certain depths is well known to be very equable; and it is only littoral or shallow-water species that would be exterminated or affected by a change of climate. Some kinds appear to be more hardy than others, and to have survived considerable and perhaps frequent changes of temperature; while others have undergone a limited modification of form, and are considered by some naturalists as distinct (or "representative") species. A great deal, however, yet remains to be done, by accumulating facts, and a critical comparison of recent with fossil species, before a complete or satisfactory theory of distribution can be established.

Mr. Jeffreys contrasted his experience of this dredging expedition with those he had made to other parts of the British coasts as well as to the Mediterranean, and also with the accounts he had received of similar expeditions to the coasts of Norway and Sweden—showing the far greater difficulties which attended an exploration of our northernmost sea, by reason of the variable and often tempestuous weather, and of that line of coast being unsheltered from the prevailing winds. He, however, succeeded in procuring three species of Mollusca new to science, which he proposed to name *Margarita elegantula*, *Aclis Walleri*, and *Nassa? Haliaëti*, besides twelve other species which were new to the British Isles. Of these last, ten are Scandinavian, one is Mediterranean, and the other had hitherto been known only as a Crag fossil. He reserved the description and particulars of these species for a work on British Conchology which he had undertaken. He ascertained that the Gulf Stream never impinges on any part of the coast which he had examined, although the climate was temperate.

The author noticed the occurrence at considerable depths (nearly 80 fathoms) of living Mollusca which usually inhabit the shore or very shallow water, viz. *Lamellaria perspicua*, *Nassa incrassata*, and *Cypræa europæa*, all of them being widely diffused species,—thus apparently illustrating the view entertained by the late Professor Edward Forbes, that those species which have the widest horizontal range have the greatest vertical depth. Judging, however, from the great depth at which he found the fossil shells of some Mollusca (*e. g. Pecten Islandicus* and *Mya truncata* var. *Uddevallensis*) which inhabit much shallower water in the Arctic zone, the author is disposed to believe that the bed of this part of our Northern Sea has sunk since the so-called "glacial" epoch, and that this circumstance may possibly account for the above-mentioned occurrence of sublittoral species at such depths.

With respect to the comparative size of those Mollusca which are common to the seas of the North as well as of the South of Europe, the author referred to an observation made by Mr. Salter, in a recent number of the 'Quarterly Journal of the Geological Society,' that some fossil shells which Mr. Lamont had brought from Spitzbergen were larger than those of the corresponding species in our own mountain limestone; and he remarked that the same rule appears to apply also to marine plants, for he never saw such gigantic fronds of the *Laminaria saccharina*, which fringes all our coast-line, as he did in the voes of North Zetland.

The author concluded by paying a just tribute of respect to the labours of Professors Sars and Lovén, Malm, Mörch, Asbjörnsen, and other Scandinavian naturalists, who were investigating the Mollusca of the Northern seas with a zeal and accuracy worthy of our emulation.

XXXIII.—*On some new Genera and Species of Mollusca from the North of China and Japan.* By Arthur Adams, F.L.S. &c.

Genus Onoba, H. & A. Adams.

Onoba subulina, A. Adams.

O. testa ovato-subulata, alba, rimata, tenui, opaca; spira producta, apice obtuso; anfractibus $4\frac{1}{2}$, convexiusculis, transversim striatis, striis creberrimis, suturis obliquis impressis; apertura oblongo-ovata, postice acuminata, antice rotundata; labio in medio subflexuoso; peritremate vix continuo; labro margine acuto, recto.

Hab. Gulf of Pe-chili; 3 fathoms.

This is an elegant subulate species, with the whorls finely striated transversely; the inner lip is flexuous in the middle, and the outer lip is thin and simple.

Genus Alvania, Risso.

1. *Alvania badia,* A. Adams.

A. testa ovato-conica, solida; anfractibus 5, duobus superioribus lævibus, cæteris longitudinaliter plicatis, plicis validis, distantibus, transversim liratis, liris prominentibus; anfractu ultimo semiplicato, basi convexa liris validis concentricis ornata, plicis ad peripheriam desinentibus; apertura ovato-acuminata; labro margine subincrassato; pallide fusca aut rufescente, basi et labro antice albidis.

Hab. Kala-hai; Shan-tung.

The colour varies from pale fuscous to reddish brown; and the species may always be known by the base and fore part of the outer lip being whitish.

2. *Alvania scitula,* A. Adams.

A. testa ovato-turbinata, tenui, rimata, luteo-fusca, semiopaca; anfractibus 5, planiusculis, duobus superioribus lævibus, cæteris longitudinaliter plicatis, plicis tenuibus confertis, transversim liratis; anfractu ultimo plicis ad peripheriam obsoletis; apertura acuminato-ovata; labro margine subincrassato.

Hab. Lo-shan-kow; Shan-tung.

The sculpture of this species is of the same character as that of *A. badia*; but the form is different, and the base and outer lip are not white. It is also a much thinner shell and more delicately sculptured.

Genus Dunkeria, P. P. Carpenter.

1. *Dunkeria rufocincta,* A. Adams.

D. testa turrita, in medio tumidula, pallide fusca, cingulo rufo ad suturas ornata; anfractibus normalibus 9, longitudinaliter plicatis, transversim valde liratis, liris ad plicas nodulosis, plicis lirisque æquidistantibus regularibus; basi convexa, cingulo rufo ornata; apertura ovata; labio simplici, arcuato; labro margine acuto.

Hab. Shan-tung; Lian-tung.

This is a common species both in Shan-tung and Lian-tung, living in deep water. The longitudinal plicæ and transverse liræ decussate each other in a regular manner, giving the surface a reticulated appearance. The rufous band at the sutures is sometimes obsolete or wanting, and the apex is often tinged with dark brown.

2. *Dunkeria candida*, A. Adams.

D. testa subrimata, turrita, in medio tumidula, tenui, alba, opaca, plicis longitudinalibus et liris elevatis transversis reticulata; anfractibus 8, convexis; suturis profundis; apertura ovata, antice subproducta; labio simplici; labro in medio rectiusculo, margine acuto.

Hab. Lo-shan-kow; Shan-tung (shell-sand).

This species is very similar in form to *D. rufocincta*, but it is pure white, and of finer and more regular sculpture.

Genus Chrysallida, P. P. Carpenter.

1. *Chrysallida casta*, A. Adams.

C. testa turrito-ovata, alba, tenui, semipellucida, subrimata; anfractibus normalibus 4, planiusculis, ad suturas vix angulatis, longitudinaliter plicatis, plicis flexuosis, angustatis, subdistantibus, interstitiis transversim valde striatis; anfractu ultimo ad peripheriam rotundato, plicis ad basin extendentibus; apertura ovata, antice producta et acuminata; plica parietali obsoleta, vix cælata; labro margine postice subangulato.

Hab. Kala-hai; Shan-tung.

A very elegant, pure-white, plicate species, semipellucid and of thin texture, with the aperture pointed and produced at the fore part.

2. *Chrysallida inconspicua*, A. Adams.

C. testa elongato-ovata, alba, nitida, solidula; anfractibus normalibus 3, planatis, longitudinaliter plicatis, plicis rectis, confertis, usque ad basin productis; suturis profundis; anfractu ultimo ad peripheriam rotundato; apertura ovata; plica parietali obliqua, mediana, parva; labro simplici.

Hab. Kala-hai; Shan-tung.

A small elongate-ovate species, with flat longitudinally plicate whorls.

3. *Chrysallida miranda*, A. Adams.

C. testa subturrito-ovata, alba, rimata, semiopaca, tenui; anfractibus normalibus 3, spiratis, planis, superne angulatis, longitudinaliter plicatis, transversim liratis; suturis canaliculatis; apertura ovata, antice producta; plica parietali obliqua, mediana; labro margine postice angulato.

Hab. Lo-shan-kow; Shan-tung.

A very pretty little species with spirate angular whorls, neatly reticulated with longitudinal plicæ and transverse liræ.

4. *Chrysallida pulchella*, A. Adams.

C. testa ovato-acuminata, rimata, subturrita, alba, tenui, semiopaca; anfractibus normalibus 4, planatis, superne ad suturas vix angulatis, longitudinaliter plicatis, plicis obliquis, tenuibus, subdistantibus, interstitiis transversim liratis; apertura ovata, antice subeffusa; labro margine postice subangulato.

Hab. Lo-shan-kow; Shan-tung.

A pretty, neatly-sculptured species, with the interstices between the slender plicæ of the whorls delicately lirate.

5. *Chrysallida tenuicula*, A. Adams.

C. testa parva, ovata, alba, tenui, semipellucida; anfractibus normalibus 2, longitudinaliter plicatis, plicis tenuibus, undatis, subdistantibus, interstitiis transversim striatis; anfractu ultimo ventricoso; apertura acuminato-ovata; plica parietali obliqua, inconspicua; labro simplici.

Hab. Hulu-Shan Bay; 4 fathoms.

A small semipellucid species, finely plicate, and with the last whorl ventricose.

6. *Chrysallida mundula*, A. Adams.

C. testa ovato-conica, alba, solida; anfractibus normalibus 3, planatis, longitudinaliter plicatis, plicis validis, confertis, interstitiis simplicibus; anfractu ultimo ad peripheriam rotundato, plicis ad basin productis; apertura acuminato-ovata; plica parietali dentiformi, mediana, transversa; labro margine subincrassato.

Hab. Lo-shan-kow; Shan-tung.

A short, ovately-conical, white, plicate species, with a peculiar dentiform parietal plica.

7. *Chrysallida costellata*, A. Adams.

C. testa pyramidato-ovata, alba, solida; anfractibus normalibus 4, planatis, subimbricatis, longitudinaliter costatis, costis rectis, validis, interstitiis simplicibus; anfractu ultimo ad peripheriam angulato, costis ad peripheriam abrupte desinentibus; basi lævi; apertura quadrato-ovata, antice producta et acuminata; plica parietali parva, superiore, transversa; labro in medio angulato.

Hab. Kala-hai; Shan-tung.

A small, ribbed, short, pyramidal species, with the outer lip angulate in the middle.

8. *Chrysallida gemma*, A. Adams.

C. testa oblongo-ovata, rimata, albida, solida; anfractibus normalibus 3, planatis, superne prope suturas longitudinaliter plicatis, inferne transversim valde liratis; suturis profundis; apertura acuminato-ovata; plica parietali transversa, valida, mediana; labro margine crenato.

Hab. Hulu-Shan Bay; 3 fathoms.

A species very much resembling *C. Mariella*, A. Ad., in style of sculpture, the whorls being plicate at the upper part, and transversely lirate at the lower part.

Genus Monoptygma, Gray.

Monoptygma cœlata, A. Adams.

M. testa elongato-ovata; spira producta, acuminata, alba, solida, transversim valde lirata, liris distantibus, interstitiis pulcherrime lineis elevatis insculptis; anfractibus normalibus quatuor, convexiusculis; suturis canaliculatis; apertura oblonga; labio incrassato; plica parietali obliqua, mediana; labro margine crenato.

Hab. Mino-Sima; 63 fathoms.

This is a short, elongately ovate species, with channelled sutures. It is the only member of the *Monoptygma* type I have met with in the Sea of Japan, the other species I have recently described being found in the Gulfs of Pe-chili and Lian-tung.

Genus Menestho, Möller.

1. *Menestho exarata*, A. Adams.

M. testa acuminato-ovali, alba, solida, imperforata; anfractibus $5\frac{1}{2}$, planiusculis, transversim exaratis; apertura ovata, postice acuminata; labio subincrassato, simplici.

Hab. Hakodadi Bay; 16 fathoms.

This shell somewhat resembles an elevated grooved *Odostomia* without any plait. The axis is imperforate, and the shell is solid. If not a *Menestho*, possibly it may be considered a *Macrocheilus*.

2. *Menestho sculptilis*, A. Adams.

M. testa pyramidali-turrita, sordide alba, solidiuscula, imperforata; anfractibus $4\frac{1}{2}$, planiusculis, transversim sulcatis, sulcis concinne punctatis; apertura late ovata; labio simplici, antice vix effuso.

Hab. Mino-Sima; 63 fathoms.

This shell is something like a *Myonia* without a fold on the inner lip; it is of a pyramidately turreted form, and, were the axis perforated, would be regarded as an *Iole*.

Genus Amathis, A. Adams.

Testa subulata, lævis, polita; anfractibus simplicibus. Apertura antice integra, dilatata, rotundata, postice acuta; labio superne plica obliqua valida instructo.

The shells composing this group will not arrange themselves under *Odostomia, Monoptygma, Myonia,* or any other genus of Pyramidellidæ. The following are the species already described, of which *A. virgo* may be considered the type:—

1. *Amathis virgo,* A. Adams.
   Myonia virgo, A. Adams (Ann. & Mag. Nat. Hist. 1860).
2. *Amathis producta,* A. Adams.
   Odostomia producta, A. Adams (Ann. & Mag. Nat. Hist. 1860).
3. *Amathis eburnea,* A. Adams.
   Menestho eburnea, A. Adams (Ann. & Mag. Nat. Hist. 1860).
4. *Amathis concinna,* A. Adams.
   Menestho concinna, A. Adams (Ann. & Mag. Nat. Hist. 1860).
5. *Amathis pellucida,* A. Adams.
   Menestho pellucida, A. Adams (Ann. & Mag. Nat. Hist. 1860).
6. *Amathis subula,* A. Adams.
   Menestho subula, A. Adams (Ann. & Mag. Nat. Hist. 1860).

Genus Lacuna, Turton.

1. *Lacuna* (*Epheria*) *decorata,* A. Adams.

L. testa oblongo-conoidea, rimato-umbilicata, tenui, transversim striata, fasciis tribus rufo-fuscis cincta, strigis rufo-fuscis distantibus longitudinalibus ornata; anfractibus $3\frac{1}{2}$, convexis, ultimo infra peripheriam obtuse angulato; apertura ovata, spiram vix æquante; rima umbilicali latiuscula.

Hab. Rifunsiri (on the shore).

This species is neither *L. carinata,* Gould (which I believe I have found in the Yellow Sea), nor *L. carinifera,* A. Adams, which I have described from Borneo. It differs from any figured in M. Philippi's Monograph of the genus. Besides the red-brown transverse bands, the shell is marked with distant red-brown longitudinal stripes.

2. *Lacuna inflata,* A. Adams.

L. testa oblongo-ovata, conoidea, umbilicata, tenui, lutescente; spira parva; anfractibus $4\frac{1}{2}$, convexis, striis incrementi longitudinalibus et lineolis elevatis creberrimis transversis decussatis; anfractu ultimo ventricoso, ad peripheriam rotundato; apertura patula, ovata; rima umbilicali angusta.

Hab. Rifunsiri (on the shore).

A thin ventricose yellowish shell with a short small spire, and the whorls with the striæ of growth crossed by fine transverse elevated lines.

3. *Lacuna turrita*, A. Adams.

L. testa elongato-conoidea; spira elata, vix rimata, tenui, pallide fusca aut livida, apice violascente, basi fascia alba circumcincta; anfractibus 4, convexis, striis incrementi et lineis transversis decussatis; anfractu ultimo rotundato; apertura ovato-orbiculari, basi subproducta.

Hab. Rifunsiri (on the shore).

This is a somewhat turreted species, partaking of the general character of *L. crassior*, Walker; the umbilical region is white, there is no distinct umbilical fossa, and the last whorl is encircled with a white zone.

Genus Teinostoma, H. & A. Adams.

Teinostoma Carpenteri, A. Adams.

T. testa orbiculato-ovata, superne convexa, lactea, opaca, lævi, nitida; umbilico callo obtecto; anfractibus rapide crescentibus; apertura producta, antice acuminata; labro supra anfractum penultimum reflexo.

Hab. Gulf of Pe-chili; 7 fathoms.

The only shell at all resembling this is *Teinostoma amplectans*, Cpr., which, however, has a rounded aperture, whereas in this species it is anteriorly produced, as in the type, *T. politum*, A. Ad. The spire is entirely concealed by the last whorl, leaving only a minute pit at the apex, and the umbilical callus has a slight rimal fissure.

Genus Adeorbis, Searles Wood.

Adeorbis sinensis, A. Adams.

A. testa discoidali, spira prominula, alba, subporcellana, opaca, striis incrementi radiantibus et lineis spiralibus transversis decussata; anfractibus regulariter crescentibus, ultimo ad peripheriam obtuse angulato; umbilico patulo, perspectivo, margine carinato; apertura quadrato-orbiculari; labro mediocri.

Hab. Gulf of Pe-chili; 4 fathoms.

This is a rather large opake-white species, having very much the aspect of *Ethalia*; but there is no trace of an umbilical callus.

Genus Ethalia, H. & A. Adams.

1. *Ethalia atomaria*, A. Adams.

E. testa perparva, ovato-discoidali, alba, semidiaphana, radiatim striata; spira planata; anfractibus rapide crescentibus; umbilico callo omnino obtecto; labro producto.

Hab. Kala-hai; Shan-tung.

This is a small white semitransparent shell, with the umbilical region entirely covered by a callus, and the outer lip produced.

2. *Ethalia perspicua*, A. Adams.

E. testa perparva, ovato-discoidali, alba, pellucida, striis incrementi conspicuis radiantibus ornata; spira planata; anfractibus rapide crescentibus; basi excavata; umbilico callo obtecto; labro producto.

Hab. Kala-hai; Shan-tung.

This species differs from *E. atomaria* in being pellucid, in the umbilical region being impressed, and in the conspicuous radiating lines of growth.

3. *Ethalia sobrina*, A. Adams.

E. testa parva, discoidali; spira planata; anfractu ultimo ad peripheriam obtuse angulato, callo semilunari umbilicum partim tegente; labro supra anfractum penultimum dilatato.

Hab. Tabu-Sima; 25 fathoms.

The species *E. amplectans*, Cpr., seems to agree most nearly with this, which has induced me to name it *E. sobrina*; it is, however, larger, and does not present the peculiarities in the callus mentioned in the Catalogue of Mazatlan Shells.

Genus Niso, Risso.

I may observe here that the only true species of *Niso* obtained by me in the Sea of Japan are the following:—

1. *Niso interrupta*, Sow.

Bonellia interrupta, Sow. Conch. Illustr.

Hab. Mino-Sima; 63 fathoms.

2. *Niso brunnea*, Sow.

Bonellia brunnea, Sow. Conch. Illustr.

Hab. Mino-Sima; 63 fathoms.

The *Bonellia imbricata* of Sowerby should form a distinct genus or subgenus, which may be thus characterized:—

Subgenus Volusia, A. Adams.

Testa turrita, axi perforata; anfractibus angulatis, transversim striatis. Apertura subquadrata, antice angulata et producta.

3. *Volusia imbricata*, Sow.

Bonellia imbricata, Sow. Conch. Illustr.
Niso imbricata, A. Adams, Proc. Zool. Soc.

Genus CONRADIA, A. Adams.

Conradia pulchella, A. Adams.

C. testa turbinata, rimato-umbilicata, sordide alba; anfractibus $3\frac{1}{2}$, convexis, supremis cancellatis, ultimo liris elevatis transversis septem instructo, superne ad suturam plicis radiantibus tenuibus ornato; basi liris concentricis, interstitiis concinne clathratis ornata; apertura circulari; labro margine simplici.

Hab. Tsu-Sima; 26 fathoms.

This is a small but very beautiful species of a genus which now numbers four species, all from the Sea of Japan. It is characterized by a delicate and elaborate style of sculpture.

Genus VANESIA, A. Adams.

Vanesia sulcatina, A. Adams.

V. testa subulato-conica, imperforata, tenui, sordide alba; apice eroso; anfractibus $5\frac{1}{2}$, convexiusculis, transversim sulcatis, sulcis exaratis, regularibus, subdistantibus; apertura ovato-acuminata, antice rotundata, producta, evasa; labro margine acuto.

Hab. Sunday Island, Coast of Manchuria; dredged from 20 fathoms.

This *Melania*-like species was obtained at the same time as the typical *V. trifasciata*, A. Adams, and resembles the group of Melaniidæ separated by my brother and myself from the genus *Vibex* under the name of *Juga*. I know of no other genus than *Vanesia* to which I can refer this marine likeness of *Melania*.

Genus ASSIMINIA, Gray.

1. *Assiminia lutea*, A. Adams.

A. testa conoidali; spira conica, elata, epidermide tenui obtecta, pallide lutea; anfractibus $5\frac{1}{2}$, vix convexis, ultimo rotundato; apertura rotundato-ovata; regione umbilicali impressa; labio lato, effuso, superne incrassato.

Hab. Estuary of the Pei-ho.

2. *Assiminia cincta*, A. Adams.

A. testa globoso-conoidali, tenuicula, epidermide cornea obtecta, pallide fulva; spira brevi; anfractibus $4\frac{1}{2}$, convexis, ultimo fasciis transversis rufo-fuscis duabus cincto; apertura ovato-rotundata; labio lato, calloso, rufo tincto.

Hab. Estuary of stream near Great Wall.

Genus STENOTHYRA, Benson.

1. *Stenothyra glabra*, A. Adams.

S. testa oblonga, lævi, polita, semipellucida, aurantiaca; anfractibus $4\frac{1}{2}$, convexis, supremis transversim obsolete striatis; suturis marginatis; peritremate continuo; anfractu ultimo ad aperturam concentrice striato.

Hab. Estuary of the Pei-ho.

2. *Stenothyra gibba*, A. Adams.

S. testa ovato-subtrigonali, compressa, semiopaca, pallide lutea, aurantio tincta; anfractibus $4\frac{1}{2}$, convexis, gibbosis, transversim striatis, striis obsolete punctatis.

Hab. Hulu-Shan, Gulf of Lian-tung; banks of rivulets.

Genus Tomichia, Benson.

1. *Tomichia Bensoni*, A. Adams.

T. testa rimata, epidermide rufo-fusca obtecta; spira elata, apice truncato; anfractibus 4, convexis, longitudinaliter strigosis; apertura ovato-elliptica; peristomate continuo, incrassato, extus subvaricoso.

Hab. Matsumai; Yesso.

2. *Tomichia japonica*, A. Adams.

T. testa rimata, epidermide olivacea obtecta; spira elata, apice truncato; anfractibus $3\frac{1}{2}$, convexiusculis, longitudinaliter strigosis, lineis virido-fuscis transversis ornatis; apertura ovato-elliptica; peristomate continuo, duplicato, interno recto, subacuto, externo valde incrassato.

Hab. Sado.

This species differs from *T. Bensoni* in being smaller and shorter, with the whorls less convex, and in the peritreme being double, the outer thickened and continued round the base.

Genus Cecina, A. Adams.

Tentacula lobiformia, plana, apicibus obtusis rotundatis. Oculi magni, nigri, non prominentes, sine pupillis, ad basin externam tentaculorum positi. Rostrum elongatum, cylindricum, annulatum. Pes brevis, oblongus, utrinque rotundatus.

Operculum ovatum, corneum, subspirale.

Testa imperforata, subcylindrica, epidermide olivacea obtecta; apice obtuso, eroso, non truncato; anfractibus planis, lævibus. Apertura ovata, verticali, antice rotundata, postice acuminata; peritremate continuo, vix incrassato; labro flexuoso, in medio subproducto.

Cecina manchurica, A. Adams.

C. testa subcylindrica, imperforata, epidermide olivacea obtecta; apice obtuso, eroso; anfractibus $4\frac{1}{2}$, planis, lævibus; suturis obliquis; apertura ovata; labio vix incrassato; labro in medio subdilatato.

Hab. Olga and Vladimir Bays, Manchuria (under damp logs near the sea).

The nearest approach I can find to this animal is *Truncatella*;

but the shell is not ribbed, and otherwise differs. In some respects it resembles *Geomelania*; but the shell, again, is smooth, and covered with an olive epidermis, like that of *Acicula* and *Tomichia*. The animal, however, certainly does not agree with *Tomichia*, which I have lately had an opportunity of observing in two Japanese species, nor with *Acicula*, if, indeed, this genus has been correctly described.

Dr. Pfeiffer, in his account of *Acicula*, observes, "Eyes on the upper part of the head; tentacula subulate;" and Dr. Gray says of the same genus, "Eyes on the back of the head, between and rather behind the base of the tentacula." The figure of *Acicula fusca*, copied from Hartmann by my brother and myself, in our 'Genera,' has subulate tentacles; and the same is the case with my figure of *Truncatella* in the same work, which was taken from a very lively individual which I had in my possession for some time. If I had only observed a stray example of *Cecina* in confinement, I should have thought the animal was sick, and that the tentacles were contracted; but I have seen hundreds crawling about the damp rotten logs, after I had turned over the latter for the purpose of watching the habits of these strange little mollusks. They resemble *Truncatella* in their mode of progression—fixing their long muzzle and dragging their shell and body close up to the fixed point, and then, fixing in turn their short foot, advancing the muzzle for another stride.

Shanghai, China,
Jan. 15, 1861.

XXXIV.—*Further Observations on the Structure of* Foraminifera, *and on the larger Fossilized Forms of Scinde, &c., including a new Genus and Species*. By H. J. Carter, Esq., F.R.S.*

[Plates XV. XVI. & XVII.]

Since my observations on the structure of *Operculina arabica* and my description of some of the larger forms of fossilized Foraminifera in Scinde were published, in 1852† and 1853‡ respectively, many valuable contributions have been made to our knowledge of the structure and species of the Foraminifera, amongst which those that I shall have to refer to most here are MM. le Vicomte d'Archiac and J. Haime's 'Monograph on the Nummulites§,' and Dr. Carpenter's 'Memoirs' on the structure

* Communicated by the Author, having been read before the Bombay Branch of the Royal Asiatic Society, April 11, 1861.—A brief summary of the results was given in the September Number of the 'Annals.'

† Ann. & Mag. Nat. Hist. ser. 2. vol. x. p. 161. ‡ *Ib.* vol. xi. p. 425.

§ Description des Animaux Foss. du Groupe Nummulitique de l'Inde. aris, 1853.

of *Orbitolites, Orbiculina, Cycloclypeus, Heterostegina**, and *Operculina*†, because they have enabled me most to correct, add to, and explain what I have already stated respecting the Foraminifera,—it being easily conceived that, in a branch of knowledge like this, which is still in its infancy, every contribution that is worth anything will probably more or less revolutionize that which has preceded it, at the same time that it will claim for its author that consideration for his errors and omissions which such progressive knowledge demands.

It might be asked, why I do not write complete editions of my papers, instead of giving simply corrections, additions, &c. My reply is, that I have not time to do this now, and therefore record what I have to offer for the use of others for this purpose, or for my own use on some future occasion, as the case may be.

Needing then no other introduction than this, I will only further premise (as much of what I have already stated has been denied) that, in my paper of 1852 on the structure of *Operculina arabica*, to which was added an illustration of an infiltrated Nummulite (*N. acuta*), showing that the canal-system was the same in both, I observed that the former would "elucidate all that has hitherto been stated of, and leave little to be added to, the general structure of foraminiferous shells, both recent and fossil;" and I am glad to be able to add now (viz. ten years since this observation and my description of the structure of *Operculina* were written), that I have not stated in either anything which I wish to recall. Since then, however, Ehrenberg has confirmed what I have described and illustrated respectively of the canal-system in *Operculina* and *Nummulites* (viz. in *Nummulites striata*, in 1855‡); and lately I have been able to repeat this myself most satisfactorily in another of the *Striatæ*, viz. in *N. Ramondi* (mihi), as I shall show hereafter.

I would also mention here my regret that, in my paper on the structure of *Operculina arabica*, I did not observe that Professor Williamson had previously pointed out the existence of the canal-system in part, viz. in the marginal cord of *Nonionina* §. This arose from ignorance of the fact; for I never have been able even up to this day to obtain the volume of the 'Transactions of the Microscopical Society of London' (1st ser. vol. iii.) in which it was published; while that on *Faujasina*, by the same author, which points out the "intraseptal canals" of this system, although read in 1851, was not published by that Society until 1853 (2nd ser. vol. i.), that is, a year after my paper on *Operculina arabica* appeared in the 'Annals and Magazine of

* Phil. Trans. part i. p. 181, and part ii. p. 549, 1856. † *Ib.* p. 1, 1859.
‡ Phil. Trans. 1859, p. 28. § *Ibid.*

Natural History;' and hence the reasons for Prof. Williamson's discovery having been omitted.

Further Observations on the Structure of Foraminifera.

Operculina, D'Orbigny.

In Dr. Carpenter's elaborate and valuable paper on the structure of this genus, taken from specimens of *Operculina arabica* originally obtained from the Philippine Islands, he has made an important addition to what I have stated on the subject in one respect, and anything but one in another, inasmuch as he has denied the spicular structure of the marginal cord, which is one of the most palpable objects in the test.

The important fact that he has added is the discovery, in the canal-system, of a main spiral trunk, which commences with the spire, in duplicate (that is, one in each horizontal half of the test), and follows it to its termination. These two large trunks, to which Dr. Carpenter has applied the name of "spiral canals," he states, "though only running along the angles of the marginal cord, pretty obviously communicate with the plexus of passages which it contains; and thus the interseptal system of one whorl is brought into direct connexion with that of the preceding*." To complete this description, I would add that, in the first two or three turns, the interseptal canals form a *direct* bond of union between the spiral canals, but afterwards only by some of their branches, as the interseptal canals then go to the inner side of the marginal cord, where they divide into branches, and the great spiral canals remain continuous outside, at the point of junction of the spiral lamina and the cord.

I had observed these canals, as may be seen by my illustration (fig. 5, *loc. cit.*), where the interseptal canals of the outer whorl are represented as springing from one of them, but had not specially recognized them as they deserved, and as has now been very fortunately done by Dr. Carpenter. But MM. D'Archiac and Haime had recognized and figured them, without knowing what they were, even before this, in *Nummulites planulata* (pl. 9. fig. 7, p. 63), where they state, with reference to "the grooves" in the marginal cord, "Une seule espèce (*N. planulata*) offre de chaque côté du bourrelet un sillon environ cinq fois plus large que tous les autres. Les canaux moyens s'ouvrent presque toujours dans ces sillons." No doubt, therefore, exists in my own mind, from having also seen them in a closely allied Nummulite, viz. *N. Ramondi* (Pl. XVII. fig. 15 *ff*), that the "sillons" represented in the figure mentioned are the "spiral canals" described by Dr. Carpenter in *Operculina*.

* Phil. Trans. 1859, p. 28.

On the other hand, the more important fact, which Dr. Carpenter has failed to recognize after my description of it, is the spicular structure of what he terms the "marginal cord," which had been previously named by myself the "spicular cord," to denote its peculiar composition, and under which appellation, although I like the former name much, I must still continue to allude to it.

I need hardly quote all that Dr. Carpenter has stated respecting the structure of this part of the test of *Operculina*; suffice it therefore to notice that he considers its structure homogeneous, and not spicular. Thus he observes, "the supposed spicular composition of this 'marginal cord' (as it may be appropriately termed) is due to the peculiar manner in which the homogeneous substance of which it is composed is traversed by the set of canals that are correctly described by Mr. Carter as forming the 'marginal plexus *.' "

Now, I would rather not have had to repeat what I stated respecting the structure of this cord ten years since; and I feel certain that, if Dr. Carpenter had taken a favourable specimen of *Operculina*, and with a small, sharp scalpel had cut off tangentially portions of this cord, there would have been no occasion for it. However, these subjects seldom lose by a second investigation, and the result of mine in this instance is, that I am not only more convinced of the spicular structure of the cord than ever, but am now able to describe its composition much more definitely than has hitherto been done.

Thus, this cord, which is almost semicircular, with the arch or convex part outwards and the chord or base within, is composed of—1st, spicules; 2nd, an interspicular substance; and, 3rd, a plexus of anastomosing canals (Pl. XVII. fig. 11).

The spicules (fig. 10) are semitransparent, homogeneous, crystalline, calcareous bodies, more or less fusiform in shape, and arranged one above another irregularly and interdigitatingly, in horizontally inclined planes, which, like the leaves of a book when open, radiate partly from the centre of the "chord" and partly along this chord on either side—that is to say, they do not all radiate from a common point; while there are also a certain number of semiplanes at the circumference, which fill up the intervals formed by the radiating of the whole ones (fig. 11 *e*).

The interspicular substance is an areolar, calcareous, membranous structure, which unites the spicules together and the planes to each other respectively. It resembles and is analogous to the albuminous tissue which surrounds and unites the spicules in the spiculiferous Sponges.

Lastly, the plexus of anastomosing canals consists of reticu-

* Phil. Trans. 1859, p. 25.

lated planes of these canals which lie between the planes of the spicules (fig. 11 *d*), the canals of which anastomose with each other through the spicular planes, communicate with the interseptal canals, and open on the surface of the cord respectively.

In some, if not in all, specimens the spicules not only exist throughout the cord (for they can be seen on its inner aspect, where the cord is in contact with the outer margin of the chambers), *but are continued inwards over the interseptal spaces almost to the centre of the Operculina.*

Now, if the substance of the cord were homogeneous, the structures mentioned in it could not be defined. If it were simply the "peculiar manner" in which its homogeneous substance were "traversed by the set of canals" which it contains, as stated by Dr. Carpenter, then portions of the cord, on transverse fracture, could not be made to present the ends of spicules at the fractured points, nor could portions of the cord fall out, on fracture longitudinally, in the form of spicules. Nothing but certain portions of the cord being harder than the rest, and these portions being of a spicular form, could give rise to either of these appearances; while if it be the "peculiar manner in which the homogeneous substance of which it is composed is traversed by the set of canals" which gives the cord an appearance of spicular structure, how is it that this spicular appearance exists over almost all the interseptal spaces of some specimens where there is no plexus, and no canals but a few short ones which pass through it almost perpendicularly? It is, however, useless to have recourse to argument for conviction when the fact can be demonstrated; so we will turn our attention to another point in the economy of this shell, viz. the "canal-system."

As regards the use of the canal-system, nothing yet has been definitely assigned. I formerly thought that it subserved the purpose of a water-circulation, as in Sponges,—viz. the water going in by the ends of the small canals which open on the horizontal surface of the test, and coming out through the orifices of the larger ones on the surface of the spicular cord; and I now think that this may be a part of their function, at the same time that they may draw in nutritious particles by the small pores also, like the Sponges. The anastomosing canals, resembling also in appearance and function the mycelium of Fungi, serve to convey portions of the sarcode (upon which the canals themselves are first moulded) to the points from which new portions of the organism are to be developed, while they undoubtedly, too, in part, perform the office of excretory channels; for in the recent and living specimens of *Operculina arabica* which I obtained on the coast of Arabia, the sarcode of the interseptal canals, after the calcareous matter of the test has been removed by acid, remains in connexion with the membranous chambers by short branches, through which globular bodies (to which I shall more particularly allude presently), that are more or less present in the chambers, readily pass, on pressure, into the larger interseptal canals; and again through these, probably by the openings on the spicular cord, during the living state, they would have obtained an exit. That the sarcode of the canal-system also carries on the development of the organism independently of the chambers, is proved by the development of the test continuing after the chambers have ceased to be formed, as will also be hereafter mentioned.

Lastly, the substance covering the horizontal surface of the test, which I have likened to the cuticle of shells, in accounting for the formation of the horizontally-laminated structure of the test, and have inferred to be connected with the sarcode of the chambers through its vertical tubuli, MM. d'Archiac and Haime have more properly likened to the "épiderme des échinides ou de l'épithèque des polypes" (p. 69). But what I meant is seen by the context in my paper, viz. that, in its dry state, it was merely *like* the cuticle of shells in appearance, and not identical with it.

Of this substance Dr. Carpenter states nothing in his paper on *Operculina*; but in his description of *Orbitolites* he observes, in a foot-note (p. 207), "I have little doubt that 'the greenish' cuticle described by Mr. Carter as covering his *Operculina arabica*, and supposed by MM. d'Archiac and Haime to be specially connected with the formation of the shell, is of the same nature," that is, of the nature of "a covering of vegetation, chiefly composed of Diatomaceæ, Desmidieæ, and other minute Algæ." To which I must simply reply that "such a mistake is impossible with a practical microscopist." Moreover, lately I have had to examine some "deep-sea soundings" from the Arabian Sea, in which there were many minute Foraminifera; and as it is at such depths that the Foraminifera are most likely to be taken up alive, or with the living sarcode of the animal in their tests, so most of these were covered with the so-called "cuticle" first seen on the substance of *Operculina arabica*.

But are not the horizontal or "spiral" laminæ (as they have been termed by D'Archiac and Haime, in *Nummulites*) of *Operculina* composed almost entirely of vertical tubuli which establish a direct connexion between the cavity of the chambers and the surface, and between the chambers of the overlying layers in *Nummulites*? Is not the sarcode which fills the cavities of the test of *Operculina*, &c., like that of the Rhizopoda generally, whose portions flow together when they come in contact; and would they not thus form a layer over the surface of the test? And could the horizontal layers of the test be formed in any other way, or are they likely to be so, under such circumstances? Lastly, is not all this in favour of what I have stated, viz. that there is a substance in appearance like the "cuticle" of shells, over the dried specimens of Foraminifera which contained the living organism when they were taken out of the water? But, as I have already observed respecting the spicular structure of the cord, the fact does not rest upon argument, but can be demonstrated; and upon demonstration I made the statement ten years ago!

The "vertical tubuli," as just stated, connect the chambers with the surface, not only in *Operculina*, but in the tests of *Nummulites*, *Orbitoides dispansa*, and *Orbitolites Mantelli*; and it is through their agency chiefly that the layers of shell and the chambers are vertically formed.

The openings on the horizontal surface over and about the septal spaces are those of canals connected with the great interseptal system. They are the same as MM. d'Archiac and Haime's "canaux d'une troisième grandeur," or middle-sized canals."

But, besides these openings, there are spaces and lines in *Operculina* which are composed of shell-substance alone, that is, without the presence of the vertical tubuli or the middle-sized canals; and these in the test of the recent *Operculina* have the appearance of homogeneity and transparency, but are opake and white in the fossilized one, where they evidently are identical with the opake-white portions of *Nummulites*, which have afforded MM. d'Archiac and Haime some of their chief distinguishing characters; and thus the latter are proved not to be what they supposed them, viz. remains of "larges canaux," but, originally, transparent portions of the shell, unaccompanied by any canal, except accidentally, as will be more particularly shown hereafter.

Animal of Operculina.—Hardly anything more of the animal of *Operculina* is known now than when my description of the test was published; and I now, as then, cannot help thinking that the existence of the animal matter of the *Robulina* which I examined at sea, and thought to be in the form of a worm in "loops" in the chambers, united by constrictions where the chambers joined, close to the spicular cord, was a fallacy; for the observations were made at sea, in a little vessel, on the deck, in the open air, with simple though powerful lenses; and since then, all that I have been able to obtain from the specimens of *Operculina* which had living animals in them when they were taken, is a number of membranous sacs, corresponding in form with that of the chambers, and united by a like membranous structure at the base, where the latter are in contact with the spire or spicular cord,—united also with the membranous tubes of the interseptal canals—those of the marginal plexus on both sides, those which unite the chambers themselves together across the interseptal spaces, and, lastly, others which unite the chambers with the vertical tubuli which open on the horizontal surface of the test.

Besides this, the chambers have generally been more or less filled with minute, spherical, nucleated bodies, the note of whose size I have mislaid, similar to those which I have described and figured in the freshwater Rhizopod called "*Euglypha*," and which I have considered to be embryonal cells (Ann. Nat. Hist. ser. 2. vol. xviii. pl. 5. fig. 26, and vol. xx. pl. 1. fig. 196, &c.), which, again, are like those figured by Dr. Carpenter in the cells of *Orbitolites* (Phil. Trans. pl. 4. fig. 3), and which he views as the sarcode broken up into propagative "gemmules." My own view of them in *Operculina* also is, that they are propagative bodies of the species. But the most interesting point which their presence in the chambers of *Operculina* has elicited with me is that by slight pressure they can be easily made to pass through the short channels of communication which exist between the chambers and the interseptal canals, into the latter,—showing thus, as before stated, that one of the uses of the interseptal canals is to give exit to these bodies through the branches of the marginal plexus which open on the surface of the last or outermost turn of the spicular cord.

The bond of union between the chambers at the spicular cord is not tubular; or, at least, I never saw the propagative spherules pass from one chamber to the other through it, while I am inclined to think that this bond is chiefly composed of the sarcodal plexus of the spicular cord, and that from *this* the chambers are developed, as will be better understood presently—also that the part of the plexus which is more directly concerned in uniting the chambers occupies the free surface of the spicular cord, and gives rise to that arched opening which exists between the septa and the spicular cord. The free margin of the septum here also frequently presents a scolloped form, as if it had rested on a plexus of sarcodal filaments, while in some cases I have not been able to distinguish any aperture between the septum and the cord at all, indicating that the two are sometimes in contact. All this seems to show that the chambers are developed from the marginal plexus, and not from each other.

As regards the function of the chambers, the presence of the nucleated spherules above mentioned in them seems to indicate that they are the reproductive organs; and the fact that in *Alveolina elliptica* they are frequently almost wanting altogether, while in other instances they are interrupted two or three times by several turns of the cortical part alone (which part is analogous to the spicular cord of *Operculina*), and that in the globose Nummulites the chambers are frequently not distinguishable in the outer turns, shows that the development of the test can go on without the presence of the chambers, and therefore that they are probably supplementary and propagative. Indeed, the approximation of the turns of the spire, or those of the spicular cord, which, of course, must entail a corresponding diminution in the size of the chambers, will be found by-and-by to indicate the full size of the species, in which the subsidence of the generative force appears to be thus indicated.

As yet, however, we know very little about the animal of Foraminifera, chiefly because we are so ignorant of the forms allied to it. The same is the case with the animal of *Spongilla*, which I have described (Ann. Nat. Hist. vol. xx. 1857). It fails to elicit much attention because, at present, it has no known alliances; but by-and-by, when these are found out and more forms of the same kind are discovered for comparison, the nature and position in organic development of these beings will be realized and their component parts understood. Till then they must remain in abeyance.

Mode of growth.—The mode of growth in *Operculina* and *Nummulites* is the same; that is, the horizontal portions, or spiral laminæ as they have been termed by MM. d'Archiac and Haime, are developed from the sarcode of the chambers passing through the vertical tubuli, while the spicular cord and the chambers in the first instance spring from the marginal plexus of sarcodal filaments. The latter is shown in *Alveolina*, as above stated, where the chambers cease to be developed and then appear again after several turns of the spire have been completed by the cortical layer alone, which part, as before stated, is analogous to the spicular cord. Both the segments of *Operculina* and those of *Nummulites* begin to be formed from the spicular cord, and three or more of the last are generally in successive stages of development, the last of all being the least formed. This must not, however, be confounded with the last chambers of the fully-developed *Operculina*, which, like those of *Nummulites*, are also successively less in size.

More recent Observations.—Since the above was written, I have again determined, for examination, to sacrifice two or three more of the few specimens I still possess of *Operculina arabica* containing the living animal when they were brought up with the "sounding-lead," on the south-east coast of Arabia, in 1844, now of course dry; and for this purpose one of these was placed in very weak spirit and water for a night first, another examined at the moment of being broken up in water, and a third subjected to a very weak solution of nitric acid and water for a night, with the following results:—

It was found that, in the latter experiment, the chambers and the canals, after having been gradually deprived of their calcareous matter, still retained their form in a membranous state (Pl. XVII. fig. 12); and under this condition they will now be described.

Chamber.—The horizontal or exposed walls of the chamber, in a membranous state, present a number of semi-opake circular bodies arranged in a pavement-like form close together, each of which has a depression or hole in the centre, and these correspond to the "vertical tubuli" (fig. 12 *a*, *b*); while the septal borders (*c*) are composed of a transparent membrane without these bodies, but pierced here and there with large holes (*f f*), from which tubes are extended to the interseptal canals. The marginal border of the chamber is also supplied by a transparent membrane loosely attached to the spicular cord, but the base or internal margin is firmly fixed to the marginal plexus of canals, now, of course, in the way we are examining them, all rendered membranous by the absence of the calcareous matter.

The chamber thus reduced to a membranous state is found to contain in its cavity various bodies (fig. 11 *e*), viz. small and large spherules (figs. 13, 14), and starch-grains, to which we will now severally direct our attention.

Small spherule (fig. 13).—This consists of a spherical portion of semi-opake homogeneous matter, surrounded by a delicate spherical transparent cell, 1-5400th of an inch in diameter. The chamber may contain a few only, or be crammed with these bodies; and they are observed to be attached in masses to branched stems or filaments, like bunches of grapes.

Large spherule (fig. 14).—The large spherule consists of a spherical portion of homogeneous matter charged with granules and enclosed in a spherical transparent capsule about 1-1800th of an inch in diameter. The capsule is not always visible, if present, and the form frequently slightly elliptical, while the colour is sometimes yellowish by transmitted light, like that of dried albumen, and at others white by reflected light, as if there were calcareous matter in it; perhaps the former difference may be from drying or pressure, while the latter is evidently that of advancement in development.

Starch-grains.—These are thin, flat, and variable in size, but otherwise bear the unmistakeable characters of the "starch-grain." They were not numerous, but always present, and, with many portions of the other soft substance of the cavity of the chamber, became purple and blue respectively, under the influence of the deliquescent yellowish liquor of iodide of potassium assisted by a little sulphuric acid.

Canal-system.—The canals (fig. 11 *d*) having been deprived of their calcareous matter, became equally membranous with the chamber; and those portions forming a communication between the chamber and the "interseptal canals" freely admitted the largest spherules to pass through them from the former to the latter (*f f*); besides this, I find a number of them, in one of my dried specimens without the animal, in all parts of the canal-system.

From these facts we learn that there are two kinds of spherules produced in the chambers, the larger of which appear to be but an advanced state of the smaller; but whether this be the correct view, or that the smaller ones are the sperm-cells or some other organ belonging to the chamber, remains to be shown. That the large spherules cannot be viewed in any other light than as propagative bodies, there can be no doubt now; but whether, again, these are impregnated or unimpregnated reproductive agents also remains to be shown. That they are the same with what I have already pointed out as the reproductive agents both in the *Euglyphæ* and in *Amœba verrucosa* (*loc. cit.*) appears also to me to be undoubted.

The next fact is, that the passage of these bodies freely from the chamber into the interseptal canals proves that one use at least of the canals is, as before stated, to give exit to the contents of the chambers.

Lastly, the presence of starch-grains, although not wonderful, as the organism is distinctly a Rhizopod, and starch-grains abound in *Spongilla*, especially in the capsules, is nevertheless interesting, as their presence also in the winter-eggs of the fresh-water Polyzoa and the close resemblance of this "egg" to the capsule of *Spongilla* thus make the presence of starch-grains in all, one point, at least, which so far allies these organisms. Not only this, but the resemblance of the canal-system, or rather the sarcodal filaments which it contains, to the mycelium of Fungi, as before noticed, and the evident connexion that also exists between *Spongilla* and some of the parasitic developments of the cell-contents of the Algæ (now properly regarded by Pringsheim as allied to *Achlya* and *Saprolegnia*)—whose spores, first consisting of monociliated polymorphic cells, then lose their cilium and become simple Rhizopods, while other developments of this kind are distinct Fungi putting forth sporangia with defined, cell-walled sporules,—seem to point out the passage of the animal into the fungal kingdom through the Foraminifera and Sponges. The parasite to which I more particularly allude is that termed by Pringsheim *Pythium entophytum*, which grows out from the cell-contents of *Spirogyra*, and in its sporangia produces the monociliated spores mentioned, which, in 1857, I described as furnishing an instance of the "transformation of the vegetable protoplasm into *Actinophrys**," forsaking my original argument that these products *must* be parasitical, which Pringsheim's discoveries have now confirmed†.

Besides the course which the spherules have for their exit through the canal-system, some of my recent specimens present a hole here and there at the base of the few last chambers, opposite the great spiral canal, in which holes the large spherules, now white, may be seen, as if in the act of being voided, and probably from the great spiral canal. A single large hole, with a smooth margin, evidently formed by the animal itself, also appears here and there, sometimes, in the side of the chambers; and this may have been for the purpose of giving exit to young *Operculinæ* which had become too large to obtain their issue in the ordinary way, such as those noticed by Prof. Schultze in the *Rotalidæ* (Ann. Nat. Hist. vol. vii. p. 306, 1861) and also by Dr. S. Wright (*ib.* vol. vii. p. 357). But both these kinds of holes must be regarded as accidental, and not as regular developments of the test.

Nummulites.

The structure of the test of *Nummulites* is precisely that of *Operculina*, *plus* the lateral or vertical growth of the former, which is but a repetition, in plan, of the horizontal plane. Of this I was aware in 1852, when my description of the structure of *Operculina* was published, and my diagram of an infiltrated specimen of *N. acuta* (Ann. Nat. Hist. *l. c.*), to confirm this, accompanied it. Since then, as before stated, the "canal-system" has been figured by Ehrenberg from an infiltrated specimen of *N. striata*; and within the last twelve months I have been able to see everything which I have described in the test of *Operculina* exemplified in richly infiltrated specimens of another of the *Striatæ*, viz. *N. Ramondi*, accompanied by equally richly infiltrated specimens of *Operculina*; so that the means of identification has, through the latter, been most satisfactory.

Canal-system.—The lateral or vertical development of *Nummulites* being the only additional part to the horizontal plane as it exists in *Operculina*, I have merely to state concerning the canal-system of this, that radiating branches are continued upward towards the centre or umbilicus of the Nummulite from the great "spiral" canals of the cord, or from others near this, along each interseptal space, and from each turn of the

* Ann. Nat. Hist. ser. 2. vol. xix. p. 259.

† Ann. des Sc. Nat. xi. p. 349, pl. 7, Bot. 1859.

cord; that vertical branches also, from each turn of the cord opposite the interseptal spaces respectively, keep up a communication (by joining the radiating branches of the different layers of the spiral lamina) between the marginal plexuses of the turns of the cord and the surface; and that, in some Nummulites, where there is a transverse division in the portions of the chambers extending up towards the centre, corresponding with the turns of the spire, the radiating branches are connected by transverse ones; so that, in fact, each chamber is surrounded by an anastomosing circle of canals thus formed, while, in the reticulated Nummulites, this anastomosis becomes retiform from the reticulated division of that part of the chambers which enters into the composition of the spiral lamina. Lastly, the canal-system sends off branches which open on the surface in the course of the interseptal spaces and along the spiral canals, as in *Operculina*. Thus in each lamina of the Nummulite the canal-system of the horizontal plane is repeated.

Vertical tubuli.—These enter into the formation of each spiral lamina just as they do into the single one of *Operculina*.

Non-tubular spaces.—Such are parts of the test which are not traversed by either the vertical tubes or the branches of the canal-system, and, as before stated, in recent *Operculina* are marked by a homogeneous semitransparency of the shell-substance, while in the fossilized species they are opake and white, —a transition which leads to the knowledge of what they are and were in *Nummulites*. They may be linear, radiating, or sinuous, as when forming that part of the test over the interseptal spaces, or punctiform, as when in the midst of the vertical tubuli, and in both positions afford signs, according to their form and number, for specific distinction. In *N. biaritzensis* these white parts may be seen to form also a minute branchwork, which extends perpendicularly outwards from the septal lines; and in *N. perforata* a similar branchwork may be observed to spread both from the septal lines and the puncta (very like the lacunæ and their branchwork in bone), but to such an extent in some specimens as to present a minute reticulation all over the cameral spaces, so much resembling a capillary canal-structure, that, at first sight, there seems to be no doubt of it. However, their being formed of an opake-white substance like the septal lines and the puncta first leads to the opinion that they are not tubes; and this is confirmed by microscopical examination of portions of the spiral lamina of *N. perforata* presenting this structure, when ground down to a thinness sufficient to allow the light to pass through them; for besides the absence of any double line indicative of the presence of a tube in these white lines (which are then found to be made up of little disjoined portions of opake material), a lash of branches from the "canal-system" may here and there be observed to come through one of the puncta, and spread out among these white lines, when the double line and transparency indicative of a continued canal in them, at once, and by contrast, shows the nature of both. Thus, from what has been stated, we see that neither the white puncta nor the minute white branchwork of lines were ever tubular. In most Nummulites the white puncta appear on the surface, and, when examined in a vertical section of the Nummulite, are observed to be more or less conical, and of different lengths according with the date of the commencement of their development, those which began with the earliest parts of the Nummulite being longest. They arise in points from the surface of the chambers and the interseptal spaces, and end at the periphery, on a level with the rest of the test; but, being harder than the latter, they project on weathering, become rounded, and thus give the fossil a more or less granular surface. Now, in none of these white lines, white puncta, nor minute white branchwork, have I ever been able to see any indication, either in recent *Operculina*, the fossilized infiltrated one, or in *Nummulites*, of any branches of the canal-system, except by accident. Neither in the ends of the columns in *Orbitoides dispansa*, which are the same as those of Nummulites, have I, in the most richly and minutely infiltrated specimens, been able to see, in the ends of the white columns on the surface, any red or yellow point indicating that they are always in connexion with a branch of the canal-system which traverses them longitudinally. So we must set these portions down as having nothing to do with the canal-system, however much they may conduce to the strength of the test.

Thus we see that the "très-petits canaux" of MM. d'Archiac and Haime (p. 60) were the "vertical tubuli;" their "canaux moyens" the openings of the canal-system on the surface and along the spiral canals and spicular cord; and their "larges canaux" no canals at all, but the ends of the columns of condensed shell-substance. Dr. Carpenter, who also at first considered the latter canals, renounced this view long ago (Phil. Trans. 1856, p. 553, *foot-note*).

Spicular cord.—The same infiltrated specimens of *N. Ramondi* which were obtained from the Rajpipla Hills, a little south of the river Nurbudda, near Broach, that have latterly furnished me with such beautiful confirmations of *Nummulites* possessing the same canal-structure as that in *Operculina*, have afforded almost as much evidence of the spicular composition of the cord; for, besides being accompanied with equally beautiful infiltrated specimens of *Operculina* for comparison, they are all imbedded in a yellow argillaceous limestone, in such a way that, by careful fracture, they fall out with surfaces so polished and even, that their preservation, thus far, may be said to be complete; and hence the marking on the surfaces respectively is most evident. We, therefore, have only to put the margins of *N. Ramondi* and this *Operculina* together, and bring them into the focus of a microscopic power, to see that those on the cord of the *Operculina* are a facsimile of those on the cord of recent *Operculina arabica*, which we know to indicate a spicular composition, and that those on the cord of *N. Ramondi* are precisely like those of the fossilized *Operculina*, with the exception that the lines are less interrupted in the cord of the Nummulite, and are therefore, continuously, much longer, which indicates much longer spicules; but the fact of all the spicules not being of the same form or of the same length in the same species, or of different lengths generally in another most closely allied organism, to wit *Nummulites*, does not affect the verity of the spicular composition of the cord. Indeed, writing of these lines as supposed grooves, MM. d'Archiac and Haime state (p. 63), "Les sillons, dont le nombre et le degré de rapprochement varient un peu, sont sensiblement droits et continus dans la plupart des cas, mais quelquefois (*N. lævigata*, pl. 4) ils sont très légèrement flexueux, et assez fréquemment interrompus." The latter is the case with the lines on the cord of *N. Ramondi*; and the same interruptions or terminations, in a *pointed* form, I have observed in *N. spira*.

Further, on comparing the cords of the two fossils mentioned, viz. *Operculina* and *N. Ramondi*, we observe a number of red points in the lines or intervals between the spicules, which are nothing more than red oxide of iron filling the canals of the marginal plexus in both the Operculina and Nummulite, which open on the surface of the cord. Thus the identity in structure and composition of the surface of the spicular cord in *Operculina* and *Nummulites* is so far complete. But we have still the interior to identify, which, as far as the layers (planes of spicules in *Operculina*) radiating from the inner side of the cord to its circumference go, even to their being constricted at intervals into a number of short portions, and the planes of the canal-system between them, I have been able to see in the *N. spira*, *N. sublævigata*, and *N. Ramondi*, both in the transverse and horizontal section of their cords respectively; still not the remotest trace of the circular or the horizontal lines of the spicules in either the one or the other of these sections have I seen. When, however, it is remembered that, although I have preparations to show distinctly the linear contours of the spicules in the horizontal section of the cord of *Operculina arabica*, and therefore can infer the existence of the circular lines which they must present in the transverse section with certainty, though I have not yet succeeded in making a preparation to show them so satisfactorily in the transverse section (nor can they be demonstrated either in the horizontal or transverse section in fossil *Operculina* under the most favourable circumstances, although they no doubt did exist there, any more than in *Nummulites*), it is not to be wondered at that they should not be demonstrable in *Nummulites*, where crystallization and fossilization must have more or less blended these structures into one mass. But, with the surface-identity mentioned, the presence of the planes of opake matter in the transverse section of the cord (which represent the planes of spicules in *Operculina arabica*), divided partially at short intervals by transverse constrictions (which in *Operculina* define the ends of the spicules), and the transparent planes or intervals in which are seen the truncated ends of the great horizontal canals of the canal-system in recent *Operculina*, I think we have here quite sufficient to enable us to infer that the cord in *Nummulites* was generally of the same composition as that of *Operculina arabica*, but with the spicules much longer; that is to say, that the cord was composed of the same kind of materials: viz. 1st, the crystalline matter of the spicules; 2nd, the interspicular substance; and 3rd, the canal-system. To arrive at this conclusion, however, it is necessary to be first well acquainted with the spicular cord in recent *Operculina*, then to compare this with fossil *Operculina*, and lastly, to compare the latter with *Nummulites*, all of which must be in specimens favourable for the purpose,—since a mere section of the cord of *Nummulites* would inevitably be met with a denial of its spicular composition, so little appearance is there in it of spicules.

Moreover, the "great spiral canals" of the cord of *Operculina arabica*, to which I have alluded at the commencement, and which are evident also in the cord of *N. Ramondi* (though not so evident, if existing at all, in *N. sublævigata*), did not escape the penetrating and sagacious observation of the authors of the "Fossiles de l'Inde;" for they, as I have previously shown, not only figure the openings of the marginal plexus, but also the two great spiral vessels of the cord in *N. planulata*, and describe them in the words which have been already quoted.

Yet, in their work, MM. d'Archiac and Haime have stated (p. 54), "Nous nous sommes assurés, par des observations très multipliées, que dans aucune des espèces de ce dernier genre [*Nummulites*] il n'existe rien qui puisse rappeler la corde spiculaire ni le plexus marginal signalés par M. Carter dans l'Operculine d'Arabie." Had the lamented naturalist whose name is last mentioned been alive, he, with his noble colleague, would now have admitted that what I stated, and showed in a figure, ten years since, at least as regards the existence of the marginal plexus in *Nummulites*, was correct. It has been admitted by Dr. Carpenter (Phil. Trans. 1859, p. 26), although he also still denies the spicular structure of the cord, but will not do so any longer, I think, after seeing my preparations. Dr. Carpenter has, however, long since marked out the skeleton of the spicular composition of the cord, as will be seen by the grooved lines on the surface and the radiating ones in the transverse section, represented respectively in his figures of *N. lævigata* (figs. 17 & 15, pls. 4 & 5, Quart. Journ. Geol. Soc. vol. vi. 1850). At the same time it should be remembered that the longitudinal grooves do not always indicate spicules, but circumscribe spaces which can be seen under a much lower power than the spicules.

Propagative spherules.—So recent must have been the infiltrated specimens of *N. Ramondi* when they were imbedded, that even the spherules, assumed to be propagative gemmules or embryonal cells in *Operculina arabica*, are exquisitely preserved in a fossilized state in many of the chambers of the former, where they are all spherical in shape, but vary in size, below the 1-2800th of an inch in diameter (Pl. XVII. fig. 15 *c*). They are not only found to exist in every part of the chamber up to the umbilicus of the Nummulite, but in the primary chamber itself, and may be not only seen in every part of the canal-system, but (the smaller ones) also in the vertical tubes of the spiral lamina, on their way out. In the infiltrated specimens of *Orbitoides dispansa* they also abound throughout both the chambers of the central plane and the columnar chambers, even to the centre of the fossil (fig. 1 *o*). I have also seen them in the chambers of *Orbitolites Mantelli*, *Orbitolina lenticularis*, and in *Alveolina elliptica*; and thus occurring so generally, there can be no longer any reasonable doubt that they are what I have assumed them to be, viz. "propagative agents," but whether the product of impregnation or of simple generation, remains for further research to determine. In one section of *N. Ramondi* which I possess (for I have sections by me to prove everything that I have stated), there is a spherule in one of the chambers of the last turn which has thrown out a second one, with a Nautiloid form of test around it, indicative of *Nummulites* being occasionally viviparous, as before stated to have been noticed in the *Rotalidæ* by Prof. Schultze (Ann. Nat. Hist. *l. c.* p. 320).

Mode of growth.—This, like that of *Operculina*, is simply spiral, with the chambers continued up to the centre or umbilicus of the Nummulite. The development of the chamber commences from the spicular cord, and extends outwards and inwards from this point; but it is not fully formed for some time afterwards; so that there are several always present in successive stages of completion, from the chamber just budding to that one extending from the margin to the umbilicus. This gradation is also a consequence of age or full development of the Nummulite, there being a gradual diminution in size from the largest chamber to the primary one on one side, as there is from the largest to the last-formed one on the other: hence the circular form of *Nummulites*. The same has been stated of *Operculina*; but here the termination is generally more abrupt, which causes the test to assume a somewhat elliptical form.

Classification of Nummulites.—On this subject I have but few observations to offer, after the able one proposed by MM. d'Archiac and Haime (p. 72), viz. 1st, *Læves aut Sublæves*; 2nd, *Reticulatæ*; 3rd, *Subreticulatæ*; 4th, *Punctulatæ*; 5th, *Plicatæ vel Striatæ*; and 6th, *Explanatæ*. What I have to state, however, will be chiefly found under the descriptions of the species which have elicited it respectively.

The dividing of the Nummulites which present a reticulated structure on the surface from the rest, which I proposed (Ann. Nat. Hist. p. 164, 1853), was being carried into effect by MM. d'Archiac and Haime for their second and third groups at the time I was writing my MS. in India. So it is evident that I was not single in suggesting this,—although I made a mistake, as they notice (p. 343), in attributing the suggestion to Dr. Carpenter in the first instance, whose proposition, on the other hand (Quart. Journ. Geol. Soc. *l. c.* p. 30), was to make the *Assilinæ* a "subgenus" of *Nummulites*. But as regards MM. d'Archiac and Haime's dividing the reticulated Nummulites into two groups, and the changing of the name *Assilina* to *Nummulites* respectively, I think it would have been better to have made but one group of the former, as noticed by Messrs. Parker and Jones (Ann. Nat. Hist.), and not to have changed the name of the latter, for reasons which will be hereafter mentioned.

Again, as regards my observation that the reticulated Nummulite *N. acuta*, Sow. "borders close upon *Orbitoides*," MM. d'Archiac and Haime observe (p. 343), "Il n'y a pas plus de passage entre cette Nummulite et l'organisation des *Orbitoides* (*O. dispansa*) qu'entre tout autre corps de ces deux genres." I was wrong certainly in stating that there was a commencing degradation of the spire in *N. acuta* into the horizontal plane of *Orbitoides*, but no further; for, as will be seen, the external appearance as well as the internal structure of *O. dispansa* approximates it to the reticulated Nummulites more than to any other discoid Nummulite. Thus, the thinness of the margin, abrupt elevation of the centre, and reticulated structure of the lateral masses are especially characteristic of both, although the abrupt elevation may not always be present in either. The columnar structure, viz. the "larges canaux" of D'Archiac and Haime, is particularly developed in the reticulated Nummulites, and is analogous to that of *O. dispansa*, although not so much developed. But, as will be seen by-and-by in *Orbitoides*, the rows of chambers in the horizontal plane are cyclical, which is a character of *Orbitolites*, and not of *Nummulites*. This, then, makes *O. dispansa*, although it more than all the other large discoidal Foraminifera approaches the reticulated Nummulites, distinctly differ from them. It will be observed further on, that the structure of *Orbitoides dispansa* compels us to view it as merely a *Cycloclypeus* with lateral growth; and Dr. Carpenter, who has studied the latter, observes (Phil. Trans. 1856, p. 563), that while *Cycloclypeus* agrees in most points with *Nummulites*, it only differs from it essentially "in the single circumstance that the mode of increase is cyclical instead of helical;" so that we have here still further, though indirect, confirmation of what I have before stated, viz. that *N. acuta* "borders close upon *Orbitoides*." As to the defective state of my figures (Ann. Nat. Hist. vol. xi. pl. 7, 1853) misleading the authors of the "Fossiles de l'Inde," it should be remembered that they bear on their faces evidence that they were only meant as diagrams, and that, in India, we have not only frequently to find the objects themselves, but to make sections of, and draw them before we describe them, and sometimes to lithograph them; and therefore that it would be fairest to judge from the descriptions, as they are most likely to be correct, seeing that we have neither such means nor such men to make sections, drawings, &c., for us in India as can be obtained in Europe.

Alveolina, D'Orb.

Of this genus I have nothing to state here further than that the tubular cortical structure appears to me to be analogous to the spicular cord and its canal-system in *Nummulites*, and the chambers to both the horizontal plane and those parts of the chambers which are lengthened out towards the poles or lateral eminences in *Nummulites*. As before stated, *Alveolina* looks to me like a flat Nummulite drawn out in each direction laterally, and has its transitional form in the globose Nummulites. Never having had a highly infiltrated specimen, I cannot state what the minute structure of its canal-system is, nor whether the cortical layer, which corresponds to the spicular cord of *Nummulites*, contained any spicules; but I should think not, and that the canal-system was replaced by the tubular structure of the cortical layer. As before stated, spherules have been observed in *A. elliptica* in its innermost chambers.

The species of *Alveolina* (viz. *A. Boscii*) described and illustrated by Dr. Carpenter (Phil. Trans. 1856, p. 552) is totally different from Parkinson and Sowerby's *Fasciolites elliptica*, which is the type of the *Alveolina* of Scinde, and of which I have given illustrations (Ann. Nat. Hist. 1854, vol. xiv. p. 99); while the new species, which I have described further on, under the name of *A. meandrina*, is again so different from either and from any other existing description, that at first sight it seems doubtful whether it should not form the type of a new genus. On examining it internally, however, it is found that its chambers, although tortuous like those on the surface of *N. gyzehensis*, &c., commence in a spiral form as simply as those of *Operculina*, but instead of remaining subsigmoid, as in *A. elliptica*, become tortuous, while there is a reticulated canal-structure arching over each, and supported on vertical tubes connected with a similar structure over the preceding layer, which, when viewed longitudinally in a vertical or horizontal section, appears to correspond to the tubular structure arching over the chambers and interseptal canals respectively of *A. elliptica*, which structure, again, corresponds, as before stated, to the spicular cord and interseptal canals of *Operculina* and *Nummulites*.

Orbitoides, D'Orb.

In this family two distinct genera have been included, viz. *Orbitoides dispansa* and *Orbitoides Mantelli*, D'Orb. (*Orbitolites Mantelli*, Cart.), as will be seen by their descriptions hereafter under their respective heads. Moreover, it will also be seen there that they are so different that they can hardly be included even in the same family: at least, while the former is closely allied to *Cycloclypeus*, Carp., the latter is so closely allied to *Orbitolites* that I proposed the name of "*Orbitolites Mantelli*" for it, instead of "*Orbitoides*" (Ann. Nat. Hist. vol. xi. p. 174, 1853). Whether this was a better name than its original one (that is, than "*Orbitoides Mantelli*") I will not stop to discuss now, but go on to notice the structure of these two fossils respectively and summarily, referring the reader to a more detailed description of them under their proper heads. The detail of their anatomy has been obtained from richly infiltrated specimens in which, as in the Nummulite and Operculina mentioned, the red or yellow oxide of iron so completely fills up the cavities of the test which were originally occupied by sarcode, while the rest remains more or less transparent and white, that sections of the fossil in this state give a much better view of these cavities than could be obtained from the test were it present in its unfossilized condition and occupied by the living animal. Following are the summary descriptions of them respectively.

Orbitoides dispansa (Pl. XVI. fig. 1, &c.).—The test of this discoidal fossil consists of a horizontal plane of *oblong* chambers covered in on each side by a mass of columnar ones. The chambers of the horizontal plane are in circular rows, concentrically arranged around a central globular cell, which may be large or small. [Formerly I stated that they began "multispirally," and gave a figure (Ann. Nat. Hist. ser. 2. vol. xi. pl. 7, p. 26) to prove it; but I have since found that this was drawn from a section of a minute *Heterostegina* which I had mistaken for an *Orbitoides*.] Each chamber is connected with the two immediately behind and before it respectively by stolon-processes; and the chambers generally increase in length in the radial direction of the test with their distance from the centre, up to a certain point, when their vertical diameter preponderates over their horizontal one, not from increase of the former, but from diminution of the latter, following, therefore, the same law that is observed in *Nummulites*. The columnar chambers, on the other hand, are arranged in convex layers arching over the horizontal plane; each chamber is compressed vertically, varies in shape and size, and is united to those immediately around it by stolon-processes. Interspersed between the columnar chambers are a number of columns, of a conical shape, having their pointed ends on the horizontal plane and their large extremities on the surface; these consist of non-tubular condensed shell-substance, which is opake and white in the fossil, and are analogous to the white columns in *Nummulites* and similar structures in recent *Operculina*. Vertical tubuli exist throughout the horizontal layers of shell-substance, as in *Nummulites*; and there is a double horizontal canal-system, consisting of a single layer of network tubulation on each side of the horizontal plane, whose meshes are parallelograms, and enclose respectively one of the oblong chambers. One cannot help seeing here a part, at least, of the canal-system of *Cycloclypeus* (Phil. Trans. 1856, pl. 29. fig. 11). Whether it be from the smallness of my specimens (which, however, are $\frac{4}{12}$ to $\frac{8}{12}$ inch in diameter) or the smallness of the canal-system (but I think the former, from the remnants of this system being most evident in the largest ones), no other part of the canal-system which has been described by Dr. Carpenter in *Cycloclypeus* appears to be developed in them.

Orbitolites Mantelli, Cart. (Pl. XVI. fig. 2, &c.).—This discoidal fossil consists of a horizontal plane of *globular* chambers, which become cylindrical externally and are covered in on each side by a mass of columnar ones. Those of the horizontal plane are in circular rows, concentrically arranged around a central one, and are *not* connected by stolon-process, but *attached* to sarcodal canals, as will be mentioned directly; they also increase only slightly in their horizontal diameter with their distance from the centre, while they so increase vertically as to become cylindrical, and thus cause the horizontal plane to be much *thicker* at the circumference than in the centre. The columnar chamber-structure is exactly the same as in *Orbitoides*, but there are *no* columns of condensed white shell-substance. Vertical tubuli exist throughout the horizontal layers of shell-substance, as in *Nummulites*. The canal-system is composed of two sets of sarcodal channels, which permeate the test. The first consists of *radiating* horizontal ones which spread off spirally, like the lines on an engine-turned watch-case, from the centre to the circumference; these are arranged in layers, commencing with two (?) in the centre, which are separate from each other, but whose lines, crossing in their course to the circumference, after the manner mentioned, unite *separately* with the chamber which is fixed in the internal angle of the interspaces that they thus form; afterwards they become doubled and trebled as the chamber lengthens, so that at the circumference each chamber becomes connected with six of such canals, and six openings appear between the chambers, at the margin of the test, in zigzag, one above another. The second set consists of *annular* horizontal canals, arranged concentrically in two layers only, viz. one on each side the horizontal-chamber layer, on a level with the ends and between the rows of chambers respectively with which they are united on the inner side: also a subsystem consisting of much smaller canals, one set of which connects the annular bands horizontally between the chambers; another connects them vertically, through the horizontal plane; and the third, only seen occasionally, seems to ascend vertically from the annular canals of each side to be lost in the interspaces between the columnar chambers. Here also one cannot help seeing the sarcodal system of *Orbitolites* given in Dr. Carpenter's diagram (Phil. Trans. 1856, pl. 5. fig. 6); but I do not see that scolloped form of the annular bands in the infiltrated specimens which appears in the uninfiltrated ones (Pl. XVII. fig. 2 *o*), and is represented by Dr. Carpenter as bearing the chambers in *Orbitolites*; nor do I see the stolon-process coming from the *convexities* of the scollops to form the chambers of the next row outwards, unless the faint transverse radiating lines of the "sub-system" be these (Pl. XVI. fig. 2, l_2). Further, Dr. Carpenter (p. 222) only allows a single layer of annular bands in the simple type of *Orbitolites*; and assuming that the horizontal plane of *Orbitolites Mantelli* commences in the same way, we might assume that it also possesses only a single layer; but the minuteness of the structure in the central part almost defies this decision in my specimens.

The reader will now have seen the differences between *Orbi-*

toides dispansa and *Orbitolites Mantelli*, and their correspondences respectively with *Cycloclypeus* and *Orbitolites*. He will also have seen how, partly following D'Orbigny's description of the latter genus, I fell into the error of changing the name of "*Orbitoides Mantelli*" into *Orbitolites Mantelli*, now evidently an ill-chosen one,—although it should not be called "*Orbitoides*," whose position I shall more particularly assign presently.

It is also questioned by MM. d'Archiac and Haime if this *Orbitolites Mantelli* be the *Orbitoides Mantelli*, D'Orb., of the United States (Tab. p. 363). Yes: it corresponds with the figures given by Dr. Carpenter (Quart. Journ. Geol. Soc. *l. c.*) of this fossil, which are too faithful to be mistaken.

Conulites, nov. gen. Pl. XV. fig. 7, &c.

This beautiful little discoidal fossil, which appears to me to have hitherto been undescribed, and upon which the genus is therefore founded, was discovered among a number of Nummulitic fossils from the valley of Kelat, which were sent to me by Dr. Cook, after whom I have named the species, in commemoration of his indefatigable and successful exertions on behalf of geology in that locality. It is not, however, confined to the valley of Kelat; for I had specimens, imbedded with Nummulites, by me from Scinde, one of which, being a vertical section in a polished pebble of nummulitic limestone, always puzzled me before I recognized the fossil in its free state, while, being partially infiltrated with yellow oxide of iron, it has since enabled me, more than any others, to describe the internal structure. This, together with the external form of the fossil, will be found fully detailed further on, under its proper head, and therefore all we need here is a short generic summary of its description, which is as follows:—

Gen. char.—Conical, compressed, discoidal; consisting externally of a spiral layer of rhomboidal chambers extending from the apex to the circumference; filled up internally with convex layers of compressed columnar chambers interspersed with white columns of condensed shell-substance; white columns opake, conical, their sharp ends resting on the inner aspect of the spiral layer, and their large ones terminating at the base of the cone, which presents a slightly convex granular surface.

It will thus be seen that while *Conulites*, in its conical form, external layer of chambers, and internal columnar chamber-structure is analogous to *Orbitolina* generally, but more especially to the solid conical forms, it, in possessing the white columns of condensed shell-substance, is also allied to *Orbitoides*, while it differs from the latter and agrees with *Nummulites* in the spiral arrangement of the layer of chambers externally. Hence it becomes questionable, after all, whether the cyclical and helical characters are of much use in classification; but to this point we will return again after having alluded to the other genera of Foraminifera in which I shall have to describe species.

Orbitolina, D'Orb.

Of this genus I have nothing to add more than is stated under the species which I have described.

Cyclolina, D'Orb.

This now appears to me to be a species of *Orbitolina*, which, had it been better defined by D'Orbigny, would have saved me from much error, as will be observed by my "Observations" under the head of "*Orbitolites pedunculata*" at the end.

Heterostegina, D'Orb., *and* Cycloclypeus, Carp.

Under these names respectively will be found a description of the specimens of *Heterostegina* and *Cycloclypeus* which, with *Orbitolites Mantelli*, I found together on the south-east coast of Arabia.

Of the former I have nothing to add here; but as regards *Cycloclypeus*, from existing specimens of which Dr. Carpenter has given his excellent description and illustration of the genus (Phil. Trans. 1856, p. 555, &c.), one cannot help seeing, in the oblong form of the chambers, the irregularity of the rows, their cyclical arrangement, their vertical thickness diminishing towards the circumference, each chamber being connected with two behind and two before it, the canal-system, and, lastly, the conical non-tubular parts of the test, which resemble the columns, that *Cycloclypeus* approaches *Orbitoides dispansa* as nearly as *Operculina* approaches *Nummulites*.

In my description of the minute structure of *Orbitoides dispansa*, I have stated that I was not able to see such an elaborate disposition of the canal-system; but then the size of the recent specimens of *Cycloclypeus* examined by Dr. Carpenter, and their structure generally, far exceeding, in both, the infiltrated specimens of *Orbitoides* in my possession, may partly, if not wholly, account for this.

For further observations on the specimens of *Heterostegina* and *Cycloclypeus* which have come under my notice, see their descriptions respectively.

Orbiculina *and* Orbitolites.

The exhaustive and valuable researches of Dr. Carpenter on these two genera, given in the 'Philosophical Transactions' for

1856, preclude the necessity of my making any further observations on them beyond what will be found under the species which I have had to describe.

Classification.

I would here merely observe that, as regards family distinction, it appears to me that *Orbitoides dispansa, Conulites, Heterostegina,* and *Cycloclypeus* should come together under one head, and *Orbitolites Mantelli,* Cart., *Orbitolina, Orbiculina,* and *Orbitolites,* as defined by Dr. Carpenter, under another. Perhaps it will be stated that the spiral form of the layer of chambers in *Conulites* should place it with *Nummulites,* among D'Orbigny's "Hélicostègues," irrespective of its being in every other way most closely allied to *Orbitoides,* which belongs to the "Cyclostègues;" and hence the doubtful value of the helical and cyclical characters as natural distinctions, to which I have before alluded.

Conclusion.

Having thus made all the prefatory observations that I have to offer at present on the different genera of Foraminifera, whose species I shall now have more or less to describe particularly, let us proceed to this part of the subject, remembering, as before stated, that my object *now* is solely to correct, add to, and explain what I have hitherto stated, and that, therefore, much will be found in my paper in the 'Annals' of 1853, to which I have alluded, which is omitted here. It will be also necessary for the most part, too, that the reader should provide himself with copies of MM. d'Archiac and Haime's 'Monograph on the Nummulites' and Dr. Carpenter's "Researches" in the 'Philosophical Transactions,' respectively; for they are so necessary for the study of the Foraminifera, that it is impossible to get on without frequent reference to them.

Among the new forms that I have had to introduce will be found two varieties, viz. *a* and *b* of *Assilina seu Nummulites exponens,* and one new species, viz. *A. obesa,* belonging to the *Explanatæ*; one new species belonging to the *Punctulatæ,* viz. *N. broachensis*; two species to the *Plicatæ vel Striatæ,* viz. *N. makullaensis* and *N. kelatensis*; one species to the *Reticulatæ,* viz. *N. masiraensis,* and an undetermined one from the coast opposite; one new species of *Alveolina,* viz. *A. meandrina*; and a new genus and species, viz. *Conulites* and *C. Cookii* respectively; one variety, if not a new species, of *Orbitoides,* viz. *O. asterifera*; and perhaps some new forms of *Orbitolina.*

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

May 14, 1861.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

Descriptions of Three New Species of Birds from Guatemala. By Osbert Salvin, M.A., F.Z.S.

The three birds I propose to describe in this paper form part of a collection lately brought to this country by Mr. Robert Owen, Corresponding Member of this Society, from Vera Paz, Guatemala. The greater part of this collection was formed by one of the collectors I employed during a visit to Coban in the early part of last year: the low-lying lands of Central Vera Paz in the neighbourhood of a village called Chisec, situated on one of the confluents of the Rio de la Pasion, is the locality from which they were derived. The rest of the collection was formed by Mr. Owen himself at Coban, or in the adjacent mountains. Amongst the known forms are many of considerable rarity, besides several additions to our knowledge of the Avi-fauna of the country from which they come.

1. Cyphorhinus philomela.

Supra brunneus, plumis anguste nigro marginatis, pileo et uropygio obscurioribus : subtus fuliginosus, plumis medialiter nigris, et nigro terminatis, gula pallidiore, lateribus brunneis nigro transfasciatis : alis caudaque nigris, plumis tectricum remigum macula parva subapicali ochracescenti-alba : rostro nigro, pedibus fuscis.

Long. tot. 4, alæ 2·3, caudæ 1 poll. angl. et dec.

Hab. In Prov. Veræ Pacis sylvis montium.

Obs. Affinis *Cyphorhino bamblæ* ex Cayenna, sed tectricibus alarum maculatis et non albo vittatis facile notabilis.

This Wren belongs to the division of this genus which Dr. Sclater has classed under the name of *Microcerculus.* It is known to the natives as the 'Ruiseñor,' or Nightingale—a name it has acquired from its great vocal powers.

2. Embernagra chloronota.

Supra olivacea, pileo cinereo : subtus cinerea, gula et ventre medio albis, crisso flavidiore, lateribus olivaceis : vitta utrinque pilei vittaque angusta per oculos transeunte nigris : alis fuscis, extus dorso concoloribus : tectricibus subalaribus et campterio læte flavis : rostro superiore nigro, inferiore corneo, pedibus carneis.

Long. tot. 5·75, alæ 2·6, caudæ 2·5.

Hab. In Prov. Veræ Pacis regione calida.

Obs. Affinis *Embernagræ conirostri* ex Nova Granada, sed statura minore, dorso olivaceo pectoreque cinereo dignoscenda.

Several specimens of this *Embernagra* are in the collection, all closely agreeing in the above characters.

3. Aphantochroa roberti.

Aureo-viridescens, supra unicolor : subtus gula cum mento lateribusque obscurioribus, ventre medio vix viridi lavato, plumis late pallido ochraceo terminatis, ventre imo albo : crisso viridescenti-fusco, plumis albo clare marginatis : alis purpurascenti-nigris, tectricibus subalaribus viridescentibus : cauda aureo-viridescente ; rectricum duarum externarum media parte nigra, parte apicali alba : rectricibus reliquis nigro terminatis : rostro omnino nigro, pedibus nigerrimis.

Long. tot. 4·75, alæ 2·75, caudæ 1·9, rostri a rictu 1.

Hab. In Prov. Veræ Pacis regione calida.

Obs. Affinis *Campyloptero cuvieri*, Gouldi, ex Costa Rica, sed rostro omnino nigro, et caudæ fascia nigra latiore distinguenda.

A single specimen, marked male, is in the collection ; I have dedicated it to Mr. Robert Owen.

Remarks on Pallas's Sand-Grouse (Syrrhaptes paradoxus). By Alfred Newton, M.A., F.Z.S.

Our Secretary having entrusted to my charge an example of *Syrrhaptes paradoxus* which died at the Gardens a few days ago, I am desirous of recording the results of my examination of it.

I must apologize to the meeting for the imperfection of the observations I am about to offer. I have not been able to compare the skeleton of this bird with that of other Sand-Grouse, except from memory ; and I prefer to confine my remarks to the structure of the sternal apparatus. This, as is the case in other species of the peculiar group to which *Syrrhaptes* belongs, offers at first sight an unquestionable resemblance to that of many of the *Columbidæ*, particularly of those members of the family which possess terrestrial habits. The similarity seems principally to arise from the form of the lateral processes of the sternum, which in *Syrrhaptes* are widened and partially united to the main portion as in *Chamæpelia* and *Geopelia*, instead of being singularly prolonged and acuminated as in the more typical *Gallinæ*. The resemblance is also increased by the exceedingly deep keel, which is of similar conformation to that of the *Columbidæ* generally. But here the likeness ends. The coracoid bones, which I am inclined to regard as the most characteristic in, as they are the most peculiar to, the ornithic skeleton, are plainly framed on the true Gallinaceous model. The furculum is very different from that of any other group of birds which I happen to remember, and bears no resemblance to the same bone in the *Phasianidæ* or *Tetraonidæ*. Still less, however, does it indicate any approximation to the same part in the *Grallæ*, or I may say of the *Columbidæ*, with both of which groups the Sand-Grouse have been supposed to have affinity. From the peculiarities, therefore, of the sternal apparatus I am fully of opinion that Bonaparte, and those authors who have followed him, are quite right in elevating the Sand-Grouse to the dignity of a family (*Pteroclidæ*), though I imagine they were chiefly led to that conclusion by an examination of the external characters only.

I should have felt it incumbent upon me to have made some remarks on the information possessed by naturalists respecting this rare and curious bird; but almost all that can be said on the subject has recently been admirably recapitulated in a paper by my friend Mr. T. J. Moore in 'The Ibis' for last year *. I would, however, observe that though the illustrious Pallas has the credit of first giving a *description* of this bird, he does not appear to have seen more than a single example of it, which was obtained in the Kirghis steppes by Nicolas Rytschkof, and mentioned by him in his Journal †. And of this example, judging from the figure given of it, not only, as Pallas himself says "*Cauda in specimine deerat,*" but it also appears to have lost the elongated portion of the shafts of the outer remiges, which form so singular a feature in the species, and which, as we see by the state of the birds in our Gardens, are no doubt easily broken off. I must be allowed to add that I think this circumstance greatly favours the supposition that the specimens which were obtained in Western Europe in July and August 1859, were not indebted to any human interference for their transport; for I have had the good fortune to examine all four of them, and each possessed these extraordinary appendages in nearly perfect preservation.

On a New Species of Water-Tortoise (Geoclemmys melanosterna) from Darien. By Dr. J. E. Gray, F.R.S., V.P.Z.S., etc.

The British Museum has just received a very distinct species of the more terrestrial kind of Terrapins, or Freshwater Tortoises, from Cherunha in the Gulf of Darien.

It is easily known from the other described species by the black colour of the upper and lower surface, and pale-yellowish sides, and the distinct bright-yellow superciliary streak on each side of the head, extending from the nostril to the occiput.

Geoclemmys melanosterna.

Shell black, one-keeled; the first vertebral plate longer than broad, truncated behind; second and third six-sided, about as broad as long, the fourth broader than long; the keel low, rather interrupted; the areola of the dorsal and marginal shield posterior; the margin rather acute, slightly bent up in front and on the sides; the nuchal shield more distinct; the sternum flat, black, with rather paler edges to the shields; the sterno-costal slope rather convex, pale yellowish; the under surface of the marginal plates pale; the axillary plate moderate, the inguinal plate small, both pale-coloured. The head moderate, rather acute in front, black, with a distinct bright-yellow

* The Ibis, 1860, p. 105.

† 'Kirgis-kaisazkoi Stepie, &c. St. Petersburg, 1772, p. 40.' I have not been able to see this work, and only quote the reference at second hand.—A. N.

streak diverging over the eyes and extending from the nostril to the back of the head. The legs and tail brown with black spots, forming more or less distinct streaks; toes 5·4, short, strong, subequal, covered with distinct band-like scales; the claws strong, conical, black.

Hab. The Gulf of Darien: Cherunha.

May 28, 1861.—Dr. J. E. Gray, V.P., in the Chair.

On the Habits of the Gorilla and other Tailless Long-armed Apes. By Dr. J. E. Gray, F.R.S., V.P.Z.S., etc.

Recently the habits of the Gorilla have excited considerable interest; and it has been described by some authors as a fierce and untameable animal, which, by its strength, has driven all other wild animals from its haunts.

It is to be observed that the Ourang Outan was formerly charged with all manner of iniquities, such as carrying off women and children, defending itself with clubs, clawing people up by its hind feet as they passed through the woods; but as the habits of the animal became known, these tales, found untrue, were transferred to the Gorilla or the adult Chimpanzee*, and I believe with as little truth.

Dr. Abel's account of the Ourang of Java, copied into Griffith's 'Animal Kingdom,' vol. i. p. 239, and more recently Mr. Wallace's paper on the Habits of the Orang Utan of Borneo, published in the 'Annals and Magazine of Natural History' for 1856 (vol. xviii.), p. 26, have entirely dispelled all these delusions as regards the Ourang; though it is said that "there is no animal in the jungle so strong as he," p. 29. It is thus shown that strength is no proof of ferocity, and all the stories of the Gorilla seem based on the fact that being strong it must be very ferocious. Never was a greater fallacy.

The Chimpanzee (according to M. Du Chaillu) "is a great tree-climber, passing much of its time among the branches of the great trees of Tropical Africa. It is thoroughly untameable (?) when grown, still not fierce and malign like the *Gorilla* (?). It has never been known to attack man, and its young are tractable and easily tamed. Like its great congener, it is not gregarious."

Raffles' description of the habits of the *Siamang*, copied into Griffith's 'Animal Kingdom,' vol. i. p. 255, shows it to be a mild and inoffensive animal, capable of being "easily tamed or, rather, reconciled to bondage," but "unconquerably timid."

Duvaucel describes the Wou-Wou (*Hylobates agilis*) as living in pairs. It springs from tree to tree with wonderful agility, and can therefore be seldom taken alive; and this is the character given by all authors I have met with who have observed the various species or varieties of Gibbons alive in their native haunts.

From these accounts, and from all that I can learn of the habits of these animals from authentic sources, where there is no attempt to enhance the danger of their chase, I am induced to believe that

* This animal exhibits an instance of how names are changed. Battle called it after the native name *Engeco*, Buffon *Engoko*, and shortened it to *Jocko*; hence *Jacko*, or *Jackey*—a name often applied to monkeys of all kinds.

all the tailless long-armed Apes, not excepting the Gorilla, are tree-living, fruit-eating animals, living where beasts of prey are not to be found, or out of their reach, if they are found together in the same locality; so that there is no reason for them to be fierce or vicious, especially as the succulent nature of their food does not render it necessary that they should come to the earth—on which they always walk with difficulty—to obtain fluid.

At the same time I have no doubt they sometimes fight among themselves for their mates, and would defend themselves, or perhaps attack any animal—the larger kinds even man—if brought to bay, and that they would use all their force and cunning to escape from confinement, and thus try to recover their liberty; but every animal, even the most docile and herbivorous, as the deer, antelope, &c., will do this, and might therefore as well be called vicious and untameable.

They are most, if not all, of them provided with very loud voices; and the *Siamang* is provided with large guttural sacs, which have been supposed to facilitate the production of these sounds; but as M. Duvaucel did not find them in the '*Wou-Wou*,' which also emits a fearfully loud voice, he infers that the bags do not affect the sound. Some of the American Monkeys are called Howlers on account of the sounds they emit, which in these animals are said to be produced by a peculiarity in the form of the larynx.

The *Ourang* and *Siamang* are seldom found far from the sea; and I have been informed by the Gaboon traders that all the *Gorillas* they have seen have been taken near the coast.

The following Postscript, bearing date Sept. 25, has been forwarded to us by Dr. Gray.—Ed. Ann. Nat. Hist.

A missionary who has resided many years in the Gaboon states that young Gorillas are often taken by the natives, who bring them alive into the settlement, that he has had several living in his house at different times, that they were quite as tame and as tractable as the young Chimpanzees, and that he never saw them walk erect or attempt to attack any one. The natives also often bring in the dead bodies of the older ones; for they are fond of hunting them in the forest near the sea; and as soon as they get them, they hasten with them across the river to the settlement to sell them: they fetch a low price; the largest which he ever saw was bought for 20 shillings, and they are generally sold for much less.

June 11, 1861.—Dr. J. E. Gray, V.P., in the Chair.

Notice of a Stag from Northern China sent by Mr. Swinhoe to the Zoological Society. By Dr. John Edward Gray, F.R.S., V.P.Z.S., etc.

Mr. Swinhoe has most kindly sent to us three examples of a Deer which were shot in the Gardens of the Summer Palace at Pekin in the winter of 1860.

There is a skin of an adult male with horns, of an adult female, and of a younger animal.

The male agrees in most particulars with the account of the *Cervus* *pseudaxis* of Eydoux, figured by Gervais in the 'Voyage of the Bonite,' and its horns with those of the same animal figured by Dr. Pucheran in the 'Archives du Muséum' (vol. iv. t. 24. f. 2–8). The specimens having been procured in the winter, agree with the figures of the animal in that state on M. Gervais's plate.

Mr. Swinhoe thought it might be the *Cervus Wallichii* of Cuvier, but it has no affinity to that species.

It is very like a series of animals (for now we have two pairs, and they are breeding) which were received a short time ago by the Zoological Society from Japan, and which I described, under the name of *Rusa japonica*, in the 'Annals and Magazine of Natural History' for February 1861, p. 143; and in the form of the horns and in the general appearance of the animal it agrees with the *Cervus sika*, Temminck, very shortly described and figured in the 'Fauna Japonica.'

Dr. Sclater, in the 'Proceedings of the Zoological Society,' has stated his opinion that my *Rusa japonica* is probably the same as *Cervus sika* and also as *Cervus pseudaxis*. But *Cervus pseudaxis* and *Rusa japonica* differ from *Cervus sika* in having a large white anal disk surrounded by a black edge, which is not represented in the figure of *Cervus sika*, nor mentioned in the short and, I own, very imperfect description of that species.

I may state that *Cervus pseudaxis* appears to be a species of the genus *Rusa* rather than *Axis*, with which I had placed it in the 'Catalogue of the Ungulated Animals in the British Museum,' p. 215; and it seems closely allied to the small species which inhabit the islands of the Indian Ocean, that form the second section of the genus *Rusa* in the catalogue above quoted; but, as in the other species of that section, we want much more materials in order to know what are and what are not species of that group.

The animal which has been figured under the name of *Cervus pseudaxis* was obtained by MM. Eydoux and Souleyet in Java, but they did not believe that it was a native of that country. It lived several years in the Jardin des Plantes at Paris, and hence a series of its horns was procured and figured; and while there it bred with the Common Axis, and the male produce was fertile (see 'Archives du Muséum,' iv. p. 421). Some naturalists have given the Sooloo Islands, near the Philippines, as the habitat of this specimen, but I do not know on what authority.

The Chinese animal seems also to be much more spotted in the winter season than its Japanese ally (*Rusa japonica*), which nearly lost its spots in the Zoological Gardens during the winter of last year.

The old male is furnished with a kind of mane; that is to say, the hair of the neck is longer and more rigid than that of the rest of the body, except just over the tail, where it is also elongated and rigid. The fur of all the three specimens is long and very close, much more so than in its Japanese ally. The male is rather paler in colour and less spotted than either of the hornless specimens; it has only an indistinct, rather darker line of rather longer hair between the withers, and it has a large blackish space of rigid, rather longer hair over the base of the tail. On the other hand, both the hornless skins have a distinct, well-marked black dorsal streak, which is wider, more distinct, and formed of longer hair on the back of the neck ; and they have only a broad, well-marked black edge on the upper surface and side of the white anal disk. The tail in all the specimens is white, with a black streak along the middle of the upper side of the base. In this respect it also agrees with *R. japonica.*

I believe that Dr. Sclater is now satisfied that the identity of my *Rusa japonica* with *Cervus sika* is very doubtful. Indeed, I cannot conceive how this can be otherwise, unless the *Cervus sika* is very badly figured and incorrectly described. We may therefore regard *Cervus sika* as a distinct species, at least until we can procure some further observations on it. It was figured and described from a single male specimen sent to Leyden.

The specimens from Northern China sent by Mr. Swinhoe (which I am inclined to think may be *Cervus pseudaxis* of Eydoux) chiefly differ from *Rusa japonica* in being of a considerably larger size, the Chinese species being as large as the Fallow Deer, and the Japanese *Rusa* considerably less—between that animal and the Roebuck.

I may state that the distinctions of the species of Stags are very difficult to describe by words ; yet the allied Deer from different countries are generally to be best distinguished by their size and habitat ; and that may be the case with this and the other small *Rusæ* which are described as coming from Timor, the Philippines, and Formosa.

The two skulls which accompanied the skins present a considerable difference in the form and depth of the preorbital pit : and this observation is of some importance, as the size, form, and depth of this pit has been considered by some zoologists as presenting a good specific distinction ; but I have observed a similar difference in skulls of apparently the same species of the genus *Cariacus.* The skulls are not of the same age ; but I do not think that this can have any effect on the form or depth of the pit. The skull of the male is of a young animal, the hinder grinder being in the course of development ; and the horns are simple, without any snags, like the horn figured in 'Arch. du Mus.' vi. t. 24. f. 2, but even wanting the basal snag, and they are covered with hair. In this skull the preorbital pit is large, subtrigonal, and not quite so deep as it is wide, rounded at the base.

The skull of the female is rather larger, and belongs to an adult animal, with all the grinders well developed. In this skull the pit is oblong, not so broad as long, and very much deeper (I should say, nearly twice as deep), and has a large aperture at the hinder part of its base, evidently for the transmission of some vessel, which is not to be seen in the skull of the male.

The male skull has short canines, not produced beyond the surface of the bone ; the female has the holes of smaller canines which have fallen out.

P.S.—Dr. Schlegel, the Director of the Leyden Museum, has, in reply to an application from me, sent me this day (July 11, 1861) the following note on the specimen of *C. sika* in the Leyden collection :—" If you mean by the anal disk the whitish or yellowish disk which extends in the Common or Canada Stag above the tail, the Japanese Stag decidedly shows nothing of this kind. In this species the white colour is restricted to the abdomen, the inside of the thighs, the anal region, and the greater end part of the tail; the root of the tail is, on the contrary, of the same brown colour as the whole back and the rest of the animal."

It is probable, therefore, that the Japanese Deer described by me as *Rusa japonica* may be the same as the *Cervus sika*, though it differs so much from the figure and short description of that animal in the 'Fauna Japonica.'

MISCELLANEOUS.

Note on the Synonymy of the Fossil Genus Echinodon *of Professor Owen.* By H. Falconer, M.D.

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

Gentlemen,—I wish to make a correction through the medium of your pages.

In his late contribution to the Palæontographical Society, on the Purbeck *Lacertilia*, p. 35, Professor Owen erroneously cites me as the authority for the name *Sauraechinodon*, as a synonym of his *Echinodon*. It should have been *Sauræchmodon*. With the barbarism ascribed to me, doubtless inadvertently, I have no concern.

I remain, Gentlemen,

Your obedient Servant,

H. Falconer.

London, Sept. 1861.

On the Death-wound of the "King of the Gorillas."

The following letter, addressed by Dr. Gray to the President of the Zoological Section, was read at the meeting of the British Association recently held at Manchester:—

"British Museum, Sept. 6, 1861.

"My dear Professor,—It is with much regret that I feel myself called upon to correct an error which appears in the report of Prof. Owen's paper on the Gorilla, &c., contained in 'The Times' of this day. Prof. Owen is there represented as stating that 'the skin of the great male Gorilla, now in the British Museum, exhibits two opposite wounds, the smaller in front of the left side of the chest, the larger close to the lower part of the right blade-bone. Two of the ribs in the skeleton of this animal are broken on the right side, near where the charge has passed through the skin in its course outwards.' As this would appear to offer a direct contradiction to a statement made by myself, I cannot (although labouring at present under a severe attack of illness, and writing from a sick chamber) pass it over in silence.

"My attention was called to the subject by Mr. Joseph Beck, the well-known microscopist, who first made the observation that none of the skins of the Gorilla exhibited by M. Du Chaillu offered any evidence of having been shot in the fore part of the chest, as invariably stated in his 'Narrative.' My own examination entirely confirmed this remark; and the unanimous conclusion of numerous sportsmen and men of science, who have since examined both skins and skeletons, has been to the same effect.

"The skin and skeleton, referred to in Prof. Owen's paper, are both, as stated, in the British Museum. While the skin was being stuffed at the Crystal Palace by Mr. Wilson, I paid a visit to that establishment, in the company of Mr. Grove, the Secretary, and several friends. I then inquired of Mr. Wilson whether he had observed any bullet-hole in the chest, and he stated that he had not, but pointed out to me two holes in the nape of the neck (now filled with putty); there are also two large holes in the thin portion of the hinder part of the skull belonging to the same skin, which pass through the bone, and are quite sufficient to have caused death. In neither skin nor skeleton is there any evidence of a gunshot entering on the left side of the chest; and the fracture of three (not of two) ribs on the right side beneath the scapula, and the supposed corresponding rent in the skin, are so utterly unlike the effects of a gunshot, that no sportsman could possibly so consider them. These are facts so easily verified that I trust all who feel an interest in the subject will examine and decide for themselves. I might cite many names of high authority in corroboration of what I have here advanced; but I am not disposed to appeal to any authority, however great, where the facts are open to the inspection of all. On these, and these only, I rest my case.

"I shall be obliged by the reading of this letter in the Natural History Section, and remain, yours faithfully,

To Prof. Babington. "JOHN EDW. GRAY."

The President added that he had addressed a note to Professor Owen, hoping that he would be able to meet and converse with him on the subject. But, unfortunately, the Professor was just on the point of leaving Manchester for two or three days, and was at that moment away. He had received a note, from which Professor Owen requested him to read a few words, but as he did not know the nature of Dr. Gray's letter, he could not, of course, answer it. Professor Owen said that he merely recorded his observations of two points or holes in the stuffed skin of the great male Gorilla—one small, and the opposite one large: the two ribs opposite had been fractured just before death, and the fractured end was stained with blood, there being no evidence of repair. His observations were made before as well as after the stuffing of the skin.

Dr. P. L. Sclater said that, when he examined the skull, he thought he saw a bullet-mark in the back of it. He had asked Professor Owen whether he had observed it, and received an answer in the negative. He had not made any special observation of the skin; but he had put the question to Mr. Bartlett and Mr. Wilson, who prepared the skin, and they both told him that there was a hole in the neck.

Mr. J. Beck stated that he did not expect to be referred to on this subject; but he certainly had looked for the impressions of bullet-marks in the front of the Apes exhibited by M. Du Chaillu, and could not find them.

Dr. Lankester said he had communicated to M. Du Chaillu the substance of Dr. Gray's letter. That gentleman's reply was, that the charge was an old one; and that, as he had answered it so frequently, he did not think it necessary to come and answer it again.

We copy the following reply to the above letter from the 'Athenæum' of Sept. 21, 1861, Professor Owen having transmitted it to that journal, as it arrived at Manchester after the Section had finished its sittings:—

Prof. Owen to the President of Section D.

"Sheffield, Sept. 11, 1861.

"Sir,—Having just received the 'Manchester Examiner' of the 10th inst., containing the letter from Dr. Gray on the death-wound of the large Gorilla, I lose no time in making that reply which I should have submitted to the Section, had I been present when it was read. To the remark that 'the fracture of the ribs, and the supposed corresponding rent in the skin, are so utterly unlike the effects of a gunshot, that no sportsman could possibly so consider them,' I answer, that the hole or rent in question is conspicuous; and that a gentleman who combines an acuteness of observation which has placed him high in science, with a well-known reputation as a skilful marksman and deer-stalker—Sir Philip Grey Egerton—concurs with me in the opinion that the hole or rent in question does present the characters of the one by which the ball escapes in an animal so killed. The wound by which the ball penetrates is much smaller; for the living skin contracts, and the difference of size in the opposite wounds plainly indicates the course of the bullet. As to the ribs, their intervals are wider in the front than at the back of the chest: a ball might enter in front without impinging on the rib or its cartilage; and it would be between the eighth and ninth cartilage, or below the latter, according to the state of the breathing of the Gorilla at the time, where the ball entered in its way obliquely upward and to the right, according to my observation of the contracted aperture, distinctly manifested in the skin before it was sent to be stuffed. At the back of the chest, the ribs, where they bend outward and forward, are so close together as almost to overlap: a ball would most probably impinge on the contiguous parts of two; and a slight glancing movement, common in gunshots, might affect a third contiguous rib. No one can look at the back part of the thorax of the Gorilla without seeing there the conditions under which such fracture as the right ribs exhibit, from within outwards, might take place, as the effect of a gunshot-wound through the chest. As I, and all who have had the pleasure of accompanying Sir P. Egerton in the deer-forest, must hold him to be a sportsman, the asseveration, therefore, that 'no sportsman could possibly consider the fracture of the ribs, and corresponding rent in the skin, as the effect of gunshot,' must pass into the category of many other assertions aimed at the character and reputation of M. Du

Chaillu. The holes in the skin of the neck were mere slits made by the knife, after the death of the Gorilla, probably in the act of flaying and removing the skin from the long projecting cervical spines: those holes showed no mark of contraction of living skin, like the wound in front of the chest.

"RICHARD OWEN."

To the Editor of the Annals of Natural History.

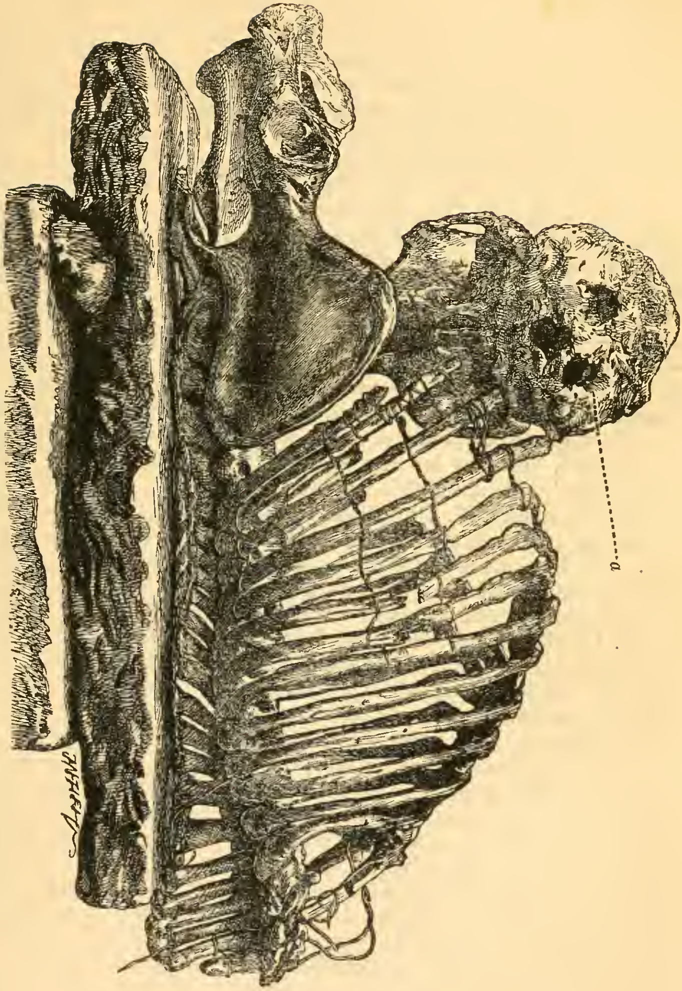
British Museum, Sept. 21, 1861.

SIR,—May I request that you will lay before your readers the accompanying engraving from a photograph* of the bones of the trunk of the 'King of the Gorillas,' with the articulating wires, and also of the posterior region of the skull of the same skeleton, exactly in the condition in which they were sent to the British Museum by M. Du Chaillu. The photograph shows the holes in the back of the skull (*a*), which Professor Owen, in answer to an observation made by Dr. Sclater at the Manchester Meeting, stated that he had not observed, together with the true position of the fracture of the ribs. I repeat my invitation to all who take an interest in the subject to inspect the specimens and determine for themselves; but, for the sake of those who are unable to visit the Museum, I offer a photographic representation as next best corroboration of the correctness of my statement. It will at once be seen that the fracture of the seventh, eighth, and ninth ribs on the right side is not situated "at the back part of the chest, where the ribs bend outwards and forwards, and are so close together as to overlap," but is very greatly in front of the position indicated, being as nearly as possible in the middle of the side, where the ribs stand widely apart, and where it is impossible that any bullet entering the chest in front could have found its exit. Neither is there the slightest indication of the fracture having taken place "from within outwards." On the contrary, it is the unanimous opinion of the medical and scientific men to whom I have shown the skeleton, that the injury to the ribs was caused by external violence; and this is rendered more probable by the existence of a fracture of the collar-bone on the same side.

The lateral position of the fractures at once disposes of all Professor Owen's argument as to the mode in which a bullet might enter "in front" of the left side of the chest without injury to the ribs of that side, and pass out on the other side, breaking three ribs in its exit. It is also very significant, that Mr. Bartlett and Mr. Wilson, the artists by whom the skin was stuffed, should not have observed any bullet-holes in the chest or back while the skin was damp and soft, and that they should have noticed the holes in the nape of the neck and considered them as bullet-holes. Certainly no taxidermist with any experience would fail to perceive the difference between a bullet-hole made during life, which forces the edge of the wound aside, and a "slit made by the knife after death, in the act of flaying."

I am, Sir, yours obediently, J. E. GRAY.

* The artist having copied the photograph without reversing it, the fracture appears as if it were on the left instead of the right side.



SKELETON OF THE "KING OF THE GORILLAS."

M. Du Chaillu and his Book.

The following letter, from Mr. R. B. Walker, of the Gaboon, appeared in the 'Morning Advertiser' of Sept. 16. It was written for and sent to 'The Times,' but not inserted:—

"Gaboon, West Africa, July 22, 1861.

"M. Du Chaillu, in his letter which appeared in 'The Times' of May 22, in reply to what he somewhat contemptuously terms the 'cavils' of Dr. Gray, having ventured to refer that gentleman to his (M. Du Chaillu's) friends in Corisco and Gaboon, and to the missionaries and traders in general, it appears to me that to remain silent after such a challenge would be an unpardonable act of complicity on their part. Therefore, as a trader in this river and the neighbourhood of ten years' standing, I take up the gauntlet he has so recklessly thrown down. I trust to your impartiality to give insertion to this letter, in which I will point out a few only of the most glaring and gross of his numerous false statements and exaggerations which have struck me on a careful perusal of his so-called 'Explorations in Equatorial Africa,'—which work is neither more nor less than an amusing fiction,—in which the author, knowing the improbability of finding speedy contradiction in England, has given full scope to his apparently very fertile imagination. Were this work to be allowed to pass undisputed, not only might the confiding public in general, but the scientific world in particular, suffer by too readily accepting as *bonâ fide* the 'traveller's tales' with which it is replete.

"Having known M. Du Chaillu for some years personally, and possessing, moreover, from reliable sources, information the most exact as to his antecedents, besides having a knowledge of many of the places and people which he pretends to describe, I am induced to request a place in your journal for the following remarks.

"M. Du Chaillu has stated that he found piles of human bones in the F'an (properly F'an, *pl.* Ba F'an) towns which he visited. I do not pretend to have been in the particular towns or villages which he mentions, and which probably have no other existence than in his own imagination; but I have twice visited the Ba F'an country, living in one of their towns for four days at a time, besides making shorter stays in some eight or ten others, one of which, situated about 120 miles from the mouth of this river, contains about 3000 inhabitants, and I never saw the slightest vestige of human remains in any of them; nor did either of the two Europeans, or the numerous natives of Gaboon and Kroomen, by whom I was accompanied, although we looked for them. I have made inquiries of all white people, whether missionaries, French officers, or traders, who have made excursions into any part of the country inhabited by the Ba F'an, but not one of them (with the single exception of an American missionary, who has been in communication with that people for many years, and speaks their language) ever saw a human bone or other remains; and the gentleman in question only came across a single skull planted in the ground in one village,—an object to be met with elsewhere in Africa than in the towns of the cannibal Ba F'an. That these people are notorious anthropophagi, no one attempts to deny; but the 'piles of human ribs, legs, hand-arm bones, and skulls,' are inventions of M. Du Chaillu.

"Again, the statement of the untameability of the young of the Gorilla, or N'Jina, is untrue. In proof whereof, let me ask M. Du Chaillu, whose memory, usually so very good, seems to have failed him signally in this particular instance, if he has forgotten the young female Gorilla, of from two to three years of age, called Seraphine, which lived at my factory for four months in 1859, and which he repeatedly saw there? I assert, without fear of contradiction by M. Du Chaillu or any other person (and I could name scores of Europeans who saw it), that this animal was perfectly tame, docile, and tractable—far more so, indeed, than many negro children of the same age. Not only was she on perfectly good terms with all grown-up people in and about the factory, but was exceedingly attached to her keeper Curtis, whom she could not bear to be out of her sight, but regularly accompanied him about the factory and in his walks in the town and neighbourhood. She was familiar and quiet with myself and clerks, and was only displeased when children approached her; and for these she seemed to have, in common with most large apes and monkeys, a very great dislike. She was seldom tied up, and even then only by a very small cord, which she could easily have broken, or cut with her teeth, had she felt so inclined. She allowed herself to be clothed, seeming to like it; and actually went to breakfast with a friend of mine, M. Barbotin, commandant de l'aviso à vapeur, le Rénaudin, upon which occasion she conducted herself to the admiration of everybody. When at times put on the table, or amongst vessels of glass or earthenware, she was most careful not to break anything. She finally died from dysentery and chagrin,—the latter caused by her keeper being prevented by his other occupations from paying her so much attention as she had been in the habit of receiving.

"M. Du Chaillu ignores totally the presence of M. Duval, who accompanied him in his trip overland to Cape Lopez, and likewise omits all mention of an American trader living close to him on the Fernan Vas, to whom he was under many obligations.

"The species of Ant to which he gives the name of '*Barhekouay*' (a word unknown in Mipongwe, and probably invented by himself) is the insect commonly known as the 'driver,' of which there are two kinds, called here respectively *Ntyounou* and *Ntyounou sakoa*. I need scarcely say that his description is a gross exaggeration; the insect, although sufficiently troublesome, being by no means so formidable as he represents it.

"In the Appendix to his work, M. Du Chaillu mentions a visit paid by him to a French emigrant ship at Cape Lopez: no ship of the kind ever shipped a single emigrant there, or even called there. The vessel to which he alludes was the 'Phœnix,' Capt. Chevalier, on board of which he accompanied me; and it was through me that he obtained permission to go, when he heard of my intention. So far from his being there able to hold intercourse with the people on board, as his boasted knowledge of the different native languages should have enabled him to do, he could hardly speak half-a-dozen words correctly, and was glad to avail himself of the services of Curtis, then interpreter to Capt. Chevalier, who furnished him with the numerals of the Kioo and other tribes to the north-west which figure in his Appendix; and I was the medium of communication with those emigrants speaking the Mipongwe. As to M. Du Chaillu's qualifications in this latter language, they are of the most infinitesimal kind, as I can assert with confidence, having a competent knowledge of it myself; and he abundantly proves his ignorance when employing any Mipongwe words, nearly all of which are wrong. His Mipongwe numerals are totally incorrect. He has even less knowledge of the dialects of the neighbouring tribes. As to his identification of individuals of thirty-eight different tribes on board the 'Phœnix,' nothing of the kind occurred; and his information must have been obtained from Capt. Chevalier, or the French délégué.

"In his engraving, the horns of '*Niare*' are simply *à l'impossible*: this animal is certainly the 'bush cow' of Dr. Gray, the native name for the animal (*Nyare-iga*) having literally that signification.

"Dr. Gray is also correct in his surmise that the specimens were not prepared on the spot. I saw many of them in the 'rough;' they were prepared in New York,—the operator finding them in such a bad state as to cause him to say that he would not undertake the task again for 100 dollars per specimen.

"With regard to the engravings which M. Du Chaillu alleges to have been prepared, with a few exceptions, from his own sketches, how does it happen that he had no sketches before leaving here, and actually told me that he could not sketch?

"I think I have sufficiently shown that M. Du Chaillu has been guilty of many incorrect statements; in fact, his work contains nearly as many errors and inaccuracies as there are paragraphs. It is, moreover, teeming with vanity; and, taking it as a whole, it is hard to say whether the author, in his attempt to impose upon, and, in fact, humbug the scientific world, displays most mendacity or ignorance. I will proceed, with many apologies for so far trespassing on your space, to give an instance of downright untruthfulness which occurs in the concluding paragraphs of the book. M. Du Chaillu there states that, after languishing for four months at Camma, waiting for a ship, his sight was at length gladdened by the appearance of a vessel which came to an anchor off the mouth of the Fernan Vas, being sent by his friends in Gaboon, the captain having orders to ascertain how he came by his death. Now, not only had his death never been reported,—and if it had, he was far too insignificant for any one to send a vessel to inquire into the manner of it,—but he had actually only left Gaboon some fifteen or twenty days previously, after having made arrangements with the very same captain to follow him to ship his ebony, &c. for America; and the four months were actually spent in Gaboon and the neighbourhood, two of them with a member of the American mission, who proceeds to England by this same mail *en route* to America, and who can confirm my statement. This gentleman may be heard of by application at the American Consulate at Liverpool.

"I, in common with most persons, doubt that M. Du Chaillu ever killed or assisted to kill a Gorilla, and also of the extent of his 'travels.' At any rate, his estimate of distances, as well as the direction in which he pretends to have penetrated, must be received with the utmost caution, as not only was he unprovided with instruments, but ignorant of their use.

"As endorsing my opinions, I am authorized to mention the name of M. Labeguerie, a French merchant here, and a distinguished member of the Agricultural Committee; to which I venture to add that of my friend M. A. Michon, of Havre, who could furnish information on the subject of his 'travels,' &c.

"With regard to his commercial exploits, which are as mythic as his sporting adventures, I beg to suggest that application be made t the firm of Oppenheim and Co., of Paris, with which firm he had some dealings in the year 1852, and who will be able to give every desirable *renseignement*, not only on that point, but on others also which I will not mention, when informed that M. Paul Du Chaillu, the Great African explorer (?) and the lion of the season in London, is identical with M. Paul Belloni.

"Having thus, as far as time will permit, done my best to arrest a career which I leave others to characterize, "I am, &c.,

'*To the Editor of* '*The Times.*'" "R. B. Walker."

On the Height of the Gorilla.
By Dr. J. E. Gray, F.R.S., V.P.Z.S. &c.

Much difference occurs in the statements of travellers and others with reference to the height of the great African Ape. Bowdich, the first traveller by whom it was referred to, under the name of the *Ingēna,* states it, on the authority of the natives of the Gaboon, to be generally five feet high; but in some recent notices it has been asserted to reach a height of six feet two inches; and the specimen exhibited at the Meeting of German Naturalists at Vienna is said, on good authority, to have measured more than six feet in height.

The measurement of a stuffed skin without bones is necessarily delusive, depending as it does, first, on the mode in which the skin has been originally prepared, and, secondly, on the extent to which the artist may be disposed to stretch it. Such measurements are not to be relied on, unless they are in accordance with those of the bony skeleton; and it has therefore occurred to me that it would be desirable to measure the long bones of the limbs of the various skeletons existing in the British Museum,—the osseous structure giving the only certain dimensions on which reliance can be placed.

The skeletons in the British Museum are six in number, viz.:—

1. A skeleton obtained from Paris by Professor Owen in 1857, and mounted in the best French manner.

2. 3. 4. Skeletons of male and female and young male, all more or less imperfect. Purchased from M. Du Chaillu, 1861.

5. A skeleton of a male, obtained at Bristol in 1858, of which we have also the stuffed skin.

6. An imperfect skeleton, purchased from M. Parzudaki of Paris in 1852.

The measurements of the several bones of each of these skeletons are given in the following Table.

	Humerus.	Ulna.	Radius.	Femur.	Tibia.	Fibula.
	in.	in.	in.	in.	in.	in.
Articulated specimen from Paris. ♂	17	14	13	14½	11½	10½
Skeleton from Du Chaillu's stuffed specimen. ♂ Called the "King of Gorillas."	16¼	14	13¼	13¾	11	9¾
Skeleton of young male, from the stuffed specimen. Purchased at Bristol	14½	11½	11	13	10	9½
An imperfect skeleton. Purchased of M. Parzudaki	12	11	10	11	...	9½
Skeleton of female. Purchased of M. Du Chaillu	13	11	10½	11	9	7
Skeleton of young male. Purchased of M. Du Chaillu	12	11½	9½	10	8½	7

They were taken by Mr. Gerrard with a tape, measuring inches and quarters of inches only, but are quite sufficient for a comparison between the specimens themselves, and as affording materials for determining the actual height of the animal. As the largest of these (viz. the Paris specimen photographed for the Trustees of the British Museum by Mr. Fenton) stands five feet two inches in height, I think we are justified in concluding that to be the extreme natural height of the full-grown animal.

I do not wish it to be understood that the Gorilla never grows higher, but that we have no evidence that it does; and the "King of the Gorillas," which we are told was a large full-grown male, certainly did not exceed that height.

The writer of the 20th and 21st chapters of the 'Explorations and Adventures in Equatorial Africa,' which are written in a very different style from the rest of the book *, and curiously interpolated in the narrative of the travels, states that there are some bones in the possession of Dr. Wyman which are much larger than any in M. Du Chaillu's collection; that he thinks the animal might have been six feet two inches high, if it could stand perfectly upright; but as the legs are always somewhat bent, and the body thrown forward, "the largest specimen would not *appear* higher than five feet nine inches." (Pp. 354 and 369.)

It is to be regretted that the measurements of the long bones of the limbs of Dr. Wyman's imperfect skeleton have not been given.

* Thus, in the body of the work, the *Troglodytes calvus* and *T. koolookamba* are called new species, but in these chapters they are said to be (and reasons given why) only varieties of the Chimpanzee (see pp. 359, 375, &c.). And a supposed peculiarity of the skull of the Koolookamba is said to occur also in the skulls of the Gorilla and *Nshiego mbouve* (p. 376); and there is considerable and correct anatomical knowledge shown, which is quite at variance with the rest of the work, or with the paper that has appeared under M. Du Chaillu's name.

Description of a Reptile, the Chelonia Caretta, *or Loggerhead Turtle, new to the British Fauna.* By Robert Dyce, M.D., Professor of Midwifery in the University of Aberdeen.

The reptile, of which the following is a description, was caught on the 1st of August, 1861, at Pennan, near Banff, by the fishermen, in the stake net, and was very lively and pugnacious. It is still alive.

Testa convexa, scutellis disci 15, vertebralibus convexis, maxillis serratis (*Gray, Syn.*).

This definition corresponds correctly with the specimen. The shield is heart-shaped, very convex, and with a prominent row of 5 tubercles on the middle of the back of the shield,—the two lowest almost rudimentary. Length of shield 19½ inches; breadth of ditto 18 inches.

Tail very short, just reaching to the inner edge of the marginal plate. Dorsal plates 15 in number. Marginal plates 25. The posterior edges of those near the hinder part are very prominent, so as to form strong projecting points.

The under or ventral side has 12 plates and 10 marginal. The shield is 14 inches across, and 13 inches long. The two carinæ, running the whole length, are not very marked; the edges seem worn by friction. Head large for the size of the animal, nearly 5 inches long, covered with 24 or 25 plates, flattened above and at the sides. The beak strong and hooked; the lower jaw when the mouth is shut passing a good way within the upper. Both jaws finely serrated.

Fore feet 12 inches long. Hind feet 9 inches long, and broad, with two strong, sharp claws on each of the four feet.

The general colour is deep brown, streaked and spotted with yellow. Marginal plates lighter brown, and those near the shoulder with more yellow. Under parts entirely yellowish white.

The weight about 25 lbs.

This species of Turtle has never before been described as an inhabitant of these seas. The number of dorsal plates, the tubercles on the back, the large head, the serrated jaws, and marked heart-shape of the carapace furnish very distinctive characters.

This variety of Turtle (*Caretta*) is said to be one of the largest, if not the largest, of the genus, as well as a "most fierce and voracious reptile, even dangerous from its courage and ferocity." The present specimen must therefore be considered a very small one; yet it does not appear to be young, judging from the coarseness and thickness of the shield, the size of its head, and other marks of maturity. The marginal plates are here and there notched and jagged at their edges, and the ventral shield worn and rubbed, as if the animal had undergone some rough usage in its long and perhaps stormy journey across the Atlantic to this country.

On the occurrence of the Loggerhead Turtle in Scotland.

Rowardannon Lodge, Loch Lomond,
August 23, 1861.

My dear Sir,—We are staying here with a very high lake (8 feet higher than usual), and gusty weather. Last night, on taking a turn out by the lake, I found a live Turtle of some kind, lying on its back on the beach. I was very greatly surprised; but I remember to have read that one species had been found on some part of the Scottish coast. It is $11\frac{1}{2}$ inches long, 10 inches broad, with large paddles $5\frac{1}{2}$ inches long. He delights to keep his head under water, and raises it only occasionally for air.

Nobody hereabouts has ever seen such a thing, or heard tell of such a thing. What can it be?—how did it get there?—is it good to eat? are the questions asked by every one; but no one can answer.

Can you assist to unravel the knotty question?

The gamekeeper said, when shown to him, How very like a bird! Head just like, and wings also! Would not Darwin have been pleased at the idea of a transformed Grouse, or, rather, a Grouse changed by natural selection to adapt itself to live in the lake instead of flying over the heather?

I remain, my dear Sir, yours faithfully,

Dr. J. E. Gray. A. D. Smee.

P.S. All say here that they vow they will eat it, if it is good to eat; so that, if it is rare, you had better reply that it is rank poison.

7 Finsbury Circus, Sept. 23, 1861.

My dear Sir,—I could obtain no more information about the Turtle. No person had ever heard of such a beast (everything is a beast!) in that part of Scotland.

It was found one evening about eleven o'clock, at the very edge of the lake, upon the beach, the water rising in waves like a miniature sea, and being about 8 feet above its usual level. It was lying on its back somewhat stupefied, but rallied on being placed in water. It was alive when I wrote to you, but died a few days afterwards, and was to have been stuffed as a trophy of the place.

The exact place where it was found was about 3 feet above a small-boat landing-place at Rowardannon Lodge, and about 330 or 400 yards from the Rowardannon Pier, where tourists land for Ben Lomond.

I told the keeper you said he had put it there to take me in; at which he seemed greatly surprised, as he had "never seen such a beast in his life." My own impression is that it had come upon the coast, and up the river, which was unusually swollen, and got into the lake, where it became feeble, and was thrown, in the tempestuous weather, upon the beach where I found it. No one could certainly have put it there for us to find, as who could have thought that I should turn out at that time of night?

It has always appeared to me a most interesting circumstance, and I think that the fact of one being found in the lake should be recorded for the benefit of those interested in its natural history. Perhaps the other specimen, which you tell me has been taken in Scotland, and this, may have been swept out of the Mediterranean together.

I remain, my dear Sir, yours faithfully,

Dr. J. E. Gray. A. D. Smee.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 47. NOVEMBER 1861.

XXXV.—*On the Nurse-Genus* Corymorpha *and its Species, together with the Medusæ produced from them.* By M. Sars*.

In the year 1835, I described, under the name of *Corymorpha nutans*, a colossal new Hydroid polype discovered by me in the vicinity of Bergen†. The same form was subsequently detected near the Orkneys by Forbes and Goodsir‡.

In an important little memoir on the 'Marine Invertebrata of Grand Manan,' which appeared in 1853, it is stated (p. 9) by the American naturalist and circumnavigator, W. Stimpson, that my *Corymorpha nutans* occurs in great abundance at Grand Manan, Fundy Bay. As, however, he gives no more particular description of the animal observed by him, and, as we shall show hereafter, several very similar, but specifically distinct, forms of *Corymorpha* occur in the northern seas, it must still be regarded as doubtful whether the American species be truly identical with *C. nutans*.

The above was all the published information regarding this genus of Hydroida, which, however, was supposed to be confined to the northern seas, and of which only a single species was known, until, in the year 1854, Professor Steenstrup described a second, and indeed a tropical, species of this genus from Rio Janeiro, under the name of *Corymorpha Januarii*§.

A Hydroid polype observed by O. Schmidt, and figured in his 'Handatlas der vergleichenden Anatomie' (Jena, 1854), tab. 9. fig. 2, of which, without describing it particularly, he makes a

* Forhandl. i Vid. Selsk. i Christiania for 1859; translated from Wiegmann's Archiv, 1860, p. 341, by W. S. Dallas, F.L.S.

† Beskr. og Jagtt. over Dyr ved den Bergenske Kyst, pp. 6–10, tab. 1. fig. 3.

‡ Ann. Nat. Hist. 1840, vol. v. p. 309.

§ Vidensk. Meddelelser fra den naturhist. Forening i Kjöbenhavn. 1854, p. 46.

new genus under the name of *Amalthæa uvifera*, is also certainly a species, and apparently a new one, of my genus *Corymorpha*. Leuckart is therefore wrong when, in his "Jahresbericht" (Archiv, 1854, ii. p. 443), he identifies this with the *Myriothela arctica* described by me in 1850*, which differs from it not only specifically, but even generically.

Lastly, Alder, in his 'Catalogue of the Zoophytes of Northumberland and Durham' (1857, p. 18), has shown that a Hydroid polype imperfectly described by Johnston, and referred by him to the genus *Hydractinia* (Hist. of British Zoophytes, p. 463, fig. 79 *a*), is a new species of *Corymorpha*—*C. nana*, Alder.

Besides the earliest-known species, *C. nutans*, I have at different times found on the northern coasts three other new species, by which the total number is raised to seven, of which six are northern (three even arctic) and one tropical.

As regards the determination of the species, these have so much in common in the form of the body and tentacles, and the number of the latter appears to be so little fixed, and also variable according to age, that it becomes extremely difficult to distinguish and characterize these forms satisfactorily. From my experience, the best and most certain characters are furnished by the Medusa-buds produced from them. From the form and structure of these, and with the addition of some other characters which are certainly less reliable, I have endeavoured to characterize the species observed by me.

1. *Corymorpha nutans*, Sars.

Sars, Beskr. og Jagtt. over Dyr ved den Bergenske Kyst, 1835, p. 6, tab. 1. fig. 3 *a–f*; Forbes and Goodsir, Ann. Nat. Hist. 1840, vol. v. p. 309; Johnston, History of British Zoophytes, p. 54, tab. 7. figs. 3–6.

Proles hydriformis 3–4-pollicaris, tentaculis inferioribus filiformibus longissimis uniserialibus 40–50, superioribus brevissimis numerosissimis sparsis; pedunculis gemmigeris circiter 15–20, tenuibus, longiusculis, ramosis, ramulis alternantibus apice gemmis medusinis numerosis minimis dense accumulatis obsitis.

Proles medusiformis decidua, pallio campanulato apice conico, canales quatuor radiantes exhibente, antice aperto margine oblique truncato ibique bulbis quatuor marginalibus æquidistantibus ornato, quorum unus solummodo in cirrum cylindricum porrectum evolvitur.

I first discovered this species in the year 1830, near Glesvaer, in the vicinity of Bergen, at a depth of 30–40 fathoms, on muddy sand; I afterwards met with it near Manger, at a depth of 8–10 fathoms, on a sandy bottom; and lastly, in my first northern journey, in the year 1849, a pair of specimens were found, mixed with the following species, which occurred in great

* Reise i Lofoten og Finmarken, p. 134.

abundance at a depth of 40–50 fathoms, on sandy mud, near Reine on Vestfjorden, in the Lofoden Isles.

2. *Corymorpha Sarsii*, Steenstrup.

Corymorpha nutans, Sars, Reise i Lofoten og Finmarken, nyt Magazin for Naturvid. 1850, vol. vi. p. 135.
Corymorpha Sarsii, Steenstrup, Meddel. fra d. naturh. For. i Kjöbenh. 1854, p. 48.

Proles hydriformis 2–3-pollicaris, tentaculis inferioribus filiformibus longissimis uniserialibus 30–40, superioribus numerosissimis brevissimis sparsis; pedunculis gemmigeris 8–10, tenuibus, brevissimis, apice divisis, gemmis medusinis paucis maximis obsitis.
Proles medusiformis decidua, pallio elongato-campanulato apice rotundato, canales quatuor radiantes exhibente, antice aperto, margine recto ibique bulbis seu cirris marginalibus enascentibus quatuor æquidistantibus, omnibus æqualibus, ornato.

This form, discovered by me in 1849, has hitherto been found only in Vestfjorden, near the Lofoden Isles, half a mile eastward of Reine (67° 57′ N. lat.), at a depth of 40–50 fathoms, on a muddy sandy bottom; here it is very abundant, and is often drawn up with its long tentacles entangled in the meshes of the dredge.

3. *Corymorpha uvifera*, Schmidt, sp.

Amalthæa uvifera, O. Schmidt, Handatlas der vergl. Anat. tab. 9. fig. 2.

Near the island of Loppen, in Finmark, at a depth of one fathom, with a sandy bottom. This form is distinguished from the two preceding species by its smaller size (1 inch or but little more), shorter inferior and fewer superior tentacles. As regards its Medusa-buds, it appears to come nearest to *C. Sarsii*, as, according to Schmidt's figure, it has four marginal bulbs of equal size, which, however, are here far larger than in the former species.

4. *Corymorpha? annulicornis*, Sars, n. sp.

Proles hydriformis $\frac{2}{3}$-pollicaris, tentaculis inferioribus filiformibus longioribus annulosis 20, superioribus 8–10 uniserialibus brevissimis apice globoso; pedunculis gemmigeris brevissimis, gemmis medusinis majoribus et paucioribus obsitis.
Proles medusiformis decidua, pallio breviter campanulato, canales quatuor radiantes exhibente, antice aperto, margine bulbo seu cirro marginali unico magno, conico-elongato vel cylindrico, introrsum flexo, cæterisque tribus indistinctis, ornato.

This small and very distinct form, which, however, I do not place in the genus *Corymorpha* without some doubt, has only occurred to me once near Floröe, in the diocese of Bergen, where I met with two specimens, at a depth of 30–40 fathoms, on a muddy bottom. It differs rather widely from the other species of the genus in many respects, especially in the annulated and more contractile inferior tentacles, and the small number of the superior ones, which form only a single circle and terminate in a knob, and approaches *Tubularia*, so that it appears actually to form a transition between these two nurse-genera.

5. *Corymorpha nana*, Alder.

Hydractinia, sp., Johnston, Brit. Zooph. p. 463. fig. 79 *a*.
Corymorpha nana, Alder, Catalogue of the Zoophytes of Northumberland and Durham, p. 18, tab. 7, figs. 7, 8.

Very small (only half an inch long), club-shaped, much narrowed downwards; the inferior long tentacles fifteen to twenty in number; the superior short and less numerous tentacles (about ten according to the figure) placed in a single circle or coronet, as in my *C. annulicornis*. Medusa-buds unknown. On the English coast.

6. *Corymorpha Januarii*, Steenstrup.

Steenstrup, Vidensk. Meddel. fra d. naturh. For. i Kjöbenh. 1854, p. 46.

At Rio Janeiro. This is the largest known species of the genus (6 inches long), and is distinguished by the great number of the inferior or long tentacles (about 80) and of the gemmigerous peduncles (about 40), the Medusa-buds of which appear to resemble those of *C. nutans* by the obliquely truncated anterior margin of their bells, and those of *C. Sarsii* by their four nearly equal marginal bulbs.

7. *Corymorpha glacialis*, Sars, n. sp.

Proles hydriformis 4–5-pollicaris, tentaculis inferioribus filiformibus longissimis uniserialibus 40–50, superioribus numerosissimis brevissimis sparsis; pedunculis gemmigeris 30–35, brevioribus, crassis, indivisis aut solummodo ramulis nonnullis brevissimis, gemmis medusinis paucis minoribus sparsis singulis aut pluribus accumulatis, obsitis.

Proles medusiformis sessilis (nunquam decidua), pallio ovali absque canalibus radiantibus et bulbis (cirris) marginalibus, undique clauso, in aliis animalibus altricibus ova, in aliis spermatozoa includens.

I found this species, which is distinguished by the remarkable form of its Medusa-buds, differing from those of all the preceding species, during my last northern journey, in the summer of 1857, in the Varangerfjord, near Nadsoe (70° N. lat.), where it occurs rarely and singly at a depth of 60–80 fathoms, but pretty plentifully at 80–120 fathoms, on a soft clayey and stony bottom: it adheres firmly with its lower extremity to particles of sand, or sometimes to fine red Algæ.

In connexion herewith the author has published the description of a new free-swimming Medusa found at Floröe, which so much resembles some of the Medusa-buds produced by *Corymorphæ,* that he thinks it probably originates from a species of this nurse-genus. It belongs to Forbes's genus *Steenstrupia,* differing in the following characters from the four known species (*S. rubra,* Forbes, *S. flaveola,* Forbes, *S. lineata,* Leuck., and the species observed by Steenstrup to be budded from *Coryne fritillaria,* which may be indicated by the name of *S. fritillariæ*) :—

Steenstrupia globosa, Sars, n. sp.

Proles hydriformis ignota.

Proles medusiformis $\frac{1}{8}$-pollicaris, pallio globoso-campanulato, hyalino, margine anteriore oblique truncato, postice rotundato absque appendice; bulbis marginalibus quatuor, rubris, æquidistantibus, de quorum uno prominente longe majore cirri marginales tres longissimi, basi bulbosa connati, de cæteris tribus vero nulli, exeunt; proboscide cylindrica rubra, extra marginem pallii non porrecta, ore simplici.

Concluding Remarks.

The nurse-genus *Corymorpha* possesses no small interest in several respects. It was one of the first Hydroid polypes in which the important physiological fact was ascertained (in 1835) that the forms belonging to this group of animals are nothing more than a preliminary generation or so-called *nurses* of Medusæ, and, indeed, of the lower Medusæ (Cryptocarpæ, Eschsch.; Gymnophthalmata, Forbes; Craspedota, Gegenb.), which are consequently developed by the process of the alternation of generations.

They are further distinguished by their colossal size in comparison with all the other known Hydroida, as also by their always occurring as single or solitary individuals, never compound, or with several individuals united to form a colony. The formation of colonies appears otherwise to be the rule amongst the Hydroida: all known genera and species, even those which were long regarded as simple, have been found by recent investigations to be proliferous, and therefore forming colonies*.

The only known permanently solitary Hydroida (and therefore never proliferous or forming colonies) are the two genera *Corymorpha* and *Myriothela* established by me (Reise i Lof. og Finm. p. 134, and described in detail in 'Forhandl. ved de skand.

* Many years ago I ascertained that our common *Coryne squamata,* Müll. (*Clava multicornis,* Forsk.), which was previously described as a simple animal, was proliferous at its base, and consequently formed colonies,—an observation which has also been recently confirmed by Wright (Edinb. Phil. Journ. 1857, vol. vi. p. 79).

Naturforskeres 7de Möde i Christiania,' 1856, pp. 194–201). The genus *Hydra* (the well-known freshwater polype), which differs from all other Hydroida by its power of moving from place to place, and by the production of *deciduous* Hydraform buds resembling the parent animal, unites, in a remarkable manner, the solitary and composite Hydroida, since at one time, namely when it has no young, it is solitary; when it is proliferous, or pushes forth buds, it represents a temporary colony, which in a short time is dissolved, the hydraform young produced by prolification gradually separating from the parent animal.

From the foregoing observations it will be seen that the genus *Corymorpha* produces Medusæ of very different nature. Five of the known species, namely, produce perfect, well-organized Medusæ, which separate from the nurse-animal and lead a completely free-swimming life, in which state only they develope generative organs and propagate. They therefore prove to belong to the great group of the so-called lower Medusæ (Cryptocarpæ, Eschsch.; Gymnophthalmata, Forbes; Craspedota, Gegenb.). One species, on the contrary, namely *Corymorpha glacialis*, produces, instead of these, Medusæ which are from the first furnished with generative materials, but otherwise extremely simple and imperfectly formed, and destined to remain sessile or permanently connected with their nurse-animal until after they have developed and evacuated their sexual products, when they dissolve and disappear.

We have here a new example of very similar nurse-animals giving origin to a very different medusiform brood. Science is not deficient in other examples. Thus, for instance, according to Van Beneden, *Tubularia Dumortieri*, V. B., produces perfect and deciduous, and *T. larynx*, Ell. & Sol. (*T. coronata*, V. B.), imperfect and sessile Medusæ. From my own observations also, *Podocoryna carnea*, Sars, and *P. tubulariæ*, Sars, give origin to perfect and deciduous Medusæ, whilst *P. Sarsii*, Steenstr., and *P. fucicola*, Sars, produce imperfect and sessile ones. Both kinds sprout, in all these Hydroida, as in *Corymorpha*, in the form of buds from the same spot in the nurse-animal; they have the same mode of development and the same form and organization up to a certain stage, when those which are destined to remain sessile are arrested in their development, whilst those which are to lead an independent free life are developed further into the perfect Medusa-type.

These complicated relations greatly increase the difficulty of classifying the Hydroid polypes according to their sexual generation—the method which is certainly most in accordance with the principles ordinarily adopted in zoology, and which, indeed, is employed by Gegenbaur in his otherwise admirable "Versuch cines Systems der Medusen" (Siebold and Köll. Zeitschr. 1856, vol. viii. pp. 202–272), in which he appends to each species of Medusa, as far as is known, the nurse-form (the Hydroid polype) from which it originates. But without taking into consideration that, at the present time, when we are still unacquainted with the nurses of many Medusæ, and, on the other hand, also with the Medusæ produced from many Hydroida, such a classification cannot be completely carried out in practice, we should by this method be led to separate all sessile Medusæ budded forth by Hydroid polypes from the free-swimming forms produced from similar nurses, and to place them in different sections, notwithstanding that in reality they are closely related. Gegenbaur, indeed, has not attempted to classify the former; nay, he even passes them over entirely in silence in the systematic revision of the Medusæ given by him. And yet these sessile Medusæ can by no means be separated from the great group of the free-swimming lower Medusæ, of which they are only inferior forms, which have remained stationary on a lower step of the evolution common to both. As a conclusive proof of the homology of the two forms, we may adduce the fact that complete transition-forms occur between them. Thus, according to Lovén, the sessile female medusoid buds produced from *Laomedea geniculata*, Müll., and, according to Strethill Wright, those of *L. dichotoma*, Wr., possess radiating vessels and developed motile (contractile) marginal filaments, whilst the male forms in both these species, according to Schultze and Wright, have no radiating vessels, and fewer and shorter marginal filaments; the Medusa-buds of *Syncoryna ramosa*, Lovén, which are likewise sessile, also possess radiating vessels and marginal bulbs or rudimentary filaments, and their bells exhibit peculiar movements of systole and diastole. These three forms of medusoid buds in Hydroida consequently stand, although sessile, on a higher stage of development than those of *Corymorpha glacialis* and the above-mentioned species of *Tubularia* and *Podocoryna*, which are destitute of radiating vessels and marginal filaments, and are immoveable. By the classification of the Hydroida solely according to the sexual generation or the Medusæ produced from them, we should therefore come to separate widely the most nearly allied nurse-forms in an unnatural manner, which would be the less justifiable as the species in these animals is evidently not completely represented by the sexual generation, which is often less perfectly organized, and, so to speak, embraces a far smaller portion of its developmental history than the nurse-generation. We are therefore undoubtedly right if we give up the mode of proceeding to which we are accustomed in the classification of the higher animals, namely, regarding the idea of the species as completely expressed in two individual creatures, the maturely sexual male and female. Both in the animals which we are here considering and in all others which are subject to the law of alternation of generations, and of which the different steps of development are represented by different individual creatures endowed with peculiar attributes, the idea of the species will only be rendered complete by the inclusion of the characters of the whole of the generations following each other in cyclical evolution.

In the present position of science it will undoubtedly be both easier and more advisable to take the Hydroid polypes (nurse-animals) as the foundation of the classification of the lower Medusæ, and to unite with each species the Medusa produced from it, but also to take sufficient notice, in the specific characters, of both generations—*Proles hydriformis* as well as *Proles medusiformis*.

That in the meanwhile we continue, as before, to indicate every newly observed nurse-form (Hydroid polype) as well as the free-swimming Medusæ, or both generations, by a proper provisional name, by no means tends, like the rest of the crowd of synonyms, to the further encumbrance of science. Nothing is easier than subsequently, when the other generation is known, to bring both forms together and to indicate them either by a single definite name, or, as has been done, for example, in the case of the Salpæ, by a double specific name.

XXXVI.—*A Catalogue of the Zoophytes of South Devon and South Cornwall.* By the Rev. Thomas Hincks, B.A.

[Continued from p. 297.]

Order **LUCERNARIDÆ**, Huxley. Fam. **Lucernariadæ.**

Lucernaria, Müller.

1. *L. auricula*, Fabr.

Common on weed near low-water mark: Littleham, near Exmouth; Petit Tor, near Torquay, &c.

2. *L. campanulata*, Lamx.

Torbay (*Dr. Coldstream*).

Class ACTINOZOA, Huxley.

Order **ZOANTHARIA**, Milne-Edwards (pars). Fam. **Actiniadæ.**

1. Actinoloba, Blainville.

A. dianthus, Ellis.

Common: large colonies amongst the trawl-stuff, Brixham; on oysters, &c.

2. Sagartia, Gosse.

1. *S. bellis,* Ellis and Solander.

Extremely abundant in tide-pools; crowded together in holes and crevices in the rocks.

2. *S. miniata,* Gosse.

Abundant: dredged in Salcombe Bay; Torquay, Dartmouth, Plymouth (*Gosse*).

3. *S. rosea,* Gosse.

About low-water mark, South-Devon coast, not uncommon.

4. *S. ornata,* Holdsworth.

Dartmouth (*E. W. H. Holdsworth*); Torquay (*Gosse*).

5. *S. ichthystoma,* Gosse.

A single specimen taken at the Ore Stone, Torbay, by the Rev. W. F. Short.

6. *S. venusta,* Gosse.

Torquay (*Gosse*).

7. *S. nivea,* Gosse.

Salcombe, between tide-marks; Dartmouth, not uncommon (*Holdsworth*); Torquay (*Gosse*).

8. *S. sphyrodeta,* Gosse.

Under ledges of rock at the base of the cliff, Littleham, near Exmouth, not common. The "tendency to a pendent posture," noticed by Mr. Gosse, is very characteristic. Dartmouth (*Holdsworth*).

9. *S. pallida,* Holdsworth.

Dartmouth (*Holdsworth*); Torquay (*Gosse*).

10. *S. coccinea,* Müller.

Cornwall (*Peach*); Torbay, abundant in deep water (*Gosse*).

11. *S. troglodytes,* Johnston.

Not common: Teignmouth (*Prof. R. C. Jordan*); Torquay (*Gosse*).

12. *S. viduata,* Müller.

Torquay, abundant (*P. H. G.*); Dartmouth (*Holdsworth*).

13. *S. parasitica,* Couch.

Common: Torbay, Salcombe, Exmouth, &c.; always on *Buccinum undatum.*

3. Adamsia, Forbes.

A. palliata, Bohadsch.

Common in Salcombe Bay, on various kinds of *Trochus,* always associated with a species of Hermit-crab; Torbay (*Gosse*).

4. Phellia, Gosse.

1. *P. murocincta,* Gosse.

Petit Tor, near Torquay (*P. H. G.*).

2. *P. gausapata,* Gosse.

Deep water, Torbay (*P. H. G.*).

5. Anthea, Johnston.

A. cereus, Ellis & Solander.

Very abundant, in rock-pools and in shallow water near the shore. At Salcombe multitudes of the grey variety are met with studding the slender leaves of the *Zostera marina,* from which they hang like blossoms, waving to and fro with every movement of the water.

Mr. Robert Patterson has described the *Anthea* as occurring to him in a similar situation in Belfast Lough.

The var. *smaragdina* is very common, often forming a most exquisite fringe along the edges of the tide-pools.

The *Anthea* is found on the west coast of Scotland; but I have never met with it on the Yorkshire coast, and it is wanting in Mr. Alder's Durham and Northumberland Catalogue.

6. Actinia, Linnæus.

A. mesembryanthemum, Ellis & Solander.

Extremely common throughout the upper zone of the littoral region.

7. Bunodes, Gosse.

1. *B. gemmacea,* Ellis & Solander.

Not uncommon between tide-marks: Exmouth, Salcombe (abundant), Torbay.

2. *B. Ballii,* Cocks.

Torquay (*Gosse*).

3. *B. coronata,* Gosse.

Occasionally in moderately deep water (about 20 fathoms).

8. Tealia, Gosse.

T. crassicornis, Müller.

Very common, in pools and clefts near low-water mark; also from deep water.

Fam. Ilyanthiadæ.

1. PEACHIA, Gosse.

P. hastata, Gosse.

"Torbay, at extreme low water, and thence downward, buried in sand" (*P. H. G.*).

2. HALCAMPA, Gosse.

1. *H. chrysanthellum*, Peach.

Fowey, Cornwall; buried in sand at low water and in tide-pools (*C. W. Peach*).

2. *H. microps*, Gosse.

In eroded limestone, Oddicombe, S. D. (*Gosse*).

3. EDWARDSIA, Quatrefages.

1. *E. callimorpha*, Gosse.

Dredged off Brixham (*Rev. C. Kingsley*).

2. *E. carnea*, Gosse.

The Orestone, Torbay (*Miss Pinchard*); Petit Tor, in the old burrows of *Saxicavæ* (*P. H. G.*).

3. *E. Beautempsii* (?), Quatrefages.

Torquay (*Rev. C. Kingsley*).

Fam. Capneadæ, Gosse.

CORYNACTIS, Allman.

C. viridis, Allman.

Abundant, in clusters between tide-marks.

In a rock-pool at Salcombe I once found a stone of small size which bore upon it a group of no less than thirty of these little gems, of the brightest green colour, and with vivid ruby tips to the arms. Another variety, from the same place, had the column of a beautiful rose-colour, the tentacles fawn, and a ring of yellow round the outside of the disk.

Fam. Zoanthiadæ.

ZOANTHUS, Cuvier.

1. *Z. Couchii*, Johnston.

Not uncommon: Salcombe Bay, on slate, stone, &c. (in about 12–15 fathoms); Cornwall (*Couch*); Torbay, 12 fath. (*Holdsworth*).

The *Mammillifera arenacea* of Sars's 'Middelhavet's Littoral-

Fauna' is identical with this species. He obtained it at Naples, in from 10–20 fathoms' depth.

2. *Z. sulcatus,* Gosse.

Mr. Gosse mentions a single colony of this pretty but very minute species as having occurred to him at Broadsands, near Brixham, on sandstone rock. On the opposite side of Torbay, however, and very close to Torquay, I have found it abundantly in the small basins hollowed out in the limestone, which I have before referred to as yielding the *Clavatella prolifera.*

The *Zoanthus* forms little colonies on the floor of these miniature pools; but they may readily be passed over as tufts of some minute weed.

3. *Z. rubricornis,* Holdsworth, Proc. Zool. Soc. March 12, 1861.

This species has lately been described by Mr. Holdsworth, who obtained it in Plymouth Sound, at a depth of 20 fathoms.

Fam. **Caryophylliadæ.**

1. Caryophyllia, Lamarck.

C. Smithii, Stokes.

Common, near extreme low-water mark: Torbay, Salcombe, Dartmouth, Polperro, &c. Dredged off Berry Head.

2. Sphenotrochus, Milne-Edwards.

S. Macandrewanus, M.-Edwards.

I insert this species in the catalogue on the strength of a very minute specimen which I found amongst some shell-sand brought in by trawlers to Plymouth. I have had very fine examples from Mr. Barlee, which were dredged off some part of the Cornish coast, but beyond the limits of my present district. Mr. Macandrew has also taken it in the same region, on clean sandy ground.

3. Hoplangia, Gosse.

H. durotrix, Gosse.

Mr. Laughrin has supplied me with a specimen of this interesting Coral from the coast of Cornwall. It had only been found previously in Weymouth Bay. In this specimen a single small and imperfectly developed Corallite buds from the spreading base of a full-grown individual. In the case of another Corallite on the same piece of rock, there is no appearance of any basal expansion.

4. Balanophyllia, Wood.

B. regia, Gosse.

On stone dredged in five fathoms, Landtivet (?) Bay, coast of Cornwall. Five or six fine specimens occur on a single piece of rock from the above locality. Plymouth Sound (*T. H. Stewart*).

Order **ALCYONARIA**, Milne-Edwards. Fam. **Alcyoniadæ.**

1. Alcyonium, Linnæus.

A. digitatum, Linn.

Very common, in shallow and deep water.

2. Sarcodictyon, Forbes.

S. catenata, Forbes.

Ilsam, near Torquay, on rock at extreme low-water mark (*Gosse*): *vid.* Ann. Nat. Hist. ser. 3. vol. ii. (1858), p. 276.

[On stones from deep water, off the coast of Antrim.]

Fam. **Pennatuliadæ.**

Pennatula, Linnæus.

P. phosphorea, Linn.

This is included among Devon species, on the authority of Turton and Kingston ('Nat. Hist. of Torquay, Dawlish, and Teignmouth'). We can hardly suppose that they were mistaken about so marked a form. But the *Pennatula* must be of extreme rarity on the western coast, as we have, I believe, no other record of its occurrence.

It is abundant along the coast of Norway, as well as on our own northern shores, and is included also in the Mediterranean 'Littoral-Fauna' of Sars; but this author states that the southern form is much inferior in size to the northern.

Fam. **Gorgoniadæ.**

Gorgonia, Linnæus.

G. verrucosa, Linn.

Common along the coasts of Devon and Cornwall, in about 30–40 fathoms' depth.

Sars informs us that in the Grotto of Nisita, where at midday there is only twilight, the *Gorgonia* occurs frequently, attached to the precipitous walls of rock, at a depth of from half a fathom to a fathom below the surface of the sea. In this situation it grows to the height of one foot.

G. verrucosa is found elsewhere in the Mediterranean at a depth of from 10 to 20 fathoms, and on our own coast is obtained universally in deep water. Its occurrence so near the surface in the Grotto is an exceptional case, and is dependent, no doubt, on the peculiar character of the locality, which in many respects must resemble its more usual habitat.

I have reason to believe that a second species of *Gorgonia*, somewhat allied to the *verrucosa*, is met with on our western coast, but I am not yet in a position to speak with confidence about it.

[To be continued.]

XXXVII.—*Further Observations on the Structure of* Foraminifera, *and on the larger Fossilized Forms of Scinde, &c., including a new Genus and Species.* By H. J. Carter, Esq., F.R.S.

[Continued from p. 333.]

Further Observations on the larger Fossilized Forms of Foraminifera in Scinde, &c.

Operculina, D'Orbigny.

"2. *O.* —— ?"—See my first paper on the larger forms of Foraminifera in Scinde, &c. (Ann. & Mag. Nat. Hist. vol. xi. p. 167, 1853). This *Operculina*, which I did not like to name, as I did not know whether or not it was a new species, has been called by MM. d'Archiac and Haime (p. 347) "*O. Tattaensis*," after the place where it was found.

Obs.—*Operculina* is much more nearly allied to *Assilina* than *Assilina* to *Nummulites*. *N. spira*, which is an *Assilina*, is but a gigantic *Operculina* with enlarged spicular cord.

Assilina, D'Orb.

"1. *A. irregularis*, H. J. C." (Ann. Nat. Hist. *l. c.* p. 168).—This has been rightly identified by D'Archiac and Haime (p. 343) with *N. spira*, De Roissy. Nevertheless it is an *Assilina* according to D'Orbigny's definition, and so closely allied to *Operculina* that the spicular cord and the septa of the chambers (that is, the spire altogether) are, with the exception of the central part, as visible as in *Operculina*.

*Largest size**.—Breadth $\frac{17\frac{1}{2}}{12}$ inch ($36\frac{1}{2}$ millim.).

Loc. Valley of Kelat (Dr. Cook)†.

Associates.—*Assilina exponens*, with varieties *a* and *b*, *A.*

* "Largest size" means the largest in *my* possession; "breadth" means the longest horizontal diameter; and "thickness" the greatest diameter at right angles to this.

† Dr. Cook, Bombay Army, late Medical Officer to the British Agency at Kelat. The name thus attached indicates the source from which the fossil was obtained.

obesa, n. sp., *Nummulites Carteri*, *N. biaritzensis*, *N. perforata*, *Alveolina elliptica*, *Orbitoides dispansa*, *Conulites Cooki*.

"2. *A.* —— ?" (Ann. Nat. Hist. *l. c.* p. 168).—This has been rightly identified by D'Archiac and Haime (p. 343) with *N. exponens*, that is to say, the species so well described and figured by them (p. 343, pl. x.). But there are two varieties besides the typical form, viz. *N. exponens*; and in the diagram which I have given (Ann. Nat. Hist. *l. c.* pl. 7. fig. 7), the size of the first variety of this fossil which I shall now describe (viz. *a*) has been represented with the external markings of the typical form.

Largest size.—Breadth $\frac{14}{12}$ inch ($28\frac{1}{2}$ millim.).

Loc. Lukput, in Cutch (Mr. Smith).

Associates.—*N. biaritzensis*, *Alveolina elliptica*, *Orbitoides dispansa*.

Variety *a*.—This differs from the foregoing in being broader, comparatively thinner, presenting more turns in the spire, and narrower chambers, with a greater irregularity in both than in the typical form (*N. exponens*), and therefore a consequent greater irregularity in the *external* indications of the turns, which are also less marked.

Largest size.—Breadth $\frac{20}{12}$ inch (43 millim.). Number of turns altogether 30, and 19 in a radius of 11 millim. The typical form given by D'Archiac and Haime is 30–35 millim. in diameter, with 16 turns in a radius of 11 millim.

Associates.—*N. spira*, *N. perforata*, *Alveolina elliptica*.

Variety *b* (Pl. XV. fig. 1, &c.).—This is still broader and thicker than the last variety (*a*), while the spire and chambers, in the horizontal section, more nearly approach that of the typical form. Externally it is smooth [the indications of the septa are not raised as in the typical form], wavy, diminishing gradually in thickness from the centre, which is plane [not depressed as in the typical form], to the margin, which is thin. Presenting a circular, white central portion, in which the markings of the septa, &c., are undistinguishable, but beyond this, with the spicular cord, become evident in the form of unraised white lines, which more or less disappear again halfway between the centre and the circumference. Spicular cord more marked than the septa, which are almost straight and, after three or four turns, only appear in fragments attached to the inner side of the cord, at right angles, so as to present the appearance of Hebrew characters. In the typical form the septal lines are strongly marked and slightly curved, beginning at the centre, but the spicular cord for the most part not indicated externally, while in the first variety (viz. *a*) there is a slight approach to the opposite state in which these parts present themselves in the second variety. Internally the spicular cord is much thicker and the chambers larger than in the second variety or typical form. In short, it is, if not a different species, a large coarse form of *N. exponens.*

Largest size.—Breadth $\frac{25}{12}$ inch (51 millim.). Thickness $\frac{2\frac{1}{2}}{12}$ inch ($3\frac{1}{2}$ millim.).

Loc. Valley of Kelat (Dr. Cook); Upper Scinde (Col. Turner).

Associates.—Assilina obesa, N. spira, N. perforata, Orbitoides dispansa, Conulites Cooki, Alveolina elliptica.

3. *Assilina obesa,* n. sp. (Pl. XV. fig. 2, &c.).—Discoidal, thick, plane towards the centre, abruptly thin towards the margin, which is sharp and wavy. Presenting a group of white puncta more or less approximated towards the centre, which become scanty and scattered in the opposite direction, where they chiefly pass into irregular curved lines that, with a circular linear fragment here and there, indicate respectively the subjacent septa and spicular cord. *Internal structure.*—Turns of the spire broad, slightly approximated towards the margin, commencing from a large central cell. Spire single throughout, but more or less irregular in course; septa curved, reflected. Chambers vary in size, but generally a little longer in the direction of the spire than across it. No lateral prolongation of the chambers towards the centre over the surface of the foregoing turns.

Largest size.—Breadth $\frac{5\frac{1}{2}}{12}$ inch ($11\frac{1}{4}$ millim.). Thickness $\frac{7}{48}$ inch (4 millim.). Number of turns in the spire 7–8.

Loc. Valley of Kelat (Dr. Cook); Upper Scinde (Col. Turner).

Associates.—Assilina seu *N. exponens* (varieties *a* and *b*), *N. Carteri, N. perforata, N. spira, Orbitoides dispansa, Conulites Cooki, Alveolina elliptica.*

Obs.—The approximation of the outer turns of the spire here (*b*), as in other full-grown Nummulites, indicates the limit of the size in the locality, though not always the limit generally, and so far separates it from the foregoing *Assilinæ*; but a more decided difference exists in the greatest width of the chambers being in the direction of the spire instead of across it (*d*). This, while it agrees with the *Punctulatæ* of D'Archiac and Haime, is the very opposite of what is found in *N. exponens* and its varieties. The central cell and turns of the spire are much larger than they are in *N. exponens* and *N. spira,* where there are six within a radius of $\frac{6}{48}$ inch, while in *A. obesa* there are only three.

Note.—I still prefer the generic name of "*Assilina*" for these Nummulites, although they appear to me to be rightly placed by D'Archiac and Haime in a distinct "group," viz. the *Explanatæ*; but the chambers being confined to the horizontal plane cause them to differ from *Nummulites* almost as much as the latter from *Operculina,* from which, again, it is much more difficult to separate *Assilina* than *Assilina* from *Nummulites*. It is only their greater size and thickness which, making them nummiform, appears to ally them to *Nummulites*. If *N. spira* were called "*Assilina spira*," its fundamental structure would be understood at once, while *Nummulites spira* would imply quite a different type. Besides, by using the term "*Nummulites*" for all, we require so many more "specifics;" whereas the same specific would do for two species, if the generic name were different. Thus there is a *Nummulites obesa*, but I want this term of designation for another form of Nummulite, which I could not use were it not called *Assilina*.

Nummulites.

"1. *N.* —— ?" (Annals Nat. Hist. *l. c.* p. 169).—This large Nummulite has been called *N. Carteri* by D'Archiac and Haime (p. 344), but only "provisionally," as these authors did not feel certain that it was not a variety of *N. perforata*. Subsequent examination, however, in comparison with their descriptions of the *Punctulatæ*, leads me to consider it decidedly a different species; and therefore I will now describe it more particularly:—

N. Carteri, D'Archiac and Haime.—Discoidal, equilateral, thin, flat or wavy, gradually diminishing in thickness from the centre towards the circumference. Septal lines tortuous, more or less branched, arranged irregularly in whorls here and there on the surface, attached to and having between the lines more or less white puncta. *Internal structure.*—Turns of the spire and chambers very numerous and very irregular, the latter narrower in the direction of the spire than across it, and much reflected.

Largest size.—Breadth $2\frac{1}{2}$ inches (64 millim.); thickness $\frac{2}{12}$ inch ($4\frac{1}{3}$ millim.). Turns of the spire, altogether, about 45.

Loc. Upper Scinde (Col. Turner).

Associates.—*Assilina exponens* (var. *b*), *A. obesa*, *N. spira*, *N. obesa*.

Obs.—This may be generally termed a "large thin Nummulite." Its greater breadth, thinness, irregularity of spire, and greater number of chambers, which are more reflected, narrower, and have their longest diameter across instead of in the direction of the spire, even to within a few of the outer turns, separate it from *N. perforata*, as well as from *N. Sismondai*, and indeed from all the *Punctulatæ* figured by MM. d'Archiac and Haime, except the Scindian species called *N. obtusa*, which, although agreeing with *N. Carteri* in the narrowness of its chambers continuing towards the margin, and thus also differing from all the other *Punctulatæ* except *N. curvispira*, nevertheless markedly differs from *N. Carteri*, like the other *Punctulatæ*, in all the other points mentioned. Some specimens are so thin that they may be termed "papyraceous;" but they still present compressed cells above and below the central plane, as may be seen by making vertical sections of them. Again, in some localities they appear to be stunted in their growth—if, as before stated, the approximation of the outer turns of the spire may be taken as a sign of full development; for I possess full-grown specimens with approximated turns of the spire, which are not more than half the diameter of the largest forms.

On the other hand, in comparing young specimens of *N. Carteri* with those of *N. perforata* of equal breadth, viz. 3-24ths of an inch, it will be observed that while the whole of the white puncta are gathered together in the centre of the former, they are more or less scattered and separate in the latter.

So far as the specimens of *N. perforata* which Dr. Cook sent from the valley of Kelat go, *N. Carteri* is not present with them, although it is associated with *N. perforata* in Upper Scinde.

In some specimens of *N. Carteri* the wearing down of the softer substance of the test and the septal lines has caused the harder portions or puncta to project in such a manner as to render the fossil so much like *N. Brongniarti* (D'Archiac and Haime, pl. 5. fig. 1, &c.), that at first sight they would be said to be the same species in this respect. Again, it was my inattention to the exact position of these puncta (which did not form specific distinctions before MM. d'Archiac and Haime wrote their work) that led me, in the figure which I gave of this Nummulite, to place all the puncta between the septal lines (Ann. Nat. Hist. *l. c.* pl. 7. fig. 9), and MM. d'Archiac and Haime, on this account, to liken it to *N. perforata*; whereas it really is more like *N. Sismondai*; for puncta are not only scattered between the septal lines, but attached to them as above mentioned. We shall soon see, however, that the presence or absence of these puncta, in specimens of the same species, renders this distinction of less value specifically, perhaps, than it may be generically.

The spire and columns of *N. Carteri* are perhaps most like the represention given by D'Archiac and Haime of *N. distans* (pl. 2. figs. 2 and 2 *a*), one of their group *Læves et Sublæves*; while *N. Carteri* generally is the nearest approach to this "group" which Scinde produces, at least so far as my knowledge extends.

"2. *N. millecaput*?" (Ann. Nat. Hist. *l. c.* p. 169).—This has been identified by D'Archiac and Haime (p. 343) with *N. gyzehensis*, one of their group of *Læves et Sublæves*. It came from Egypt, and was merely inserted among the Scinde specimens for comparison. As yet, I have not seen a single specimen of this group from Scinde.

"3. *N. obtusa,* Sow." (Ann. Nat. Hist. *l.c.* pl. 7. fig. 13).—This has been identified by D'Archiac and Haime (p. 343) with the fossil from Cutch described by Sowerby under this name, chiefly, I presume, from my figure being without "puncta" on the surface; and thus these authors have again been led into error so far as the figure goes; for in the Nummulite from which it was taken I now find there are abundance of puncta, although in the smaller specimens, from which the description was made, there are only one or two, here and there, attached to the septal lines. Moreover, I find that all the specimens which I now possess, and which respectively come from the valley of Kelat and various parts of Scinde, have that striking character (according to D'Archiac and Haime) which distinguishes all the other *Punctulatæ,* except *N. curvispira,* from *N. obtusa,* viz. the greatly increasing diameter of the chambers in the direction of, over that across, the spire, towards the margin. In D'Archiac and Haime's figure of *N. obtusa* (pl. 6. fig. 136), the chambers, in relative proportion, are nearly the same throughout; in which case I have never yet seen a specimen of this Nummulite from Scinde or elsewhere.

The presence of the puncta, again, or their absence, their attachment to the septal lines or their separation from them, or the existence of both in the same specimen, or indeed the absence of the septal lines altogether and the presence of an abundance of puncta may exist, respectively, in the different forms of the globose Nummulite, *N. perforata,* which abounds in the valley of Kelat and Scinde, showing that much dependence, as I have just stated, must not be placed on the puncta or septal lines for specific distinction. How much the plainness of the puncta, in their white opake form, may depend on the compactness of the material of which the fossil is composed, I am ignorant; but it seems to me that the harder and darker it is, the more evident are the puncta, while the lighter and more chalky, the more indistinct, until they disappear altogether. Still, this is not always the case, since in the specimens from Kelat, which are all equally hard, the puncta are sometimes wanting, when the form of the chambers of the central plane proves them otherwise to be of the same species. That all these variations may nevertheless depend on fossilization may easily be conceived, from the puncta in the first instance being the most transparent parts of the test, as shown in *Operculina.* However, to avoid further confusion, I will now give a more complete description of this Nummulite than I could do formerly, assigning to it the name of *N. perforata* rather than that of *N. obtusa,* as I think the former will be found the best adapted for it.

N. perforata, D'Orb. (D'Archiac and Haime, p. 115, pl. 6).—Globose, or discoidal and compressed, presenting several whorls of white septal lines on the surface more or less crooked, sinuous, branched, and mixed with more or fewer puncta, which may be attached to or separate from the lines, or even present without the lines; presenting in some instances a branchwork of minute lines radiating from the puncta, and also extending from the septal lines across the cameral spaces.

Internal structure.—Spire regular, turns approximated towards the circumference in proportion to the sphericity of the specimen. Chambers as long as broad about the centre, becoming much longer in the direction of the spire than across it towards the circumference.

Largest size.—1. Globose variety: breadth $1\frac{1}{24}$ inch ($26\frac{1}{2}$ millim.); thickness $\frac{9}{12}$ inch ($19\frac{1}{2}$ millim.). 2. Compressed variety: breadth $\frac{10\frac{1}{3}}{12}$ inch ($21\frac{1}{2}$ millim.); thickness $\frac{4\frac{3}{4}}{12}$ inch (10 millim.). 3. Thin variety: breadth $\frac{7}{12}$ inch (15 millim.); thickness $\frac{2\frac{1}{2}}{12}$ inch ($5\frac{1}{2}$ millim.).

Loc. Upper Scinde (Col. Turner); Valley of Kelat (Dr. Cook).

Associates.—Assilina exponens (var. *b*), *A. obesa, N. spira, N. biaritzensis, Alveolina elliptica, Orbitoides dispansa, Conulites Cooki,* at Kelat; *N. Carteri* and *N. spira* in Upper Scinde.

Obs.—As this Nummulite has all the forms (viz. globose and flat) of *N. perforata,* and at one time the same external markings while at others not, which, as before stated, makes the latter of little specific value, while it resembles it also in the shape of its chambers, their increase in diameter in the direction of the spire, and the increase in number and approximation of the turns of the spire towards the circumference, more especially in the globose forms, I think we must set down this fossil as *N. perforata.* There is so little difference, however, between some of the flatter forms and *N. Brongniarti, N. Verneuili,* and *N. Sismondai* (D'Archiac and Haime), that it might occasionally be taken for either of them.

MM. d'Archiac and Haime also state (p. 117), regarding *N. perforata*: "Les nombreux individus que nous avons observés qui provenaient tous d'une même localité, présentaient à l'extérieur un teinte violette, beaucoup plus faible en dedans. C'est, d'ailleurs, le seul exemple de coloration que nous avons observé dans les Nummulites, et qui puisse être regardé comme ne provenant pas d'une circonstance étrangère." This happens to be the case, so far as regards the colour, with most of the *Punctulatæ* which Dr. Cook sent from the Valley of Kelat (a great number), but it is not confined to them; for the other Foraminifera, viz. *Assilina obesa,* n. sp., and *Orbitoides dispansa,* which are associated with them are in like manner and equally violet-coloured, while the same species from parts of Scinde, associated with the same kind of Foraminifera, are more or less without colour; hence I am inclined to think that the violet colour in the Kelat specimens is derived from the material in which they were imbedded, for it only extends a little deeper than the surface of the Nummulite; and this material is coloured more or less red or yellow by the presence of much oxide of iron, while most of those from Scinde, which are colourless, are imbedded in white or greyish limestone.

N. broachensis, Cart. (Pl. XV. fig. 3, &c.).—Discoidal, thick; margin angular; surface smooth, presenting puncta arranged spirally without striæ. Spire regular; chambers increasing in diameter in the direction of the spire more than in the transverse direction, towards the circumference; septa curved, reflected.

Largest size.—Breadth $\frac{5}{48}$ inch; thickness $\frac{2}{48}$ inch. Number of turns in the spire, altogether, 6.

Loc. Wasna, a little village in Rajpipla, about fifteen miles E.S.E. of Broach, and about five south of Ruttunpoor (Major Fulljames).

Associates.—N. Ramondi, Orbitoides dispansa, Operculina.

Obs.—This little Nummulite, which was first described in my 'Geological Papers on Western India' (p. 697, 1857), is smaller than *N. Lucasana,* D'Archiac and Haime (pl. 8. fig. 5); the long diameter of the outer chambers is relatively greater, and the puncta tend to a concentric arrangement, with but slight appearance of the septal lines. Possibly, as the outer turns of the spire are *not* approximated, it may be the young of a larger size. I have designated it "*broachensis,*" to record the existence of Eocene Strata near this town, and *not* "fifty miles up the Nurbudda" on the north side, as stated (*loc. cit.*) by mistake. Pieces of yellow argillaceous limestone were brought from Wasna to the late Major Fulljames, containing this fossil, with *N. Ramondi, Operculina,* and *Orbitoides dispansa*; and he transmitted them to me. These are the specimens to which I have alluded as being so richly infiltrated with red or yellow oxide of iron as to afford an unerring guide to their internal structure respectively.

Plicatæ vel Striatæ, D'Arch. & Haime.

1. *N. biaritzensis,* D'Arch. and Haime (p. 131).—None of this "group" of Nummulites were noticed in my first paper.

Largest size.—Breadth $\frac{1}{2}$ inch ($19\frac{1}{2}$ millim.); thickness $\frac{2\frac{1}{4}}{12}$ inch (6 millim.).

Loc. Valley of Kelat (Dr. Cook). Booghtee and Murree Hills and Sukkur (Dr. Malcolmson). Lukput (Mr. Smith).

Obs.—All the specimens that I possess from the different localities mentioned must be referred to *N. biaritzensis.* They are characterized externally by a single bunch or whorl of septal lines flowing in a sigmoid form from an eccentric point on the disk, towards the circumference (see fig. 5, pl. 8, D'Archiac and Haime), and internally by the regularity of the spire and the chambers, which are much reflected and continue longer across than in the direction of the spire, even to the circumference.

Here, again, there are so many varieties, and the species described by D'Archiac and Haime are so much alike, that it has been exceedingly difficult for me to identify all those which I possess with *N. biaritzensis.* Nevertheless, after careful comparison, this has been the conclusion at which I have arrived.

The number of chambers in one-fourth of a turn half the radius of the fossil from the centre or circumference is only of use where the specimens happen to be of the same size as that from which the typical description is given, since the number of chambers varies in the different turns, and the further the turn is from the centre, the more numerous are the chambers. Thus, if a specimen of *N. biaritzensis,* 12 millim. in diameter, has eight chambers in one-fourth of a turn half the radius of the fossil from the centre, a specimen of less breadth, which perhaps is the only one possessed, will have fewer chambers in the $\frac{1}{4}$ of a turn half the radius from the centre. Hence, as there are many chances to one that the typical size is not possessed, this character may be of very little service.

The largest or mean diameter, again, of the specimen requires such an immense number for deduction, that this also is of little use. There appears to me to be no possibility of ascertaining how large any species of Nummulite may be, under a certain limit; for every day, so to write, seems to bring us a larger one, while the test of full-development to which I have alluded, viz. the approximation of the outer turns of the spire, is only that of the full development or largest size of the locality.

At one time I thought the striated Nummulites which I possess from Kelat and Sukkur might be referred to either *N. biaritzensis* or *N. Viquesneli,* while the striated Nummulites from the Booghtee and Murree Hills closely resembled *N. Beaumonti.* The "posterior superior angle" of the chambers in the Booghtee specimens *not* being "almost rectangular," and the septa consequently being much instead of "little arched," leaves the decision in favour of *N. biaritzensis.*

With none of the Nummulites described and figured in D'Archiac and Haime's work have I had such difficulty in identifying my specimens as with the *Plicatæ vel Striatæ.*

2. *N. Ramondi,* Defr., mihi (D'Archiac and Haime, p. 218) (Pl. XV. fig. 5, &c.).—Discoidal, thick; margin angular, wavy;

surface smooth, marked with radiating septal lines, for the most part unbranched, flowing in a somewhat sigmoid form from the centre to the circumference. Spire very regular, chambers numerous, narrower throughout in the direction of the spire than across it; septa slightly curved, reflected.

Largest size.—Breadth $\frac{2\frac{1}{2}}{12}$ inch; thickness $\frac{1}{12}$ inch; number of turns in the spire altogether 9; but the outer turns not being approximated, I doubt if this be the full-grown size.

Loc. Wasna (Major Fulljames).

Associates.—N. broachensis, Operculina, Orbitoides dispansa.

Obs.—This little Nummulite was first described in my 'Geological Papers on Western India,' p. 696, 1857. For remarks applying to locality, &c., see "*Obs.*" to *N. broachensis,* with which it is associated. From the richness of the infiltration of red and yellow oxide of iron in this species, I have, as before stated, been able to make out its internal structure even better than if it had been a recent specimen. The whole is identical with that of *Operculina arabica, plus* the extension of the chambers to the centre, on both sides of the horizontal plane, which additional structure is but a repetition in plan of the horizontal one. Even the lines indicating the spicular composition of the marginal cord are visible, although longer than those of *Operculina*; but to this I have already more particularly alluded, and therefore need not repeat it here.

3. *N. makullaensis,* n. sp. (Pl. XV. fig. 4, &c.).—Discoidal, rather thick than thin; margin obtuse. Surface presenting a number of papillæ grouped towards the centre, from which delicate curved septal lines pass off to the circumference. Internally, spire regular, turns wide and few in number; chambers very narrow in the direction of the spire; septa much curved and much reflected.

Largest size.—Breadth $\frac{2}{10}$ inch; thickness $\frac{1}{16}$ inch; number of turns 5.

Loc. Makulla, on the S. E. coast of Arabia. In pinkish limestone.

Obs.—This is an insignificant Nummulite, but still it is a Nummulite, and therefore shows that the limestone at Makulla is of Eocene era. (See 'Geological Papers on Western India,' p. 614, foot-note.) Its granulated surface at first appears to claim a place for it among the *Punctulatæ*; but the curved septal lines on the surface, and the curved and reflected septa themselves internally, together with the narrowness of the chambers throughout, make it rather belong to the *Plicatæ vel Striatæ.* I see no Nummulite in D'Archiac and Haime's Monograph approaching it except the last of this group, viz. *N. Heberti.* To record the existence of a Nummulite in the limestone at Makulla, I have described and named it after that town, rather than from anything striking or interesting in the fossil itself.

N. kelatensis, n. sp. (Pl. XV. fig. 6).—Discoidal, compressed, wavy; septal lines on the surface thin and approximated, gyrating from white irregular puncta in the centre to the circumference. Internally, spire remarkably regular, turns numerous; chambers slightly reflected, bearing the same relative proportions throughout the disk; septa straight, or nearly so, slightly reflected externally.

Largest size.—Breadth $\frac{3}{12}$ inch; thickness $\frac{3}{48}$ inch; number of turns in the spire, eleven.

Loc. Valley of Kelat (Dr. Cook).

Obs.—The number of septal lines on the surface, the number of chambers internally, the regularity of the spire and its number of turns, but especially the straightness of the septa, separate this from *N. biaritzensis* and from all the *Striatæ* figured by D'Archiac and Haime. I have called it "*kelatensis*" from its being known to me from no other locality. The last turns of the spire being the broadest in the largest specimen I possess, I am led to suppose that it probably attains a larger size. It comes from a deposit of many kinds of small Foraminifera, viz. *Orbitoides dispansa* (the stellate variety), *Alveolina elliptica* (small variety, *A. meandrina*, *Operculina*, and *Orbitolina*, all of which are of diminutive size.

N. irregularis, Desh. (D'Archiac and Haime, p. 138).

Largest size.—Breadth $\frac{7}{12}$ inch; thickness $\frac{1}{12}$—$\frac{1\frac{1}{2}}{12}$ inch; number of turns, seven.

Loc. Valley of Rodinjo, which joins the Valley of Kelat (Dr. Cook).

Obs.—The only specimens which I possess of this Nummulite were sent to me by Dr. Cook with some of *N. biaritzensis*, both from the Valley of Rodinjo; but whether they were found together or in separate localities I am ignorant.

Reticulatæ (D'Arch. & Haime).

"*Nummularia acuta* (?), Sow." (Ann. Nat. Hist. *l. c.* p. 171).—This, by the aid of MM. d'Archiac and Haime's work, I am now able to identify with *N. sublævigata*, D'Archiac and Haime (p. 106).

Largest size. — Breadth $\frac{9}{12}$ inch (20 millim.); thickness $\frac{2\frac{1}{2}}{12}$ inch.

Loc. Kurrachee (Dr. Cook). Scinde (Capt. Partridge). Muscat, in Arabia (Capt. Newbold).

Obs.—The reticulated structure of this Nummulite, into which the septal lines pass, begins close to the margin; and hence, according to D'Archiac and Haime's classification, it ought to belong to their *Reticulatæ* or 2nd group, whereas they have placed it among the *Subreticulatæ* or 3rd group, which is distinguished from the 2nd by the reticulation commencing in simple flexuous lines at the margin first. Nevertheless, from the localities in Scinde from which many of these Nummulites were obtained being the same as those from which the specimens of *N. sublævigata* described by D'Archiac and Haime came, their internal structure being the same, and from other circumstances which will be stated presently, I cannot consider them as belonging to any other species than *N. sublævigata*.

Hence I question whether it would not have been better for these authors to have made only one group of the reticulated Nummulites, and thus to have included all under the head of their second group or *Reticulatæ*, instead of adding a third, viz. *Subreticulatæ*. The last group seems to me to be superfluous and confusing, especially as the species of *Reticulatæ*, like those of all the other groups, have for the most part so little difference between them that their division is equally perplexing.

All the specimens that I have, from Scinde and Muscat respectively, are in a yellow argillaceous limestone, and those of *N. sublævigata*, from which D'Archiac and Haime made their description, were in "calcaires marneux, jaunâtres, de la chaîne d'Hala (Scinde);" thus they appear to have come from corresponding parts of the same series. Now, this series at Muscat, which is immediately opposite Kurrachee, on the other side of the Gulf of Oman, successively consists, from below upwards, of conglomerate, variegated sands (the yellow colour chiefly prevailing), variegated coloured clays (also chiefly yellow), argillaceous limestone, ending with pure compact yellowish limestone; and assuming the Nummulitic series in the neighbourhood of Kurrachee and of the Hala Mountains to be the same, it would follow, from the composition and colour of the material in which these Nummulites are imbedded, that they come from the lower part of the series. Hence the *Reticulatæ*, or at least *N. sublævigata*, may be amongst the oldest of the large Nummulites; unless this part of the series be a middle Tertiary one, since D'Archiac and Haime (p. 79) state that the reticulated form named *N. garansensis* comes from the "first deposits of the middle Tertiaries" in the north-west part of the Pyrenees; and indeed it has always struck me that the yellow series of Lower Scinde and of Muscat, including that of the island of Masira on the south-east coast of Arabia, which is the same as that of Muscat, was of a later date than the great "white" limestone formation of Upper Scinde, and that of the more elevated portions of the south-east coast of Arabia, respectively. Whether or not this is a fact remains to be proved.

The only large Foraminifer associated with *N. sublævigata* that I have found is *Orbitolites Mantelli* (*Orbitoides Mantelli,* D'Orb.); and the latter fossil, again, I have never found in company with any other Nummulite.

The diagram of "*N. acuta,*" which I have given (Ann. Nat. Hist. vol. x. pl. 4. fig. 9), to show that the same canal-system existed in *Nummulites* as in *Operculina,* was compiled from sections of what we must now regard, with the rest, as *N. sublævigata*; for, besides being exactly alike, they came from Scinde, and, from their being imbedded in an impure yellow argillaceous limestone, probably came also from the lower deposits of the Nummulitic series, if not from the "Hala Range" itself. It is among these that the specimens of *Orbitolites Mantelli* are found to which I have just alluded.

Lastly, I would observe that the Nummulites brought by the late Captain Newbold from Muscat belong to the species called *N. sublævigata,* and not to "*N. obtusa,*" as stated by me formerly. The error, therefore, into which D'Archiac and Haime have thus been led (p. 123) should be corrected by transferring what they have stated to the "Localités" of their *N. sublævigata.*

N. masiraensis, n. sp.—Discoidal, wavy, with a tendency to sudden elevation in the centre. Septal lines reticulated, but not densely, and in some instances almost tending to radiation from the centre. Internal structure presenting the regularity in the spire, and lengthening of the chambers in the direction of, instead of across, the spire, characterizing the *Reticulatæ* generally.

Largest size.—Breadth $\frac{4}{5}$ inch; thickness $\frac{1}{8}$ inch; number of turns, seventeen.

Loc. Island of Masira, on the south-east coast of Arabia.

Associates.—The only Nummulite associated with *N. masiraensis* is a small thick form, which appears to consist merely of younger specimens of the same species, which, in their semiglobose figure, contrast strongly with the thinness of the young specimens of *N. sublævigata.*

Obs.—At first I thought this was *N. garansensis,* Joly et Leym., and so called it (Geol. Papers on Western India, pp. 544 & 572); but on closer examination, assisted by D'Archiac and Haime, I find it, from its open reticulation, not to be that species, but to belong to their *Subreticulatæ.* The figure which I have given of it (Ann. Nat. Hist. *l. c.* pl. 7. fig. 19) is evidently, as these authors have stated (p. 343), "une coupe d'Orbitoïde," that is to say, the representation of the vertical section (fig. 20), in which, by some oversight, the layers on either side of the central plane, characteristic of Nummulites, have been omitted.

In the spire, *N. masiraensis* closely corresponds with *N. sublævigata*, and thus differs in this respect from *N. garansensis* as much as *N. sublævigata*. Then, again, it is much larger than *N. garansensis*, and does not present the "subpustuliform pores" (D'Archiac and Haime, pl. 3. fig. 7). That I have the largest size (at all events, of the locality) is proved by the approximation of the outer turns in the largest specimens.

It differs from *N. sublævigata* in being smaller, in the septal reticulation being more open, and in the young ones being semiglobular instead of thin, which they are in *N. sublævigata*. There is, however, the same tendency to sudden elevation in the centre which appears to be common to all the *Reticulatæ*.

These Nummulites are imbedded in a loose, calcareous, gritty, sandy deposit, of a pinkish colour, passing upwards into a whitish compact limestone (Geological Papers on Western India, p. 571).

In the Museum of the Asiatic Society of Bombay is a slab of pink arenaceous limestone richly charged with a reticulated Nummulite so closely allied to *N. masiraensis* that I think it must be the same species. It is accompanied by numbers of *Orbitoides dispansa* and a small Nummulite belonging to the *Striatæ*, all of which retain their whiteness, while the limestone in which they are imbedded is of a deep pinkish colour. The locality from which the slab came is unknown; but the colour and composition of the matrix, together with the reticulated Nummulite, closely correspond with the Masira bed in these respects, although there is not the remotest probability of its having come from that island.

N. ——? Thin, compressed; the reticulated structure commencing at the margin. Spire regular; chambers lengthening in the direction of the spire towards the circumference.

Largest size.—Breadth $\frac{2\frac{1}{2}}{12}$; thickness $\frac{1}{12}$; number of turns eleven.

Loc. Ras Khoriat, on the mainland of the south-east coast of Arabia, nearly opposite the island of Masira.

Obs.—I have examined and described this small Nummulite chiefly to record the existence of the Nummulitic series at this point on the mainland of the south-east coast of Arabia. Although nearly opposite, and very close to, the island of Masira, and a reticulated form, it is not *N. masiraensis*, as the thinness compared with its breadth proves. It is probably the young of a species which attains a larger size, as the specimens are very small and the outer turns of the spire not approximated. In thinness it corresponds with *N. intermedia*, D'Archiac and Haime (pl. 3. fig. 3), and is found in a white chalky deposit.

ALVEOLINA, D'Orb.

"3. *Fasciolites elliptica*, Park." (Ann. Nat. Hist. *l. c.* p. 171). —*Alveolina elliptica*, D'Orb. (D'Arch. and Haime, p. 349).

Largest size.—Length $\frac{7}{12}$ inch; breadth $\frac{3}{12}$ inch.

Loc. Lukput, in Cutch. Scinde, in many parts. Valley of Kelat (Dr. Cook). Bolan Pass (Dr. Leith).

Associates.—*Orbitolites*, on the south-east coast of Arabia (misquoted "*Orbitoides*" in D'Arch. and Haime, p. 349). *Orbitolites* in abundance, and a small Nummulite (like *N. kelatensis*) belonging to the *Striatæ*, on the Buran river, in Scinde. With *N. exponens*, *N. biaritzensis*, and *Orbitoides dispansa* at Lukput, in Cutch. With *Nummulites* and *Orbitoides* in the Valley of Kelat.

Obs.—The typical structure of this Foraminifer I have given in Ann. Nat. Hist. vol. xv. p. 99, since which I have received much larger specimens. The largest elliptical form that I have seen was brought to me from Lukput, in Cutch; the next in size from the valley of Kelat. Both are nearly of the same size, and equal in dimensions to that given by Sowerby (Grant, Geol. Cutch, Trans. Geol. Soc. Lond. vol. v. 2nd ser.). At Tatta, in Scinde, a great bed of the spheroidal form (*A. spheroidea*) exists. At Hydrabad, on the Buran River, and in many other parts of Scinde, a small, narrower, elliptical variety is more or less present. On the south-east coast of Arabia, the Melanoid form (*A. melanoidea*) occurs with *Orbitolites*, as above stated.

Here, again, a great variety in the same species of Foraminifer appears to me to occur. Thus, at Lukput, the *Alveolina* is $\frac{7}{12}$ inch long by $\frac{3}{12}$ broad, and rounded at the ends. At Kelat the largest is about the same size, but pointed at the ends. All the elliptical *Alveolinæ* about Hydrabad and many other parts of Scinde appear to be but diminutive forms of the *A. elliptica* of Lukput, although they seldom exceed in length even the breadth (viz. $\frac{3}{12}$ inch) of the Lukput one, with $\frac{1\frac{1}{2}}{12}$ inch for the short diameter; while the spheroidal forms with the same length (viz. $\frac{3}{12}$ inch) appear to pass into the elliptical forms on one side, and the Melanoid on the other. So that if all these sizes were found together in one bed, they could hardly be considered otherwise than as varieties of one species; nor is there in their separation anything to oppose this, beyond the prevalence of the spheroidal, the diminutive, narrow, elliptical forms, and the large size, almost exclusively, in their respective localities. The late Mr. Loftus found one in Persia 3 inches long and $1\frac{1}{2}$ inch broad (Ann. Nat. Hist. 1860, vol. v. p. 182). Thus *Alveolina* presents another instance among the Foraminifera of great variety in the same species, and of the difficulty of determining which are species and which varieties.

The internal structure of *Alveolina elliptica* is exactly that of *Nummulites* elongated vertically, with the exception of the layers of spicules of which the spicular cord is composed in the latter being separated into ridges in the former, and the septal divisions, instead of stopping at the spicular cord, being carried through it, in *Alveolina*, while the intervals between the ridges appear to correspond to the layers of anastomosing canals or marginal plexus in the cord of *Nummulites.* I have never been able to see any traces of spicules or of a marginal plexus in the marginal or canaliferous layer, as it may be termed, of *Alveolina*; but then I have never yet met with any richly infiltrated specimens to enable me to determine this, as in *Nummulites.* Tracing the transition still further, in proportion as a Nummulite becomes thick the external turns of the spire are more approximated, until, in the globose forms, they are almost as much in contact as in *Alveolina*, that is to say, there is hardly any space for chambers left; hence their approximation becomes greatly increased when the globose passes into the elliptical form, as in *Alveolina*, where there is no space at all left for the chambers; while the turns of the canaliferous layer which correspond, as before stated, to the spicular cord of *Nummulites*, are thus brought into direct contact with each other. But this approximation, although chiefly occurring in the outermost layers in *Alveolina*, is not always confined to them, as it sometimes commences from the first cell and is continued throughout, while in others it begins with the spire, and ceasing after two or three turns, is followed by a turn or two of chambers, and then again the canaliferous layers become approximated. So one might fairly infer that the functions of the soft structures of the canaliferous layer and that of the soft structures filling the chambers were different; for it is evident that the former went on growing without the presence of the latter (and, indeed, it would be difficult to make out any chambers in many of the globose forms of *N. perforata* towards the circumference); but the chambers do not appear, in like manner, *without* the presence of the canaliferous layer. Hence, as before stated, may we not infer that the latter contains the developing part of the organism, and the former the reproductive one?

Alveolina meandrina, n. sp. (Pl. XVII. fig. 4, &c.).—Elliptical, nearly globular, externally covered with whorls of tortuous septal lines and interspaces, indicating the form of the chambers beneath; internally composed of a spiral layer of long, narrow, tortuous chambers commencing from a central cell and gradually elongating themselves in each direction, at right angles to the spire, as the latter winds round its long axis to form the test, each chamber extending from pole to pole, and each layer covered with a cortical tubular reticulation.

Largest size.—Length $\frac{11}{48}$ inch; thickness $\frac{10}{48}$ inch.

Loc. Valley of Kelat (Dr. Cook).

Associates.—Found in the bed of diminutive Foraminifera mentioned under the head of *N. kelatensis.*

Obs.—The *Alveolina* (*A. Boscii*) described and illustrated by Dr. Carpenter (Phil. Trans. 1854) is classed by him with *Orbitolites,* or D'Orbigny's "Cyclostègues." That which I have described under the name of *A. elliptica* must be classed with *Nummulites* or the "Hélicostègues" of D'Orbigny. It begins spirally from a central cell like *Operculina,* &c. (*d*), and as the chambers increase, so they become extended vertically on both sides, but go beyond the sigmoid form of the chambers of *A. elliptica* in becoming tortuous; so that the surface of the test presents the wavy appearance of the surface of *Nummulites gyzehensis* when the superficial incrustation is dissolved or rubbed off (*a*). A canal-system (*e* 1, *f* 2, 3) can also be easily perceived at the commencement, which follows the margin or surface of the spiral lamina and the interseptal spaces respectively, assuming a reticulated structure in the former (*e* 1, *f* 2), supported on a series of straight canals (*f* 3) in the latter, which seem respectively, also, to answer to the horizontal and interseptal canals in *A. elliptica,* and to the marginal plexus and interseptal canals in *Operculina* and *Nummulites.*

[To be continued.]

XXXVIII.—*A Preliminary Synopsis of the Labroid Genera.* By Dr. Albert Günther.

During my examination of the Labroid fishes, I have found it necessary to propose a more natural arrangement of the genera of that family. As the alterations suggested affect the greater number of the genera which had been previously established, I have considered it useful to give an abstract from the manuscript of the fourth volume of the 'Catalogue of Fishes' before its publication, in order to assist others who may engage in similar investigations, or to receive from them better information. Too little attention has been hitherto paid to the number of the fin-rays in generic division: this character is very constant in the allied species, and begins to vary only where the number of rays is very great, as in *Labrus.* Out of the forty genera proposed, five, viz. *Semicossyphus, Pteragogus, Cirrhilabrus, Olistherops,* and *Malapterus,* I have not seen. The three latter, however, are so well described and figured, that no doubt remains with regard to their generic value. *Pteragogus,* we hope, will be figured in the forthcoming work on the Mossambique fishes by Prof. Peters.

First Group: **Labrina.**

Dorsal fin many-rayed, composed of more than twenty rays, thirteen of which at least are spinous. All the teeth in the jaws are conical; no posterior canine tooth.

Temperate regions of the North Atlantic: only one species from the Caribbean Sea; another species from the coasts of Chile.

* *Anal spines three.*

1. Labrus (*Labrus,* sp.; *Crenilabrus* et *Coricus,* Cuv.). Teeth in a single series; cheeks and opercles with imbricate scales; dorsal spines not prolonged. (*L. maculatus,* Bl.; *L. melops,* L.; *L. rostratus,* Bl., &c.)

2. Lachnolaimus, Cuv. & Val. Teeth in a single series; cheeks and opercles with imbricate scales; anterior dorsal spines much produced. (*L. falcatus,* L.)

3. Tautoga, Mitch. (*Tautoga,* sp., Cuv. & Val.). Teeth in a double series; scales on the cheeks rudimentary, opercles naked. (*Tautoga onitis*=*Labrus onitis,* L.=*Tautoga nigra,* Mitch.)

4. Malapterus, Cuv. & Val. Teeth in a single series; imbricate scales on the cheek; operculum with a series of scales along the lower margin, the rest of the opercular apparatus being naked. (*M. reticulatus,* Cuv. & Val.)

5. Ctenolabrus, Cuv. & Val. Teeth of the jaws forming a band; cheeks and opercles scaly. (*C. rupestris,* L.; *C. burgall,* Schoepff, &c.)

** *Anal spines more than three.*

6. Acantholabrus (*Acantholabrus,* sp., Cuv. & Val.). Teeth of the jaws forming a band. (*A. Palloni,* Risso; *A. Couchii,* Cuv. & Val.)

7. Centrolabrus (*Acantholabrus,* sp., Cuv. & Val.). Teeth in a single series. (*C. exoletus,* L.; *C. trutta,* Lowe; *C. romeritus,* Val.)

Second Group: **Hypsigenina.**

Dorsal fin with twenty rays, thirteen of which are spinous. The lateral teeth are more or less confluent into an obtuse osseous ridge, whilst the anterior remain free, conical.

From the Chinese seas to the coasts of Australia.

8. Hypsigenys (*Cossyphus,* sp., Cuv. & Val., Bleek.; *Creni-*

labrus, sp., Bleek.). Four canine teeth anteriorly in each jaw; scales on the cheek very small; operculum scaly. (*H. macrodon*, Lacép.; *H. ommopterus*, Richards.; *H.* (*Labrus*) *japonicus*, Cuv. & Val., &c.)

Third Group: Julidina.

Dorsal fin with less than thirteen spines; anterior teeth free, conical, compressed in *Anampses* only, the lateral sometimes more or less confluent into a ridge; teeth of the lower pharyngeal not confluent, or pavement-like.

Seas of the tropics, single species extending into the temperate regions.

* *Eleven or twelve* (*ten*) *dorsal spines; lateral line not interrupted; cheeks and opercles scaly.*

9. Xiphochilus, Bleek. The membrane of the soft dorsal without scales; both limbs of the præoperculum scaleless; four canine teeth anteriorly in each jaw; lateral teeth more or less confluent into an obtuse osseous ridge; a posterior canine tooth. (*X. typus*, Bleek.)

10. Semicossyphus (*Cossyphus*, sp., Cuv. & Val., Bleek.). The membrane of the soft dorsal without scales; both limbs of the præoperculum scaleless; four canine teeth anteriorly in each jaw; lateral teeth more or less confluent into an obtuse osseous ridge; no posterior canine tooth. (*S. reticulatus*, Cuv. & Val.; *S.* (*Labrus*) *pulcher*, Ayres.)

11. Decodon (*Cossyphus*, sp., Poey). The membrane of the soft dorsal without scales; the scales on the cheeks extend over the lower præopercular limb, the posterior being naked and serrated; four canine teeth anteriorly in each jaw; lateral teeth not confluent; a posterior canine tooth. (*D. puellaris*, Poey.)

12. Pteragogus, Peters*. Base of the dorsal fin scaly; the posterior limb of the præoperculum serrated; scales large (L. lat. 25). D. $\frac{10-11}{11-10}$. A. $\frac{3}{10}$. (*P. opercularis*, Pet.; *P. tæniops*, Pet.)

13. Cossyphus (*Cossyphus*, sp., Cuv. & Val.). The membrane of the soft dorsal is scaly at the base; scales of moderate size (l. lat. 30–36). Teeth in the jaws well developed; a posterior canine tooth. D. $\frac{12}{9}$. A. $\frac{3}{12}$. (*C. mesothorax*, Bl.; *C. axillaris*, Benn.; *C. macrurus*, Lacép.; *C.* (*Crenilabrus*) *an-*

* Not having had an opportunity of examining the species of this genus, we do not feel quite confident that the base of the dorsal fin is really scaly. If the scales at the base of the fin are merely the enlarged scales of the uppermost series of the back, without adhering to the membrane of the fin, this genus and the preceding should, perhaps, be united.

thioides, Benn. = *C. zosterophorus*, Bleek.; *C. rufus*, L. = *C. bodianus*, Cuv. & Val., &c.)

14. Clepticus, Cuv. & Val. The soft dorsal is enveloped in scales; teeth in the jaws very small; no posterior canine tooth. (*C. genizara*, Cuv. & Val.)

** *Nine dorsal spines; lateral line not interrupted; cheeks and opercles scaly.*

15. Duymæria, Bleek. Præoperculum serrated; opercles and cheeks with large scales; teeth in the jaws in a single series. D. $\frac{9}{11-12}$. A. $\frac{3}{9}$. (*D. aurigaria*, Richards.; *D.* (*Ctenolabrus*) *flagellifera*, Cuv. & Val.; *D.* (*Cossyphus*) *filamentosa*, Pet.; *D. enneacantha*, Bleek., &c.)

16. Labrichthys, Bleek. (*Labrus*, sp., Cuv. & Val., Richards.; *Tautoga*, sp., and *Julis*, sp., Richards.) Præoperculum not serrated; opercles scaly, cheeks more or less scaly; scales large; teeth in the jaws in a single series. D. $\frac{9}{11}$. A. $\frac{3}{10}$. (*L. celidotus*, Forst. = *Labrus pœcilopleurus*, Cuv. & Val.; *L. rubiginosus*, Schleg.; *L.* (*Labrus*) *laticlavius*, Richards.; *L.* (*Tautoga*) *luculentus*, Richards.; *L. cyanotænius*, Bleek.; *L.* (*Tautoga*) *tetricus*, Richards., &c.)

17. Labroides, Bleek. (*Labrus*, sp., Rüpp.; *Cossyphus*, sp., Cuv. & Val.) Præoperculum not serrated; opercles and cheeks scaly; scales of moderate size; teeth in the jaws minute, forming a band; a pair of curved erect canines in each jaw*. (*L. dimidiatus*, Cuv. & Val.; *L. xanthurus*, Bleek.; *L. quadrilineatus*, Rüpp., &c.)

*** *Nine to eleven dorsal spines; lateral line interrupted; cheeks and opercles scaly.*

18. Cirrhilabrus, Schleg. (*Cheilinoides*, Bleek.) Eleven dorsal spines; præoperculum serrated; teeth in several series anteriorly; scales on the cheek small, in several series. (*C. Temminckii*, Bleek.; *C. cyanopleurus*, Bleek.; *C. solorensis*, Bleek.)

19. Doratonotus, Gthr. Nine dorsal spines; teeth in a single series; a posterior canine tooth; the middle of the spinous dorsal is strongly depressed; scales very large†. (*D. megalepis*, Gthr.)

20. Cheilinus, Cuv. Nine or ten dorsal spines; teeth in a

* The gill-membrane is attached to the isthmus in *L. quadrilineatus*; this would be another important character for that genus, if it should be found in the other species.

† The specimen on which this genus has been founded is not in a good state of preservation, and the scales on the head have been rubbed off, if they were present.

single series, each jaw anteriorly with one pair of canines, the lower pair received between the teeth of the upper; no posterior canine tooth; dorsal spines subequal in height; scales large; cheek with two series of large scales; lower jaw not produced backwards. (*Ch. chlorurus*, Bl.; *Ch. lunulatus*, Forsk.; *Ch. diagramma*, Lacép. &c.).

21. Epibulus, Cuv. Nine dorsal spines; scales very large; the lower jaw much produced backwards. (*E. insidiator*, Pall.)

**** *Eight or nine dorsal spines; head entirely naked or with only a few very small scales, either on the cheek or on the operculum.*

22. Anampses, Cuv. Dorsal spines nine; head entirely naked; scales of moderate size; lateral line continuous; each jaw with two compressed teeth anteriorly, the lower of which are received between the upper ones. (*A. cæruleo-punctatus*, Rüpp.; *A. geographicus*, Cuv. & Val., &c.)

23. Hemigymnus (*Halichœres*, sp., Rüpp.; *Tautoga*, sp., Cuv. & Val., Bleek.). Dorsal spines nine; opercles naked, cheek with a strip of very small scales; scales of moderate size; lateral line continuous; each jaw with two conical canines anteriorly, the lower of which are received between the upper ones. (*H.* (*Mullus*) *fasciatus*, Thunb.; *H.* (*Labrus*) *melapterus*, Bl.; *H. notophthalmus*, Bleek.; *H. leucomos*, Bleek., &c.)

24. Stethojulis (*Julis*, sp., Cuv. & Val.; *Halichœres*, sp., Bleek.; *Halichoeres*, Kner). Dorsal spines nine; head entirely naked; scales rather large, those in the thoracic region as large as, or larger than, those on the side of the body; lateral line continuous; a posterior canine tooth. (*St. strigiventer*, Benn.*; *St. trilineata* = *Labrus trilineatus*, part., Bl. Schn. = *Julis sebanus*, Cuv. & Val. = *Halichoeres Casturi*, Bleek.; *St. albovittata* = *Labrus albovittatus*, Bonnat. = *Julis balteatus*, Quoy & Gaim.; *St. interrupta*, Bleek.; *St. bandanensis*, Bleek.)

25. Halichœres (*Halichœres*, sp., Rüpp., Bleek.; *Julis*, sp., Cuv. & Val., Kner, not *Halichœres*, Kner). Dorsal spines nine; head entirely naked; scales of moderate size, those in the thoracic region smaller than those on the side of the body; lateral line continuous; anterior teeth conical; a posterior canine tooth. (*H. Dussumieri*, Cuv. & Val. = *J. exornatus*, Richards. = *H. notophthalmus*, Bleek.; *H. hortulanus*, Lacép.; *H. melanurus*, Bleek.; *H. miniatus*, Kuhl & v. Hass.; *H. Argus*, Benn.; *H. Bleekeri*, Gthr = *J. Cuvieri*, Bleek.; *H. Cali-*

* In all the eight specimens examined by me, the posterior canine tooth is as distinct as in its congeners.

fornicus, Gthr = *J. modestus,* Girard; *H. cyanostigma,* Cuv. & Val.; *H. pyrrhogramma,* Schleg., &c.*).

26. Novacula (*Xyrichthys,* sp., et *Novacula,* Cuv. & Val.; *Xyrichthys* et *Novacula,* sp., Bleek.; *Novacula,* sp., Steindachner). Dorsal spines nine, the two anterior of which are sometimes remote from the others; head entirely naked or with a patch of small scales on the cheek; scales of moderate size; lateral line interrupted; head elevated, with the anterior profile parabolic. (*N. cultrata,* Cuv. & Val.; *N. uniocellata,* Spix; *N. tæniura,* Lacép.; *N. macrolepidota,* Bl.; *N. pavo,* Cuv. & Val.; *N. pentadactyla,* L.; *N. bimaculata,* Rüpp.; *N. argentimaculata,* Steind., &c.)

27. Julis (*Julis,* sp., Rüpp., Cuv. & Val., Bleek., Kner). Dorsal spines eight; head entirely naked; snout of moderate extent; scales of moderate size; lateral line continuous; no posterior canine tooth. (*J. trilobata,* Lacép.; *J. pavo,* Hasselq.; *J. bifasciata,* Bl.; *J. lunaris,* L.; *J. melanochir,* Bleek.; *J. dorsalis,* Q. & G.; *J. cupido,* Schleg.; *J. umbrostigma,* Rüpp. = *J. Souleyetii,* Cuv. & Val., &c.)

28. Gomphosus, Lacép. Dorsal spines eight; head entirely naked; snout much produced; scales of moderate size, lateral line continuous; no posterior canine tooth. (*G. cæruleus,* Lacép., &c.)

29. Cheilio, Commers. Dorsal spines nine, flexible; cheeks naked, operculum with a single series of very small scales; scales of moderate size, lateral line continuous; body elongate; head low. (*Ch. inermis,* Forsk.)

30. Coris (*Coris,* Lacép.; *Hologymnosus,* Lacép.; *Halichœres,* sp., Rüpp., Bleek.; *Julis,* sp., Cuv. & Val., Bleek., Kner). Dorsal spines nine; head entirely naked; scales small, lateral line continuous. (*C. mediterranea,* Risso = *Labrus gulis,* L. = *J. vulgaris,* Flem.; *C. Giofredi,* Risso; *C. aygula,* Lacép.; *C.* (*Labrus*) *annulata,* Lacép.; *C. Cuvieri,* Benn. = *J. stellata,* Cuv. & Val.; *C. Gaimardi,* Q. & G.; *C.* (*Labrus*) *formosa,* Benn.; *C. pulcherrima,* Gthr = *Julis formosus,* Bleek.; *C. auricularis,* Cuv. & Val.; *C. flavovittata,* Benn. = *J. Eydouxii,* Cuv. & Val.; *C. heteroptera,* Bleek.; *C. variegata,* Rüpp.; *C. Greenoughii* = *J. Greenovii,* Benn. = *J. leucorhynchus,* Bleek.)

31. Cymolutes (*Julis,* sp., et *Xyrichthys,* sp., Cuv. & Val.; *Novacula,* sp., Bleek., Steindach.). Dorsal spines nine; head entirely naked, or with a small patch of rudimentary scales on the cheek; scales small, lateral line interrupted. (*C.* (*Julis*) *prætextatus,* Q. & G.; *C. microlepidotus,* Cuv. & Val.)

* More than seventy species.

Fourth Group: **Pseudodacina.**

Each jaw armed with two pairs of broad incisors and with a cutting lateral edge; teeth of the lower pharyngeal confluent, pavement-like.

East Indian Archipelago.

32. Pseudodax, Bleek. (*Odax,* sp., Cuv. & Val.) Eleven dorsal spines; scales of moderate size, lateral line continuous; cheeks and opercles scaly. (*P. moluccanus,* Cuv. & Val.)

Fifth Group: **Scarina.**

The teeth in both jaws are intimately soldered together into a broad convex cutting lamina, and become sometimes entirely indistinct; pharyngeal teeth pavement-like. Scales rather large. From eight to ten dorsal spines*.

Seas of the tropics; single species extending into the temperate regions.

33. Scarus (*Scarus,* sp., Forsk., Cuv. & Val.; *Scarus,* Bleek.). Cheek with a single series of scales; the dentigerous plate of the lower pharyngeal broader than long; upper lip double in its whole circuit; dorsal spines pungent.

34. Scarichthys, Bleek. (*Scarus,* sp., Cuv. & Val.) Cheek with a single series of scales; the dentigerous plate of the lower pharyngeal broader than long; upper lip double in its whole circuit; dorsal spines flexible.

35. Callyodon (*Callyodon,* sp., Gronov., Cuv. & Val.; *Callyodon,* Bleek.). Cheek with a single series of scales; the dentigerous plate of the lower pharyngeal broader than long; upper lip double only posteriorly; jaws with distinct oblong imbricate teeth anteriorly.

36. Callyodontichthys, Bleek. Cheek with a single series of scales; the dentigerous plate of the lower pharyngeal broader than long; upper lip double only posteriorly; teeth of the lower jaw distinct, disposed in oblique series. Dorsal spines stout.

37. Pseudoscarus, Bleek. (*Scarus,* sp., Forsk., Cuv. & Val.) From two to four series of scales on the cheek; the dentigerous plate of the lower pharyngeal longer than broad; upper lip double only posteriorly; dorsal spines flexible.

Sixth Group: **Odacina.**

The edge of each jaw is sharp, cutting, without distinct teeth

* The genera of this group having been lately worked out by Dr. von Bleeker, we repeat shortly the diagnoses given by him.

anteriorly; pharyngeal teeth pavement-like. Scales small or rather small. Dorsal spines numerous, flexible.

Coasts of Australia and of New Zealand.

38. Odax (*Odax*, sp., Cuv. & Val.). Cheeks and opercles scaly; snout conical, but with the upper jaw not produced. (*O. pullus*, Forsk.; *O. semifasciatus*, Cuv. & Val.; *O. radiatus* = *Malacanthus radiatus*, Q. & G. = *Cheilio lineatus*, Cuv. & Val.)

39. Olistherops, Richards. Head naked. (*O. cyanomelas*, Richards.)

40. Siphognathus, Richards. Cheeks and opercles scaly; snout very long; upper jaw terminating in a pointed appendage. (*S. argyrophanes*, Richards.)

XXXIX.—*On the History of the 'Maté' Plant, and the different Species of* Ilex *employed in the Preparation of the 'Yerba de Maté,' or Paraguay Tea.* By John Miers, F.R.S., F.L.S. &c.

[Continued from p. 228.]

The note in M. Bonpland's handwriting, accompanying the specimens sent by him, is as follows:—

"No. 596. Herbe du Paraguay—Maté—*Ilex theæzans*, Bonpland—*Ilex Paraguayensis*, St.-Hilaire. Se trouve dans le Paraguay, le Brésil, et Entre Rios.

"No. 2425. *Caúna* des Brésiliens—*Ilex ovalifolia*, Bonpl., nouv. espèce. Se trouve dans le Faxinal, au sortir de la Picada de S^a^ Cruz, à 4 lieues du Rio Pardo.

"No. 2333. *Caúna* des Brésiliens—*Caachiriri* ou *Caachiri* des Guaranís—*Ilex amara*, Bonpl., n. esp. Se trouve dans les montagnes de S^a^ Cruz et dans les forêts du Paraná.

"No. 2332. *Caúna* des Brésiliens—*Caachiriri* des Guaranís—*Ilex crepitans*, Bonpl., n. esp. Se trouve dans les bois de Guayaraça dans le cœur de S^a^ Cruz et sur les bords du Paraná.

"No. 2330. *Caúna de folha larga* des Brésiliens.

"No. 2374. *Caúna amarga* des Brésiliens.

"No. 2479. *Caúna* des Guaranís—*Ilex gigantea*, Bonpl., n. esp. Se trouve dans les bois de S^a^ Cruz et sur les bords du Paraná.

"No. 2471. *Caunina* des Brésiliens—*Ilex Humboldtiana*, Bonpl., n. esp. Se trouve dans le Picada de S^a^ Cruz qui conduit à Rio Pardo, Prov. Rio Grande, Brésil.

"Toutes ces espèces d'Ilex sont employées à faire de l'herbe Maté. Les nos. d'ordre correspondent à mon journal botanique.

"Corrientes, 17 Juin, 1857." "Aimé Bonpland."

When in Paris three years ago, I endeavoured to ascertain whether any of these specimens agreed with St.-Hilaire's typical plant; but the latter, unfortunately, had been mislaid or lost in the removal of the collections exhibited in the great 'Exposition' of 1855. St.-Hilaire states that he had compared his plant from Curitíba with specimens from Paraguay, and found them specifically identical: this conclusion does not correspond with the specimens before me.

I have since obtained from Curitíba a specimen of the plant there used in the preparation of the Herva de Paranaguá. On comparing it with the true *Ilex Paraguayensis* sent by Bonpland, I find the two sufficiently distinct, as will be seen by the diagnoses that will follow: this fact is of interest, as it accounts at once for the difference in the quality of the tea respectively prepared from these two plants.

Hitherto I have spoken only of the Yerba produced from these two species. Bonpland, however, states positively that the other species, of which he sent specimens, are also employed in the preparation of the Yerba of commerce. This fact has lately been confirmed by the assurance I have received from a Brazilian gentleman from Porto Alegre, who trades extensively in this commodity: his information is very interesting, both as regards the difference in the quality of these products, and the districts in which the trees are found; and from his knowledge of this matter and his long experience, his account may be fully depended on. The other species grow principally in the districts that stretch far to the eastward and southward of the long mountain-range which extends from the "Serra Géral" of Curitíba, in lat. 26° S., to lat. 32° S., where it is shown in the maps as the "Serra do Herval," so called from the abundance of its Maté trees. The summits of this wide-spread mountain-range are very broad, forming numerous table-lands which afford excellent pasturage for cattle. The Maté trees are never found on these table-lands, nor in the broad plains that skirt the river-beds: they grow invariably on the inclined hill-sides in the numerous gorges intersecting the country, which in most cases are densely wooded; and it is in these woods that the different species of *Ilex* abound. In some places the Maté trees attain a considerable size, often exceeding 100 feet in height. These larger trees grow especially on the declivities of the western side of the same mountain-range, where all the streams flow into the river Uruguay. The Yerba here produced is of an excellent quality: that called by the Brazilians "Herva de Palmeira" is renowned as being equal to the best Paraguay tea.

It is in this region that seven of the far-famed Missions established by the Jesuits are situated, where the Maté is extensively collected. Upon the eastern declivities, along the tributaries of the rivers Pardo and Jacuhy, are the 'Hervales' of Faxinal, Santa Cruz, and Guayaraça, to which Bonpland's specimens refer. Here also is that of Butacarahy, equally renowned, where the *Ilex gigantea* of Bonpland abounds, and where it attains a height of 70 feet: the other four kinds, with smaller and more lanceolate, punctate leaves, rarely here exceed the height of 30 or 40 feet. The latter are more irregularly branched, with a more straggling growth, and they produce the sort called by the Brazilians *Herva brava* (wild Maté), while the larger-leaved species, such as the *Ilex gigantea*, yield a kind of tea called *Herva mansa* (mild Maté); such trees have straighter trunks, with more regular and rounded heads. The former sorts have a more bitter and stronger flavour, and want the peculiar and more agreeable aroma of the Paraguay type. When, however, the Herva brava is mixed with the Herva mansa in the proportion of 1 in 3 or 1 in 4, it produces a kind of Maté which is hardly distinguishable from the genuine Paraguay Yerba; and it thus forms a considerable object of commerce.

Still further to the southward of the Serra do Herval, in the mountain districts of the Taypes or Canguassú, some species of *Ilex* abound which are said to produce a tea as valuable as the best sorts of Herva de Palmeira, or even vying with the Paraguay tea, being equal to them in fragrance, flavour, and strength. This fact is worthy of notice when we take into consideration the great difference in the latitude of these districts. The quality of the tea of all these various kinds depends greatly on the time of year in which the leaves are gathered, the best season for the harvest being well known to the natives.

Dr. Reisseck has lately published, in Martius's 'Flora Brasiliensis,' a Monograph of the Brazilian species of *Ilex*. He evidently had not seen any specimen of the true *Ilex Paraguayensis*; for his diagnosis under that name refers to some of the smaller, more lanceolate, and punctate-leaved species of the genus, and certainly not to the celebrated true Paraguayan plant.

I now present the characters of the several Maté plants that have been here referred to:—

1. *Ilex Paraguayensis*, St.-Hil. in Spr. Syst. iv. cur. post. p. 48; Hook. (in parte) Lond. Journ. Bot. i. 35. tab. 1;—Ilex Paraguariensis, *St.-Hil.* (*in parte*) *Mém. Mus.* ix. 351; *DC. Prodr.* ii. 15;—Ilex Paraguensis, *D. Don in Lamb. Pin. App.* p. 7. tab. 4;—Ilex theæzans, *Bonpl. MSS.* (*non Mart.*);—ramulis angulato-striatis; foliis oblongis vel obovato-oblongis, coriaceis, glaberrimis, integris aut obsolete aut profundius grossedentatis, margine revoluto, utrinque concoloribus, nervis superne vix distinctis, subtus prominulis, reticulato-venosis, epunctatis; petiolo canaliculato; inflorescentia in axillis pluriflora; pedunculis 4–6, subfasciculatis, e nodo bracteato ortis, petiolo sublongioribus, interdum 1-floris, vel medium

versus 2–3-fidis, cum pedicellis 1-floris; floribus in ♂ 5-meris, in ♀ 4-meris, glaberrimis; sepalis parvis, rotundatis; petalis oblongis, reflexis, calyce 4-plo longioribus; drupa glabra, piperiformi; nucibus 5, singulis stria mediana prominula carinatis.—Paraguay; in Brasilia australi introducta.

Type *a.*—In the typical specimen sent to me by Bonpland as the real Paraguay species, the leaves are very entire, or sometimes with only a slight indication of distant teeth near their summit; they are quite opake above, nearly concolorous: the upper surface is smooth and almost nerveless; but the nerves, when present, are slender and prominent beneath. They are $3\frac{3}{4}$ inches long, $1\frac{3}{4}$ inch broad, on a petiole 3 lines long: about four very slender fasciculated peduncles issue from an axillary stipitiform nodule, each bearing three one-flowered pedicels: the peduncle measures 3 lines, the pedicels 2 lines, with a globular flower-bud 1 line in diameter: sometimes one or two of these pedicels are wanting, in which case the peduncle is 5 lines long and 1-flowered. The specimen was collected at Candelaria, in the province of Corrientes, "in a wood planted by the Jesuits." —*Herb. Bonpl.* no. 596*.

Var. *β. idonea*;—foliis crassioribus, rachi subtus crassiori.

In this variety (sent with the preceding, without any locality) the leaves are thicker and obsoletely dentated all round their margin, which is revolute; above, the nervures are distinct and the midrib is thicker; the blade is $3\frac{1}{4}$ inches long, $1\frac{1}{4}$ inch broad, on a petiole of 5 lines. The specimen is without flower or fruit†.

Var. *γ. dentata*, nob.;—foliis e medio usque ad petiolum cuneatis, grosse dentatis, dentibus obtusis glandula minima donatis; fructibus piperis magnitudine.

The leaves are here more deeply and obtusely toothed for two-thirds of their length, the lower portion being quite cuneiform and entire; they are somewhat shining above, very smooth, with immersed nervures; the lower face is opake, with prominent fine nervures, the midrib being much raised; they are 3 inches long, $1\frac{1}{2}$ inch broad, on a petiole of 5 lines. The specimen is in fruit; the pedicels are fasciculated on a short nodule, and are either 1- or 3-flowered and 5 lines long; the drupe, seated on a 4-lobed calyx, is globular, 2 lin. diam., crowned with a thin, flat, sessile, 4-lobed stigma. The plant is probably from one of the old Jesuit plantations on the Uruguay‡.

* A drawing of this plant is given in Plate 61 A of the 'Contributions.'

† A sketch of this variety will be seen in Plate 61 B.

‡ An outline of this variety will be seen in Plate 62 A.

Var. δ. *usitata*, nob.;—foliis e medio ad basin cuneatis, breviter et remote dentatis, dentibus glandula mucronulatis, margine paulo reflexis; corymbo petiolo 2-plo longiore, e basi ramoso, ramis 3–4-floris, pedicellis longiusculis, tenuissimis, umbellato-fasciculatis, imo bracteolatis; floribus 4-meris, glaberrimis, parvulis; drupa piperiformi.—Prov. San Páolo (Gaudichaud, no. 57).—An species distincta ?

The leaves are 3–3½ inches long, 1⅝ inch broad, on a petiole of 5 lines; they are more finely toothed than the preceding: the primary branch of the axillary corymb is 2 lines long, the five or six fasciculated branchlets 3 lines, and the three pedicels at the extremity of each 2 lines long; the expanded flower is 2 lin. diam. Both the ovary and ripe fruit are crowned with a flat sessile stigma, as in the Paraguayan species; the drupe is globular, and nearly 3 lines in diameter*.

2. *Ilex Curitibensis*, nob.;—Ilex Paraguariensis, *St.-Hil.* (in parte) *Mém. Mus.* ix. 351; *Voy. Diam.* i. 273; *DC. Prodr.* ii. 15;—Ilex Maté, *St.-Hil. Pl. Remarq.* i. 41;—glaberrima, ramulis teretibus, angulato-striatis, fuscis, lenticellis notatis, junioribus subcompressis, acute 4–6-gonis; foliis elliptico-oblongis, imo cuneatis, apice breviter et repente acuminatis, acumine obtuso aut emarginato, grosse dentatis, dentibus paucis obtusis valde gibbis et apice glandula mucronatis, subcoriaceis, rigidulis, supra fuscescentibus, nitidis, costa nervisque omnino immersis, subtus pallidioribus, subferrugineis, opacis, epunctatis; petiolo longiusculo, canaliculato; floribus ♀ paucis, in axillis fasciculatis, 4-meris; drupa ovata, stigmate pulvinato 4-lobo coronata, nucibus 4.—Prov. San Páolo, *v. s.* ex sylvis prope Curitíba; *etiam in hb. Delessert*, Sorocába (Sellow).

This must be the plant collected by St.-Hilaire at Curitíba, and considered by him to be identical with the Paraguay species, which he does not appear to have seen; the two plants, however, are manifestly different. Here the branchlets are very angularly sulcated, shining, and, as well as the leaves, grow nearly black in drying; the leaves are more distinctly cuneate, the dentations are fewer in number, and consequently larger, deeper, very obliquely rounded, each tooth having near its sinus a short acute mucronate gland; the opacity on the lower side is caused by the presence of very minute and crowded granulations, which are very manifest under a lens: they have no immersed black glands, as in Reisseck's second section of the genus; the midrib is somewhat prominent below, polished, and very dark. The

* This variety is shown in Plate 62 B of the 'Contributions.'

leaves are 3–4 inches long, $1\frac{1}{2}$–2 inches broad, on a petiole 6 lines long: the drupe is oval, $2\frac{1}{2}$ lines long, 2 lines diam., supported on a 4-lobed calyx, and crowned with a prominent, pulviniform, 4-lobed stigma; it encloses four nuts*.

Var. *Gardneriana*, nob.;—Ilex Paraguayensis, *Hook.* (*in parte*) *Lond. Journ. Bot.* i. 35. tab. 1;—ramulis opacioribus, foliis non fuscescentibus, coriaceis, supra nervis venisque reticulatis subconspicuis, ad costam profunde sulcatis, subtus pallidioribus. An species distincta?—Prov. Rio de Janeiro in Montibus Organensibus (Gardner, no. 346), *v. v.*

This plant is well represented by Sir Wm. Hooker, in the drawing above cited, under the name of *Ilex Paraguayensis*, var. *a.* It is a small tree, about 15 feet in height: its leaves are $2\frac{1}{2}$–3 inches long, 15–18 lines broad, on a nearly terete slender fuscous petiole 5–6 lines long; their margin is much reflexed, with a very acute uncinate gland on the apex of each tooth, close to the sinus: the under side, viewed through a lens, presents a similar minutely granulated surface, and is quite epunctate. My specimen has no fruit; but that in the Hookerian herbarium had a single drupe, which is of a globular form, $2\frac{1}{2}$ lines diam., crowned with a depressed, pulvinate, 4-lobed stigma, as shown in the plate referred to.

3. *Ilex gigantea*, Bonpl. MSS., n. sp.;—arbor excelsa, glaberrima, ramulis subrugosis, junioribus angulatis, lenticellatis; foliis cuneato-oblongis vel obovatis, apice rotundatis vel retusis, hinc brevissime acutis aut mucronatis, integerrimis, margine incrassato valde revoluto, crasso-coriaceis, supra nitidulis, costa nervisque omnino immersis, subtus glauco-ferrugineis, epunctatis, nervis gracillimis paulo prominulis; petiolo crassiusculo, canaliculato; racemulis ♀ axillaribus, e basi 3–4-floris, petiolo dimidio brevioribus; drupis globosis, lævibus, piperis magnitudine, stigmate majusculo mammæformi 4-lobo prominente coronatis; nucibus 4.—In sylvis ad Sª Cruz, prov. Rio Grande, et ad ripas fl. Parana, Prov. Entrerios.—Bonpland, nos. 2330, 2374, et 2479.

This is certainly a very distinct species, apparently allied to *I. integerrima*, Reiss. It forms a very lofty tree, with a copious rounded head; its leaves are very thick, coriaceous, very smooth, nerveless and polished above, with entire, very rounded and revolute thick margins, cuneate at base, very opake beneath, with inconspicuous nervures; they are 3 inches long, $1\frac{3}{8}$–$1\frac{1}{2}$ inch broad, on a thick, broad, and somewhat marginated petiole 5 lin. long; the pedicels of the fruit are barely 3 lines long;

* This plant is represented in Plate 63 of the 'Contributions.'

the drupe is 3 lin. diam., with a prominent mammiform and obsoletely 4-lobed stigma. In another specimen the leaves are more polished, extremely smooth above, the margin showing a disposition to become toothed; they are pale brown above and fuscous brown beneath, the petiole being thinner and 3-carinated below*.

4. *Ilex amara*, Bonpl. MSS.;—ramulis rubellis, glaberrimis, striato-angulatis; foliis lanceolatis, imo longe cuneatis, versus apicem cuneatis, et hinc obtusiusculis et emarginatis, ultra medium integerrimis, hinc inde serratis, dentibus extus rotundatis, apice glanduliferis, margine vix revoluto, glaberrimis, crassiusculis, superne nitidis, pallide viridibus, nervis costaque mediana rubella immersis, subtus flavo-opacis, epunctatis, nervis tenuissimis, anastomosantibus, inconspicuis; petiolo flavo, angusto, canaliculato.—In sylvis circa Missiones, ad ripas fluvii Paranensis, et ad montem Santa Cruz in prov. Rio Grande.

This is a still more distinct species, with lanceolate leaves, which are cuneate and entire for two-thirds of their length, their summit being shortly attenuated and emarginated; above, they are opake and very smooth, almost nerveless, with a reddish flat midrib; they are pale green, somewhat paler and yellowish below, where their delicate nervures are scarcely prominent, and their midrib, of an orange-red colour, is not much raised. They are $2\frac{1}{4}$–$2\frac{1}{2}$ inches long, $\frac{3}{4}$ inch broad, on a petiole 4 lines long. The specimen has neither flower nor fruit. In form the leaves somewhat resemble those of *I. nigropunctata*, but they want the peculiar dotted glands so conspicuous in that species†.

5. *Ilex Humboldtiana*, Bonpl. MSS. (stirps ♂);—Ilex crepitans, *Bonpl. MSS.* (*stirps* ♀);—Ilex Paraguariensis, *Reiss.* (*non St.-Hil.*), *var.* angustifolia, *Flor. Bras.* xxviii. p. 63. tab. 13. fig. 17;—glaberrima, ramulis rugulosis, subangulatis; foliis confertis, lanceolatis, utrinque gradatim attenuatis, summo anguste obtusis, crassiusculis, obsolete dentatis, dentibus glanduliferis, superne nitidis, olivaceo-viridibus vel atrovirentibus, lævissimis, fere enerviis, ad costam profunde sulcatis, subtus flavescentibus aut pallide ferrugineis, nervulis subpatentibus paulo prominulis inter se arcuatim nexis, hinc remote nigro-punctulatis; petiolo tenui, canaliculato; paniculis axillaribus, e basi ramis 3–6, fasciculatis, ramis 3-floris, floribus 4-meris, glaberrimis; drupis parvis, globosis, stigmate mammæformi sub-4-lobo coronatis, nucibus 3–4.—In

* This species is represented in Plate 64 A of the 'Contributions.'
† A drawing of this species will be seen in Plate 64 B.

montibus Guayaraça et Santa Cruz, versus Rio Pardo, in prov. Rio Grande, et in Missionibus, versus fluv. Paraná, in prov. Corrientes (Bonpland, nos. 2449, 2471, 2332).

The above two species of Bonpland appear to me identical, there being no difference, except that the one is the male plant, with somewhat paler leaves, the other being the female plant, with less elongated and extremely dark leaves. It is evidently one of the varieties of Reisseck's *Ilex Paraguariensis,* but it bears no analogy whatever with the Paraguay type. It is one of the most esteemed kinds of Maté trees, and the tea yielded by it is so strong in flavour as to require tempering by admixture with others of a milder kind. The leaves are very much smaller than any of the preceding species, are attenuated at both ends, above are of a dark green (in the ♀ blackish green), polished, veinless, and deeply channelled at the place of the midrib; beneath, in the ♂, glaucous, in the ♀ of a yellowish hue, opake, owing to a minutely granulated surface, which is remotely spotted with small, immersed, black glands. In the ♂ the leaves are $1\frac{1}{2}$–$1\frac{3}{4}$ inch long, $\frac{1}{2}$ inch broad, on a petiole of $3\frac{1}{2}$ lines; in the ♀ they are 2–$2\frac{1}{2}$ inches long, 5–8 lines broad, on a petiole of $2\frac{1}{2}$–3 lines. The flowers are numerous in the axils of the younger branches, in a short fasciculated branching corymb, the basal ramifications being slender, $2\frac{1}{2}$ lines long, each bearing three small flowers on pedicels 2 lines long; the four petals are three times as large as the sepals, orbicular, concave, glabrous, white, the flower expanded being 2 lines in diameter: in the ♂ the sterile ovary is depressed, broadly 8-rayed in the summit, with a small sessile 4-lobed stigma in the centre: in the ♀ the drupe is globular, $1\frac{1}{2}$ line diam., crowned with a prominent mammiform sessile stigma; it encloses three or four nuts *.

6. *Ilex ovalifolia,* Bonpl. MSS.;—Ilex Paraguariensis, *Reiss.* (*non St.-Hil.*) *in Mart. Flor. Bras.* xxviii. p. 63, *var.* longifolia, tab. 13. fig. 16;—Ilex Paraguarensis, *Spach, Phan.* ii. 430. pl. 16;—glaberrima, ramulis angulato-striatis; foliis ellipticis vel elliptico-oblongis, utrinque acutis, apice breviter coarctato et obtuso, coriaceis, rigidulis, glaberrimis, obsolete dentatis, dentibus glandula minuta donatis, margine cartilagineo subreflexo, superne nitidulis, profunde viridibus vel brunnescentibus, nervis immersis vix distinctis, ad costam sulcatis, subtus opacis, pallide glaucis aut flavescentibus, remote nigro-punctulatis, costa valde prominente, nervis subpatentibus inter se arcuatis paulo prominulis; petiolo sulcato,

* A representation of this plant is shown in Plate 65 A of the 'Contributions.'

sublongiusculo, sæpius recurvo; paniculis axillaribus, multifloris, petiolo 2-plo longioribus, sub lente obsolete puberulis, demum subglabris; floribus 4- rarius 5-meris, petalis oblongis, patentibus; ovario stigmate magno mammæformi 4-lobo sessili apiculato; drupa globosa, stigmate mammillari coronata.—In prov. Rio Grande, ad Faxinal, et versus Rio Pardo (Bonpland, no. 2425) ♀; *ex herb. Delessert,* Rio de Janeiro (cult.?), A. Richard (♂).

This species is very nearly allied to the preceding, and appears to be one of the varieties which Dr. Reisseck has mistaken for the true Paraguay Maté-tree. In the specimen collected near Rio de Janeiro, which seems to be the male plant (appertaining to the female, Bonpland, no. 2425), the leaves are much darker and more polished; they are $1\frac{1}{2}$–$1\frac{3}{4}$ inch long, 8–9 lines broad, on a petiole 3 lines in length: the inflorescence is a branching corymb, 6–9 lines long, with lateral racemose branchlets, each bearing three pedicelled small 4-merous flowers; the sepals and petals have ciliated margins; the sterile ovary has a flat depressed 8-grooved summit, with an obsolete 4-lobed stigma. In Bonpland's female plant the leaves are similar in size and shape, but are much paler above and more glaucous below: its inflorescence is an axillary panicle, 6–12 lines long, with several pedicels, which are either 1- or 3-flowered; if 1-flowered, the pedicel is 2-bracteated below the middle, showing the point where the two abortive flowers would have been inserted: these 1-flowered pedicels are 2–3 lines long; in the 3-flowered ramifications the ultimate pedicels are 1–2 lines long. This female flower is much larger than that of the male, and when expanded is 2 lines in diameter; it is generally 4-, sometimes 5-merous, the sepals and petals having ciliated margins; the ovary is somewhat oval, surmounted by a large, mammiform, sessile, 4-grooved stigma*.

The two following species have been referred by botanists to the true Maté plant:—

7. *Ilex nigropunctata,* nob.;—Ilex Paraguayensis, *var.* γ, *Hook.* (*non St.-Hil.*) *in Lond. Journ. Bot.* i. 35. tab. 3. plant. ♂;—Chomelia amara, *Vell. Flor. Flum.* 42. *Icon.* i. 106. plant. ♀;—ramulis sulcatis; foliis oblongis aut oblongo-lanceolatis, utrinque attenuatis, apice obtusiusculis, obsolete dentatis, dentibus glanduliferis, margine subrevoluto, superne pallide viridibus, nitidiusculis, ad costam sulcatis, utrinque nervosis et reticulato-venosis, subtus (in sicco) flavido- vel glauco-viridibus et nigro-punctulatis, costa prominente; petiolo tenui, canalicu-

* A drawing of this species is given in Plate 65 B of the 'Contributions.'

lato; racemis axillaribus, multifloris, ternatim compositis, petiolo 2–4-plo longioribus; floribus 4-meris pedicellisque pilosulis; ovario in ♂ depresso, radiatim sulcato, in ♀ ovato; stigmate pulvinato, 4-lobo.—Brasilia, ad Campos de Goitacazes, versus ostium fluv. Parahyba, prov. Rio de Janeiro.—*v. v.* ad Rio de Janeiro, in hort. bot. Imp. cult. (♂ et ♀), et in hort. Kew. Lond. introduct. (♂).—*v. s. in herb. Delessert* (Guillemin, no. 95 ♀).

This has always appeared to me a perfectly distinct species, differing widely in all respects from *Ilex Paraguayensis*, of which it was considered to be a mere variety by Sir Wm. Hooker. I find no species in Reisseck's enumeration of the genus that corresponds with it: he appears, however, to have known this plant only from Sir Wm. Hooker's drawing of it, and he makes it identical with *Ilex affinis*, Gardn. (no. 3086). It is clear to me that, if he had been able to compare these plants with one another, he would have come to a very different conclusion. In the male plant under consideration, the leaves, sometimes alternate, frequently opposite, are lanceolately oblong, pointed towards both extremities, pale on both faces, very reticulated, toothed on the margin at nearly equal distances, the teeth being rounded externally, with an acute gland near the sinus; the under surface of the leaves is spotted all over with very distinct black dots. They are $3\frac{3}{4}$ inches long, $1\frac{1}{8}$ inch broad, on a petiole nearly 4 lines in length. The inflorescence is a simple panicle, $\frac{3}{4}$–$1\frac{1}{2}$ inch long, with alternate secondary pedicels $1\frac{1}{2}$ line long, each surmounted by three pedicellets 1 line long, bearing flowers which before bursting are globular, and 1 line diam.; the flowers are 4-merous, the calyx pubescent, the petals have ciliated margins, the ovary is depressed and radiately sulcate, with a small 4-lobed stigma. In the female plant the leaves are of similar form, but somewhat smaller, fuscous and enervose above, more rigid in texture, the margins more reflexed, and the under surface opake and of a dull yellow colour: the inflorescence is more racemose, bearing 3–5 or 7 flowers, which are somewhat larger and 4-merous; the sepals are small, orbicular, and ciliated, the petals obovate and smooth, the ovary globular, with a small mammiform 4-grooved stigma. Padre Velloz, who has figured the female plant, says it is called *Congonha*, and is used as Maté; but it is more bitter than the ordinary Herva de Curitíba*.

8. *Ilex acutangula*, Neuw. ex Nees in Flor. 1821, p. 329;—Ilex Paraguayensis, *Hook.* (*non St.-Hil.*) *Bot. Mag.* 3992;—Celastrus 4-angulatus, *Schrad. Gött. Anz.* 1821, p. 716; *DC.*

* The male plant is shown in Plate 66 A, the female plant in Plate 66 B of the 'Contributions.'

Prodr. ii. 7;—ramulis 4-angulatis, rubescentibus; foliis suboppositis, ellipticis, imo subacutis, versus apicem rotundioribus, hinc acumine brevi repente coarctato, recurvatim canaliformibus, irregulariter serratis, dentibus acutis, glanduliferis, supra lucidis, subtus pallidioribus, epunctatis, nervis utrinque paulo prominulis; petiolo brevi, canaliculato; racemis axillaribus, paniculatis; pedicellis plurimis, subumbellatis; calyce pubescente; drupis siccis, sub-8-sulcatis.—Brasilia, *v. v.* in hort. Kew. cult. sub nom. "*Ilex Paraguayensis.*"

This is the species described by Sir Wm. Hooker as the Paraguay Tea-tree, which he figured in the 'Botanical Magazine,' as then growing in Glasgow, where it first flowered in June 1842, having been introduced into this country by Messrs. Luccomb and Pince of Exeter; he again mentioned it in his interesting account of the Maté plant (Lond. Journ. Bot. i. 31). It is distinguished from all the preceding species by its quadrangular stems, its opposite serrated leaves (a character of frequent occurrence in the preceding species), the teeth being very close and regular, and furnished with glandular points which are almost spinous: the recurved and suddenly contracted apex of the leaves affords an additional character. In all its essential features it corresponds with the species above quoted and described in Prince Maximilian Neuwied's 'Travels.' It is certainly allied to the true *Ilex Paraguayensis*, which it resembles in the size of its leaves; but it differs widely in its specific characters: its leaves are less rigid and coriaceous, differently nerved, their margins being closely serrated, the petiole is more terete, and the inflorescence is very different. Both species, having epunctate leaves, belong to the first section of Reisseck's distribution. The leaves are $3\frac{1}{2}$ inches long, 2 inches broad, on a petiole 3 lines in length; their short sharp serratures are 1 or 2 lines distant from one another. I have not seen it in flower, the above floral characters being taken from the figure in the 'Botanical Magazine.' The raceme, as there shown, differs from that of the many preceding species in its primary branches bearing several umbellate pedicels and a cluster of flowers.

The *Ilex truncata* of Prince Neuwied, recorded at the same time, appears to be a closely allied plant: it is the *Celastrus ilicifolius* of Schrader, mentioned in DeCandolle's 'Prodromus,' ii. p. 7.

Allied to these plants is the following species, which I found in the Organ Mountains, and which has been described by Dr. Reisseck under the name of

Ilex ebenacea, Reiss. in Mart. Flor. Bras. fasc. 28. p. 44.

tab. 11. f. 7.—*v. v.* in Montibus Organensibus, Prov. Rio de Janeiro.

The description above cited is that of the male plant; but the plant found by me had hermaphrodite flowers and fruit. In this the leaves are alternate, sometimes opposite, rarely ternate, very coriaceous, with immersed nerves, which are scarcely prominent below: the upper surface is convex, sub-polished, with cartilaginous margins, which are very revolute; the midrib is immersed and sulcate above, prominulent below; the lower surface of the leaves is paler and opake, being densely covered with very minute, whitish, punctate scales, seen only under the lens: they want the larger black dots found in the preceding species. The leaves are $2\frac{1}{4}$–$2\frac{1}{2}$ inches long, 10–11 lines broad, on a somewhat slender petiole 6–9 lines long. The inflorescence ⚥ is axillary, consisting of 2–5 fasciculated 1-flowered peduncles 2–3 lines long: the calyx is 5-toothed; the five petals are oblong, obtuse, rotately expanded, 3 lines long, $1\frac{1}{2}$ line broad, slightly coalescent at their base by the adhesion of the alternate filaments, which are as long as the petals, and in like manner expanded: the ovary is oval, 5-celled, each cell having one suspended ovule: the stigma is broadly mammiform and sub-5-lobed: the drupe is oval, purplish red, fleshy, 5–7 lines long, 4–6 lines diam., crowned with a large conical stigma, and containing five osseous grooved nuts, each 1-seeded: the embryo is minute, near the summit of the albumen.

It is probable that the *Ilex rivularis*, Gardn., and *I. affinis*, Gardn., both from the province of Goyaz, are theiniferous. Dr. Reisseck considers the one to be a mere variety of the other; but they appear to me sufficiently distinct. In the former the leaves are much broader, stouter, with a more revolute and thicker cartilaginous margin; the nerves are fewer, coarser, more distant and more divaricated; the petiole is shorter and broader. In the latter the racemes are more elongated, more spicated, and the pedicels much longer; the flowers are nearly half the size of the former, with a glabrous (not a pubescent) calyx. These differences cannot be sexual, for in both my specimens the flowers are ♀ and 4-merous.

All the above species, excepting the last-mentioned, are extra-tropical, or scarcely reach the limit of the southern solstice, and they all appear to contain the peculiar principle (*theine*) which exists in Chinese tea and in coffee. The Yerba de Paraguay, like coffee, owes its refreshing qualities not only to the presence of theine, but to a peculiar acid. Dr. Stenhouse found 2 per cent. of theine in Congou tea, and 0·75 to 1 per cent. of the same principle in coffee—called also *caffeine*, both having been found to be identical. The quantity existing in the Yerba de Paraguay has not been ascertained, but it is probably not less in amount than in coffee. Coffee, however, derives its pleasant flavour principally from its peculiar acid, called caffeic acid, which is very analogous to kinic acid, or the vegetable acid of Cinchona-barks. Dr. Stenhouse relates that when caffeic acid is treated with sulphuric acid and binoxide of manganese, it yields the peculiar principle called *kinone*, and that the Paraguay tea also furnishes kinone when subjected to a similar treatment. It is worthy of notice that the leaves of our common Holly, when exposed to the action of the same reagents, also yield kinone, as do the whole of the Cinchona tribe of plants and Asiatic Tea. There is another vegetable product of an analogous nature, the *guaraná*, or inspissated juice of the *Paullinia sorbilis*, prepared by the Indians of Pará, the infusion of which affords a very refreshing drink, of which the Indians are very fond. This has been analysed by Dr. Stenhouse, and found to contain a large proportion of theine. It is singular that Man, in the lowest grades of civilization, should have had the faculty of distinguishing and applying to his use those plants which contain the peculiar principle to which the tea of China owes its invigorating property.

XL.—*On a supposed new Genus and on some new Species of Pelagic Mollusca.* By Arthur Adams, F.L.S. &c.

As the little floating forms of Mollusca which inhabit the high seas are so little known and so seldom met with, I consider it interesting to the zoologist that the capture of every novel example should be recorded, even supposing the presumed "new genus" should hereafter be proved to be merely a synonym of some well-known type. Thus *Zoea* of Leach led the way to Thompson's revelations of the metamorphoses of the Crustacea, and *Cirrhopteron* of Sars to those of the Mollusca. *Sinusigera* of D'Orbigny has been said to be the larva of *Dolium*, the nucleus of which, however, is smooth and tumid, and the outer lip thin and simple. The same species, *S. cancellata*, has also been supposed by Macdonald to be the young of a very different shell, namely *Pedicularia*. The nearest approach to the small shells described below is *Sinusigera*; but if they be the fry or embryonic condition of some other mollusk, I cannot imagine to what known genus they can be affiliated.

Genus Alciope, A. Adams.

Testa dextrorsa, spiralis, trochiformis; anfractuultimo ad peripheriam acute carinato. Apertura subquadrata; labio recto, in spinam vel rostrum antice producto.

1. *Alciope rostralis*, A. Adams.

A. testa trochiformi, vitrea, pellucida; anfractibus $3\frac{1}{2}$, convexiusculis; suturis, peripheria et rostro rufo tinctis; rostro mediocri.

Hab. China Sea.

2. *Alciope spicata*, A. Adams.

A. testa trochiformi, semipellucida, nucleo magno nigricante; anfractibus planiusculis, ultimo acute carinato; rostro recto, valde producto, violascente.

Hab. China Sea.

Genus Sinusigera, D'Orbigny.

1. *Sinusigera fusoides*, A. Adams.

S. testa ovato-fusiformi, alba, subopaca; anfractibus tribus, ultimo magno, in medio tumido; apertura angusta; labio recto, crasso, antice producto, acuminato; labro antice et postice sinuato, in medio lobato.

Hab. In the sea, east coast of China.

2. *Sinusigera bicarinata*, A. Adams.

S. testa ovato-turbinata, fusca, semipellucida; anfractibus $3\frac{1}{2}$, convexis, lævibus, ultimo bicarinato, basi carinula infra carinam inferiorem cincta; apertura ovata; labio brevi, antice abrupte truncato; labro margine in medio lobato, antice et postice sinuato.

Hab. Indian Ocean.

These species, like those I have hitherto described, appear to be perfect adult shells with small nucleolar whorls and well-developed outer lips.

Genus Macgillivrayia, Forbes.

Macgillivrayia perspicua, A. Adams.

M. testa helicoidea, perforata, vitrea, lævi, nitida, pellucida; spira depressa, apice lutescente; anfractibus 3, convexis, ultimo amplo, superne subangulato; apertura semiovata; labio simplici, arcuato.

Hab. China Sea.

A small pellucid species, which, as shown by the operculum, belongs to this genus.

Genus Recluzia, Petit.

Recluzia Bensoni, A. Adams.

R. testa turbinata, tenui, pallide fulva, anguste umbilicata; spira elata, acuta; anfractibus $4\frac{1}{2}$, convexis, transversim striatis lineis-que incrementi instructis; suturis profundis; apertura ovata, antice vix producta; labio rectiusculo, margine subreflexo; labro integro, regulariter arcuato.

Hab. China Sea, off Formosa.

In this species the whorls are more convex than in *R. turrita*, V. d. Busch, which it most nearly resembles, and the straight, elongate inner lip has the free margin somewhat reflexed; the aperture, moreover, is produced anteriorly, and the whorls are transversely striated. The nucleus is small and pointed, and the nucleolar whorls are quite pellucid.

The capture of this species was effected by my friend Lieut. Bullock, of the 'Dove,' Tender to the 'Actæon,' to whom I am largely indebted for specimens and for the observation of particular localities. It may possibly be the same species as that observed by Mr. Benson on his voyage to India, of which he has made mention in his paper on *Ianthina* in the 'Annals;' and to him, as a token of respect for his accuracy and enthusiasm, I have dedicated it.

Genus Ianthina, Bolten.

Ianthina (*Iodina*) *megastoma*, A. Adams.

I. testa helicophantoidea, turbinato-depressa, umbilicata, violacea, superne pallida; nucleo magno, obliquo, decumbente; anfractibus normalibus $1\frac{1}{2}$, rapide crescentibus, longitudinaliter sulcatis, ultimo amplo, ad peripheriam obtusim angulato; apertura subtrigonali, magna, patula, antice producta, subeffusa; labio recto, antice vix everso; labro margine in medio excavato.

Hab. Indian Ocean.

This is a very beautiful but rather small species, not quite so large as *I. exigua*, Lam., and resembling in form the genus *Helicophanta* or *Eurycratera*. The nucleus is large, of two whorls, and decumbent; the shell is depressed and obtusely carinate at the periphery, and the aperture wide, expanded, somewhat triangular and effuse anteriorly. Two adult and two young specimens were obtained in the towing-net during our passage across the Indian Ocean. It belongs to the subgenus *Iodina* of Mörch.

Genus Bellerophina, D'Orbigny.

Bellerophina recens, A. Adams.

B. testa parva, nautiliformi, globulosa, involuta, tenui, albida, roseo tincta, umbilicata, subsymmetrica, concentrice crenato-sulcata; apertura angusta, transversa, semilunari; labro margine integro, simplici.

Hab. Indian Ocean.

One specimen only of what I believe to be a recent species of *Bellerophina* has occurred to me, from the middle of the Indian Ocean. From the general appearance of the shell, I should be inclined to place the Bellerophontidæ after the family Atlantidæ, among the Heteropods.

Genus Litiopa, Rang.

The species of *Litiopa* of Rang, or *Bombyxinus* of Bélanger and of Lesson, are not well known. One is named *saxicola*, another *pelagica*; but there is much confusion attending them. About a dozen species have been described, but require to be brought together and compared. This from the Indian Ocean appears to be different from the others, and may be thus characterized:—

Litiopa ventrosa, A. Adams.

L. testa ovato-conoidali, tenui, cornea, semipellucida, longitudinaliter minutissime striata; spira elata, apice obtuso; anfractibus $4\frac{1}{2}$, convexis, ultimo ventricoso, basi producta; apertura ovata; labio recto, antice truncato; labro margine regulariter arcuato.

Hab. Indian Ocean.

There was no *Sargassum* in the sea where this species was taken in the towing-net. It is a somewhat inflated, thin, horny shell, with the inner lip abruptly truncate, and the outer lip continued beyond the truncature, so that the aperture cannot be said to be truncate anteriorly.

Shanghai, China,
May 3, 1861.

XLI.—*On the Arrangement of the Families and Genera of* Chlorospermous Algæ. By Dr. John Edward Gray, F.R.S., V.P.Z.S., F.L.S. &c.

Having been recommended to change the course of my studies for a time, I have returned to my "old love," and have been devoting my vacation and my leisure time to the study of *Algæ* and the reading of the various books and papers on the subject which have come in my way. Thus, after an interval of forty years, I have ventured to prepare a paper on systematic botany, and to send to the 'Annals' some suggestions as to the arrangement of the Chlorospermous Algæ.

I always look back with pleasure to the time that I spent in collecting plants and in studying and teaching botany, and especially to the period when I was occupied in preparing the scientific part of the 'Natural Arrangement of British Plants,' the work that first introduced the Natural System of plants to the student of English botany; for I need make no secret of the fact that I alone am responsible for that part of the work, since, though it was published under my father's name, he wrote the introduction only. Having in his youth studied British plants according to the system of Ray, he never would adopt the Linnæan system; and the only interest that he took in the scientific part of the work was that he considered the 'Genera Plantarum' of Jussieu as a revision and modification, according to the increase of knowledge, of the Rayian method, while he regarded the Linnæan system as only a dictionary by means of which the names of plants could be most easily discovered. The kind encouragement and assistance which I received during its preparation from M. DeCandolle, the father, and M. Dunal of Geneva (then in England), from Mr. R. A. Salisbury, and from my dear friends Edward Bennett, the late Secretary of the Zoological Society, and J. J. Bennett, now Keeper of the Botanical Collection in the Museum, and the use that the course of study it necessitated has been to me in after life, fully made up for all the obstruction and difficulties that were thrown in my way by other botanists, which delayed the appearance of the work for nearly a year, and for the ill-will exhibited towards me for many years after. But their opposition was of no avail: the Natural System has been established for years; and though the work was not a success—and, indeed, how could one be that attempted to introduce at once into English botany almost all that had been done on the Continent up to the period of its publication, and thus was so far in advance of the then state of botanical knowledge in England, where the study had been under the incubus of a blind attachment to the Linnæan system? —yet it has kept its ground; and the very opposition was useful to me by causing me to pay more attention to analytical studies, and to carry into zoology the knowledge, accurate terminology, and systematic method of study employed in the sister science which has led me to believe that the study of botany is the best introduction, even now, for the successful prosecution of the other branches of natural science.

The Melanosperms, and especially the Rhodosperms, have been well studied*. The Chlorosperms have been divided into a series of families or orders: but these families have not been arranged in satisfactory groups; at least, that is the conclusion

* Mr. Berkeley, however, observes, "Thuret describes and figures the antheridia of *Dictyota dichotoma*, and shows the necessity of considerable reformation in the classification of the Melanosperms, in consequence of the diversity of the reproductive organs."—*Introd. Crypt.* p. 566.

that I have arrived at. The last and best arrangement of the Melanosperms I have seen is Dr. Harvey's, published in his 'Nereis Boreali-Americana,' vol. iii. Feb. 1858. But the knowledge of the fructification of Algæ in general, and of this group in particular, is still so imperfect, and the accounts given of it by different authors are so conflicting, that it is by no means easy to reconcile them and bring them into a general system. The fructification of so small a proportion of the species has been examined and well described, that it is very doubtful whether many of the species which are referred to the different genera really belong to them; and in many genera the fruit has been so imperfectly described, that it is doubtful to what family they should be referred.

Under these circumstances, I feel that any attempt at arranging the families into larger groups must be attended with considerable uncertainty, and that we can only hope to advance towards a good arrangement by very slow degrees, adding very gradually to our knowledge as we proceed.

In forming groups, we ought to observe the resemblances of the species in their habits as well as in their properties and structure. It is nearly an impossibility to define with absolute strictness the confines of any group, of whatever value it may be, whether a genus, a family, or an order; and we must recollect that the distinctness of a group does not depend on the facility with which it can be characterized in a phrase or longer description. To take an example from zoology: no one doubts the distinctness of the Rabbits from the Hares; yet every zoologist and anatomist has failed to give a scientific character by which they can be separated—and most countries have their own species of hares or rabbits. I have known experienced sportsmen puzzled to say whether the variety of the Rabbit called the *Leporine* is a Hare or a Rabbit, and call some animals of the same litter hares, and others rabbits; yet they are most distinctly marked in their habits, as Mr. Bartlett justly observes. The Hares, which live in a "form" above ground, have the young born with the eyes open, covered with hair, and ready to feed themselves a few hours after birth, as is also the case with the Guinea Pig; while the Rabbits live in burrows, have the young born blind and naked, and dependent on their mother's milk for support for some time after birth. Now, if this is the case with animals so well known, what must be the imperfection of our knowledge regarding Algæ, which we can only observe at distant periods, and which are often so minute as to escape our sight without the aid of glasses, and many of which are greatly transformed in external appearance during their life and growth!

My observations lead me to think that the class may be divided into two subclasses.

Subclass I. MONOPHYTES.

The zoospores formed within the cells of the plant, isolated; each zoospore developing into a frond formed of a gradually-developed cell or cells like the parent.

Order I. Microsporæ.

The zoospores small, formed from the endochrome of a single cell.

Suborder I. *Siphoneæ.*

The plant of a single, tubular, simple or branched cell, not subdivided into joints, or at length furnished at the tip with a number of simple or branched articulated threads with cylindrical joints.

I. *The cell always undivided.* Siphoneæ veræ.

A. Zoospores in a distinct sporidium.

Fam. 1. **Codieæ.**

The cells simple, without any internal fibrous network, generally more or less interlaced together, forming a more or less spongy mass. Sporangium lateral, without external antheridia.

1. *Codium.*

Fam. 2. **Halimedeæ.**

The cell or plant branched, tufted, enclosed in an external coat of carbonate of lime.

"The *Halimedeæ* are generally barren; the fructifying individuals present little confervoid tufts, divided repeatedly above, and terminating in subglobose fastigiate (inarticulate) branchlets; the endochromes of these generally become organized, and produce innumerable active molecules, which doubtless are capable of propagating the plant." (Berkeley, Crypt. 160. f. 42.)

1. *Halimeda.* Frond branching, articulate; the joints flattened. (Harvey, Ner. Bor.-Am. 22. t. 40.)
2. *Udotea.* Frond fan-shaped, simple or cleft, on combined stems. (Harvey, Ner. Bor.-Am. 26. t. 40 c.)

B. Zoospores in the usual cells. Cell free, tufted, branched.

Fam. 3. **Caulerpeæ.**

The cell or plant free, tufted, more or less expanded as if branched on the sides.

1. *Caulerpa.* The cell filled with internal fibres.

2. *Bryopsis.* The cell slender, without any internal fibres.

3. *Chlorodesmus.* (Harvey, Ner. Bor.-Am. iii. 30. t. 40 c.)

II. *Cell or plant at first simply elongate* (*like the true* Siphoneæ), *at length developing at the apex a number of branched articulated filaments formed of elongate cells. Zoospore in the cell of the branched filament.* Siphoneæ barbatæ.

Fam. 4. **Valoniaceæ.**

* Stem tubular, vesicular, and branched.

1. *Valonia.*

** Stem nodulose, with whorls of jointed, byssoid, deciduous fibrilli, and a head of radiating larger cells, which are also deciduous.

2. *Acetabularia.* Cell of head radiating, united. (Harvey, Ner. Bor.-Am. t. 42 A.)

3. *Cliftonella.* Cell of head radiating, free; stem not perforated. (*C. calyculus* (*Polyphysa Cliftonii,* Harvey ?).)

4. *Polyphysa.* Cells of head clustered. (*P. penicillus.* Harvey, Ner. Aust. t. 11.)

*** Stem annulated, covered with a tuft of forked jointed filaments.

† *Head a tuft of slender filaments.*

5. *Penicillus.* Stems very slender, many interlaced together, forming a thick stipes. (*P. arbusculus,* Harvey, Ner. Aust. t. 22.)

6. *Chamædoris.* Stem single, separate, thick, annulate. (*C. annulata,* Harvey, Ner. Bor.-Am. 42. t. 42 B.)

†† *Head branched; branches like the stem, annulate.*

7. *Apjohnia.* (Harvey, Ner. Aust. t. 5.)

††† *Head a reticulated frond.*

8. *Struvea.* (*S. macrophylla,* Harvey, Ner. Aust. 1. t. 7. *S. plumosa,* Harvey, *ib.* t. 32.)

Suborder II. *Arthromorpha.*

The cells many, united together, forming a chain-like filament, one at the end of the other; sometimes in the older parts, as the stems, the threads are incorporated into a solid or tubular axis.

A. The zoospores developed in some dilated cells, forming a beaded, thread or in a large cell situated at the end of the branches or branchlets.

* *The spores in beaded threads radiating from the centre, and densely packed into a spherical ball immersed among the branchlets.*

Fam. 1. **Batrachospermeæ.**

Frond gelatinous, clothed externally with slender articulated ramuli on a solid stem of densely interwoven threads.

Dr. Harvey thinks these balls are rather buds than spores, the plant and fructification having great resemblance to *Helminthocladiæ* among the Rhodosperms.

1. *Batrachospermum.*

*** Sporidia solitary on the branchlets.*

Fam. 2. Thoreæ.

The frond gelatinous, clothed with a number of byssoid scattered ramuli on a cellular stem formed of densely interwoven threads.

1. *Thorea.*

Fam. 3. Lemaneæ.

Frond cartilaginous, solid or hollow, with a cellular peripheral layer and internal tufts of articular branched threads bearing a sporangium.

1. *Lemanea.*

"The threads are at first precisely like those of a *Conferva*; certain joints, however, are protruded from the sides, after the manner of the first division of the threads in *Cladophora*; these rapidly increase, both in length and breadth, by means of transverse and vertical division; a cavity is formed in the centre; the walls are lined with large transparent cells, from which articulated threads are sent forth horizontally into the cavity either from every point of the surface or in whorls, insomuch that the structure is almost that of a *Cymopolia* or *Batrachospermum* turned inside out." (Berk. p. 137.)

"The spores at first vegetate into confervoid, slender, jointed filaments, with long joints containing a spirally-arranged endochrome; at length thick branchlets spring from the cells, which soon acquire rootlets at their base and grow into the perfect frond." (Thwaites, Linn. Trans.)

Fam. 4. Dasycladeæ.

Frond green, naked or coated with carbonate of lime, having a unicellular simple or branched axis, which is whorled throughout its whole length with articulated ramuli. Spores spherical, developed in proper fruit-cells.

** Sporidia lateral, at the base of the branchlet.*

1. *Dasycladus.* (Harvey, Ner. Bor.-Am. 35. t. 41 B.)

*** Sporidia at the top of the branchlet.*

2. *Cymopolia.* (Harvey, Ner. Bor.-Am. 33. t. 41 A.)

Dasycladus has been illustrated in Debès and Solier's memoirs, and is also figured by Kützing, and seems rather a compound *Conferva* and *Vaucheria.*

Fam. 5. Chætophoreæ.

Frond green, filiform, articulated; branches invested with gelatine of a more or less determinate form. Cell filled with endochrome; tips of the filaments attenuated, jointed. Sporangium globose, on the sides or end of the branchlets.

1. *Chætophora.* Filaments aggregate, clustered, combined into a gelatinous frond of definite form. *C. endivæfolia.* Sporidia lateral. (Hassall, t. 9. f. 1, 2.) ?*C. dilatata.* Sporidia terminal. (Hassall, t. 13. f. 2.)

In *Chætophora* the threads are studded with globose lateral cysts.

Müller informs us that in *C. tuberculosa* he has repeatedly seen two kinds of cysts—one scarlet, and constituting *antheridia,* the other larger, and at length producing spores.

2. *Draparnaldia.* Filament separate, dimorphous. Cells of stem and branches hyaline cross-banded, of ramuli filled with endochrome. *D. glomerata.* (Hassall, t. 13. f. 1.)

"In *Draparnaldia* the diaphanous prolongations of the filament are septate, each consisting of a series of elongated cells. The *sporangia* also in *Draparnaldia glomerata* and *Chætophora elegans,* in which species we have observed them, are formed within the original cell of the ramuli, causing the latter to assume a moniliform appearance. Quaternate *zoospermata,* which are most probably gemmæ, likewise occur in these species, as well as in those of the genus *Stigeoclonium* of Kützing." (Thwaites in Harvey, Ph. Brit. t. 226.)

Fam. 6. Blodgettiaceæ.

The genus *Blodgettia* of Harvey, Ner. Bor.-Am. 46. t. . *B. confervoides,* which he thus describes:—

"Fronds cæspitose, branching, confervoid, articulate; articulations unicellular, filled with grumous viscid endochrome. The cell-wall formed of separable membranes, the outer of which are hyaline and homogeneous, the innermost traversed by parallel longitudinal veinlets. Spores serrated, in moniliform strings, and developed from the veinlets of the inner cell-wall." Appears to be the type of a new family.

B. The zoospores are small and numerous, produced in the cells of the frond, which are of a uniform structure.

Fam. 7. Confervaceæ.

Frond green, filiform, articulated, destitute of any investing gelatine, attached or, more rarely, free. Cells elongate, mostly uniform in size. Endochrome filling the cavity of the cells. Zoospores minute, undefined, numerous in each cell.

* *The stem branched.*

1. *Cladophora.*

** *The stem unbranched.*

"A large quantity of *Confervaceæ* consist of simple unbranched articulate threads, increasing in length by constant division of the endochrome, and propagated either by the rupture of the thread or by active granules formed within these articulations, and escaping by a regular aperture." (Berkeley, Crypt. p. 133.)

2. *Chætomorpha.* (*C. melaginium,* Harvey, Ph. Brit. t. 99 *a.*)
3. *Hormotrichium.* (*H. Younganum,* Harvey, Ph. Brit. t. 328.)
4. *Rhizoclonium.* (*R. riparium,* Harvey, Ph. Brit. t. 238.)

The following genera, having a frond of filmy network formed of dichotomously-branched anastomosing filaments, should, perhaps, be arranged in this family.

5. *Microdictyon.* (*M. Agardhianum,* Harvey, Ner. Aust. i. t. 50.)
6. *Talarodictyon.* (Payen, Crypt. 24.)
7. *Anadynomene.* (*A. flabellata,* Harvey, Ner. Bor.-Am. 49. t. 41 A.)

See also *Cladophora* ? *anastomosans,* Harvey, Ner. Aust. ii. t. 111.

Suborder III. *Solenomorpha.*

The cells isolated, more or less uniform, often forming a beaded series, contained in an inarticulate tubular sheath or in a gelatinous frond formed of the more or less coalesced tubular sheaths. The threads are simple, or only appear branched from apposition, and contain the zoospores. The cells or series of cells sometimes divide longitudinally.

Fam. 1. **Oscillatoriaceæ.**

The cells compressed, disk-like, very short; they multiply by transverse division. Threads articulated, simple, or branched by the division of a metamorphosed cell, more rarely by the protrusion of the central cord consequent on the rupture of its outer coat. Cells generally very narrow. Propagation (where the mode of fructification has been ascertained) by means of zoospores.

"It was once supposed that their endochromes were totally different from those of *Confervæ,* consisting merely of circular disks filling up a common tube, and finally expelled from it. There is, however, no doubt that they are of the same nature as in other allied Algæ, that each is contained in a distinct sac, and that multiplication takes place in the same way, by division of the endochrome and formation of a new membrane round each division." (Berkeley, Crypt.)

* *Filaments free, tufted, erect.*

1. *Calothrix.* (*C. confervicola,* Harvey, Ph. Brit. t. 254.)

** *Filaments free, decumbent, simple.*

2. *Lyngbya.* (*L. majuscula,* Harvey, Ph. Brit. t. 62.)
3. *Oscillatoria.* (*O. litoralis,* Harvey, Ph. Brit. t. 105 A.)

*** *Filaments branched by apposition.*

4. *Petalonema.* (*P. alatum,* Hassall, t. 68. f. 6.)
5. *Scytonema.* (*S. myochrous,* Hassall, 237. t. 68. f. 2.)

**** *Filaments bundled in a sheath.*

6. *Microcoleus.* (*M. anguiformis,* Harvey, Ph. Brit. t. 249.)
7. *Schizosiphon.* (*S. Warreniæ,* Harvey, Ph. Brit. t. 316.)

***** *Filaments radiating from a centre, and having a spherical cell at the root.*

8. *Rivularia.* (*R. plicata,* Harvey, Ph. Brit. t. 315.)

Fam. 2. **Nostochineæ.**

"The cells subglobular, increased by transverse and longitudinal division. Threads very slender, moniliform, invested with gelatine, which is at length, to all appearance, common to the mass, but at first appertains to each individual thread. Propagation by division of the threads or by zoospores." (Berk. p. 139.)

"The threads, broken up into fragments, burst through the common envelope and become dispersed in the water; in this condition they are endowed with spontaneous motion. These fragmentary threads divide longitudinally and transversely, at last constituting a bundle of new threads, which gradually, by increase of the gelatinous or filamentous element, assume the normal form of the species." (Berkeley, p. 140; see also Harvey, Ner. Bor.-Amer. p. 111.)

"It has been asserted that they are nothing but a state of Lichens. It is true that the fronds of the Collemal Lichens do contain gonidia arranged in little necklaces; but this appears to be a mere case of analogy." (Berkeley, Crypt. p. 141.)

a. *Filaments invested in a mucous matrix forming a defined mass or frond.*

1. *Nostoc.*
2. *Monormia.* (*M. intricata,* Hassall, 286. t. 75. f. 11.)

b. *Filaments not enclosed in gelatine having a defined form.*

3. *Spirillum.* (*S. Jenneri,* Hassall, 277. t. 75. f. 5.)

4. *Aphanizomenon.* (*A. incurvum,* Hassall, 280. t. 76. f. 6.)

5. *Sphærozyga.* (*S. Carmichaelii,* Harvey, t. 113.)

6. *Spermosira.* (*S. Harveyana,* Harvey, t. 173.)

Suborder IV. *Phyllomorpha.*

Cells united together side by side, forming an expanded flat or tubular frond; the cells parting into four, eight, or sixteen cells by transverse and longitudinal section.

Fam. **Ulvaceæ.**

"Cells divided vertically and horizontally, so as to make a frond-like or tubular membrane. Propagation by zoospores furnished with flagelliform cilia." (Berkeley, p. 162.)

a. *Frond and endochrome purple.*

1. *Porphyra.* Frond leaf-like, flat. (*P. vulgaris,* Harvey, Ph. Brit. t. 211.)

2. *Bangia.* Frond filiform, tubular. (*B. fusco-purpurea,* Harvey, Ph. Brit.)

These genera, according to Thuret, have *antheridia* like Rhodosperms. (See Ann. Sc. Nat. Oct. 1856.)

b. *Endochrome and membranous frond green.*

3. *Enteromorpha.* Frond tubular, simple or branched, of a single series of cells. (*E. intestinalis,* Harvey, Ph. Brit. t. 154.)

4. *Phycoseris.* Frond membranous, of one series of small cells. (*P. Linza,* Harvey, Ph. Brit. t. 39.)

5. *Dictyosphæria.* Frond membranous, of one series of large vesicular cells; the cells are quaternately divided. (*D. favulosa,* Harvey, Ner. Bor.-Am. t. 44 B.)

6. *Ulva.* Frond membranous, of two strata of small cells. (*U. lactuca,* Harvey, Ph. Brit. t. 243.)

c. *Endochrome and gelatinous frond green.*

7. *Tetraspora.* (*T. lubrica,* Hassall, 300. t. 78. f. 10.)

8. *Prasiola.* (*P. calophylla* (*Ulva*), Hassall, 298, t. 677. f. 1.)

9. ?*Merismopoedia.* (*M. punctata,* Hassall, 299. t. 84. f. 6.)

Greville observes that sometimes there is only a single line of quaternate granules in the narrowest frond, and as many as ten or twelve in the broadest, of *Ulva calophylla* (see Algæ Brit. 176), and he states that the same difference occurs in *Bangia,* giving some fronds much the appearance of a Conferva (p. 177). Dr. Hicks, from observing the same fact, seems to think that *Lyngbya muralis*, *Schizogonium*, and *Prasiola* are only states of the same species. If this is the case, as the true *Lyngbyæ* have not been observed to change into any other plant, *L. muralis* must be the young state of a plant putting on the form of a genus of a different group (see Quart. Journ. Micros. Science, July 1861). The development of *Enteromorpha* and of *Ulva clathrata* have been described by Hassall (Brit. Freshwater Algæ, pp. 296, 304), and also by Greville in his 'British Algæ.'

Order II. Macrosporæ.

The zoospores large, formed by the union of the endochrome of two neighbouring cells in the same or contiguous threads, or by the division of a single primary endochrome of a single cell.

Suborder I. *Trichomorpha.*

The plant formed of a thread-like series of cells. The propagation entirely, or at least chiefly, by zoospores. The endochrome generally assumes some definite arrangement, often forming one or more spirals or stars.

Fam. 1. Zygnemaceæ.

Filaments free, floating, simple, articulated, thread-like, composed of cylindrical seriated cells. Zoospores formed by the union of the endochrome of two cells, simple.

A. The zoospore formed by the union of the cells of two different threads.

a. *The conjugating filaments parallel, or nearly so, to each other.*

1. *Zygnema.* Endochrome in spiral lines; zoospore in the cells. (*Z. nitida*, Hassall, t. 22. f. 1, 2.)
2. *Tyndaridea.* Endochrome in two stellate masses; zoospore in the cells. (*T. cruciata*, Hassall, t. 38. f. 1.)

b. *The conjugating filaments angulated, bent, and coalescing at the bend.*

3. *Mougeotia.* (*M. genuflexa*, Hassall, t. 40. f. 2.)

B. The zoospore formed by the union of the endochrome of the cells in the same thread.

4. *Rhynchonema.* Endochrome in a spiral thread; thread generally bent at an angle where the spore is formed. (*R. rostratum*, Hassall, t. 33. f. 1.)

Fam. 2. Thwaitesieæ.

Filaments free, floating, simple, articulated, thread-like, composed of seriated cylindrical cells. The zoospore formed by the union of the endochrome of two cells, which at length become divided crosswise into four spores.

* *The filaments parallel.*

1. *Thwaitesia.* (Berkeley, Crypt. 152. f. 39.)

** *Filaments bent, united at the angle.*

2. *Mesocarpus.* (Payen, Crypt. 26. f. 114; Hassall, t. 42. f. 1.)
3. *Staurocarpus.* (Payen, Crypt. 26. f. 113; Hassall, t. 47. f. 1.)

Fam. 3. **Œdogoniaceæ.**

The frond rooted, simple, articulated, thread-like, composed of a series of equal cells filled with endochrome; some of the cells eventually becoming dilated and swollen. Spore formed by the division of the endochrome of a fertile cell; the cell separates into two half-cells by a transverse partition. The zoospore is formed in one half; the other half lengthens to its proper size, and divides again; and this process is often repeated. (Thwaites, Ann. Nat. Hist. xvii. 333; Berk. Crypt. p. 151. f. 38.)

1. *Œdogonium.* (*Vesicularia capillaris,* Hassall, t. 50. f. 1, 2.)

"The divided portion of the endochrome which does not bear a spore swells, increases in length, is itself divided, and the posterior half becomes fertile; and this process may be repeated till a chain of spores is formed. The endochrome in the fertile half-cell, whether mixed with that of the neighbouring cell or not, contracts into a globular or elliptical mass, acquires a distinct envelope, most probably after impregnation; and this forms a spore. In some instances these spores are perfectly quiet, but in others they have ciliated appendages at one extremity, by means of which they move about with an apparently spontaneous motion. The spores after a time become attached at one end by two or three root-like processes, the endochrome divides, and new threads are formed.

"The upper cells of the antheridium of *Œdogonium* produce two elliptical bodies, which pass into the cavity of the spore-cell and there effect the impregnation of the spores. The antheridia are first formed within special cells, from which they escape and move about by means of a coronet of cilia, till they fix themselves upon the spore-cell." (Pringsheim, in Berkeley, Crypt. p. 565.)

Fam. 4. **Bulbochætaceæ.**

"Threads articulate, branched; fertile branchlets bulb-shaped, surmounted by a long inarticulate hair-like point. Endochrome apparently impregnated by bodies provided in little antheridia seated on the wall of the fertile cells, dividing at length into four ovate zoospores." (Berkeley, Crypt. p. 156.)

"The endochrome of the bulb soon becomes compact, and at the same time little processes like those of *Œdogonium* are developed on the surface; and the wall itself becomes fissured, apparently to admit the contents of the microgonidia. The endochrome then acquires a membrane and appears as a perfect spore." (Berkeley, Crypt. p. 156.)

In the genera *Ochlochæte, Bulbochæte,* and *Coleochæte,* "the setæ, when present, are rigid continuous tubes; and the fruit, so far as has been observed, is not contained within an original cell of the filament, but each sporangium is in a new cell, formed, it is true, by the elongation of an original cell, but subsequently separated from it by a septum. This occurs in *Tiresias* (*Œdogonium*), *Bulbochæte,* and *Coleochæte.*" (Thwaites, in Harvey, Ph. Brit. t. 226.)

1. *Bulbochæte.* (*B. setigera,* Hassall, t. 54. f. 1–4.)
2. *Coleochæte.* (*C. scutata,* Hassall, t. 77. f. 6.)
3. *Ochlochæte* (*O. histrix,* Harvey, Ph. Brit. t. 226) may also belong here; but the fructification is unknown.

Chætophora pisiformis is not congeneric with *C. elegans*, Ag.: it has the fruit and setæ of *Coleochæte,* from which it would seem to be separated only by its erect, free, not adpressed filaments. There can be little doubt, therefore, that *Chætophora tuberculata* is equally a *Coleochæte.* (Thwaites, in Harvey, Ph. Brit. t. 226, note.)

Suborder II. *Siphonomorpha.*

The plant a single, elongate, contiguous, tubular cell, more or less interlaced, on which is developed a sporangium. The zoospores are formed by the union of these two cells on the same plant.

Fam. 1. **Vaucheriadeæ.**

Cell simple, tubular, with a distinct ovate sporangium and a lateral process (*antheridium*), which temporarily conjugates and produces a globular zoosperm. (See Karsten, Ann. Nat. Hist. viii. 1861, p. 86, t. 9 A.)

1. *Vaucheria.*
2. *Saprolegnia*?

Suborder III. *Callomorpha.*

Plant consisting of isolated cells, separate, or simply cohering together in elongated simple or branched threads. Cells rarely conjugating.

Mr. Berkeley justly observes "that Desmidiaceæ and Diatomaceæ may grow for years without forming a spore, the propagation being carried on meanwhile by mere division" (p. 116).

A. Cells dividing by a simple dissepiment.

Fam. 1. **Palmelleæ.**

The cells (like *Protococcus*) are laid without order, or in a quaternary manner, in large numbers, within a common gelatinous false frond.

"Cells free, or surrounded by a gelatinous mass, sometimes stipitate; propagation by the division of the endochrome, which is mostly quaternary, and sometimes transformed into spores." (Berkeley, p. 114.)

In *Elæocapsa Hookeri*, which is found in chalk-clefts in Norfolk, "the inner membrane repeatedly bursts through the outer, though always adherent behind, so as to form a gelatinous mass of annulated threads, with a bright eye at the tip of each. The endochrome is occasionally bipartite, and then each new membrane acts for itself." (Berkeley, *l. c.* p. 117. f. 28.)

"The scattered cells in the early stages of *Palmella* are connected by slender gelatinous threads radiating from a larger central cell; the cells conjugate, two contiguous cells being united by a narrow connecting tube, which soon enlarges, and through which the contents of the two cells are mixed, and thus a sporangium is formed, the membranes of the original cell being absorbed." (Thwaites, Ann. Nat. Hist. ii. iii. n. s.)

"In *Palmoglœa Meneghinii*, at least, there is a distinct coupling of neighbouring spores; and Brébisson has noticed a similar fact in *Coccochloris protuberans* and *P. rubescens*, while the transparent peduncles point in the direction of certain Diatomaceæ.

"According as the endochrome divides vertically or transversely the mass increases in width or length; and as the divisions alternate after some tolerably fixed law, a network of greater or less width is formed, according to the proportion of vertical and horizontal division." (Berkeley, 119.)

* *Cells in a gelatinous mass.*

1. *Palmella.*

** *Cells in a confervoid simple or branched tubular filament.*

2. *Hormospora.* (*H. ramosa*, Harvey, Ph. Brit. t. 213.)
3. *Hydrurus.* (*H. penicillatus.*)

B. Cells dividing by the formation of two new central half-cells.

Fam. 2. **Desmidiaceæ.**

"Green; the cells membranous, free from silex. Cells free, or forming brittle threads or minute fronds; increasing by the formation of two half-cells in the centre or medial line, so that the two new cells consist each of a new and old half-cell. Spores generated by the conjunction of two distinct individuals." (See Berkeley, p. 120. f. 31, 32.)

"All writers agree in their increase by the partition of the mother-cell, accompanied by the growth of two new half-cells : in many cases this division goes no further, but each half with its new lobes grows into a perfect whole, and again divides. But this is by no means the case in all; for the two original halves do not always separate, but remain united with their progeny for many generations, thus forming a filiform body, in which the two primary halves are at each extremity and the youngest in the middle of the thread,—a mode of increase which we shall meet with again in the following tribe." (Berkeley, p. 17. f. 7, p. 121. f. 30 *a, b*.)

There is no difficulty in pointing out the passage between the Desmidieæ and the Zygnemidæ; for the genus *Spirotænia* has all the appearance of being a separate joint of a *Zygnema*.

Fam. 3. Diatomaceæ.

Endochrome yellow-brown. Cells covered with a silicious coat, often beautifully sculptured. Propagation and division of cells as in Desmidiaceæ.

"As in Desmidiaceæ, there are solitary species, and others grouped into lines and membranes; and in a few which have been observed to produce new plants by means of spores, the new production does not exhibit at first the normal character of the species." (Berkeley, p. 124.)

"The Diatomaceæ were long believed to be animals, and this view has more especially been maintained by Ehrenberg; but the discovery of the coupling of fronds by Mr. Thwaites, and the confirmation of this fact by myself, Mr. Broome, and others, leave no doubt that they belong to the same order of beings as Desmidiaceæ and Conjugatæ." (Berkeley, p. 126.)

The genera have been divided into three groups : first, those with smooth and transversely striated frustules; the second, with vittate, and the third with areolar frustules (p. 129).

The British species have been well described and beautifully figured in Dr. Smith's work, and the whole subject has been revised in Pritchard's 'Diatomaceæ;' but it appears to me that the arrangement of Smith is more in conformity with nature than that now proposed, which appears to be intended solely to enable the microscopist to name the species in the easiest manner from the isolated or prepared specimens that come into his hands.

Subclass II. POLYPHYTES.

The zoospores aggregated into a definite form, and often covered with a membranous or gelatinous coat; each zoospore developing within itself a similar aggregate group of minute zoospores, which enlarge and afterwards become free.

Fam. 1. **Hydrodictyeæ.**

Frond green. Zoospores naked, oblong, united at the ends into a saccate net with polygonal meshes, each side of the mesh being formed of a single zoospore.

1. *Hydrodictyon.*

"The granular mass gives rise, at a certain period of growth, to a number of elliptical grains endowed with active motion; these become attached to each other by their extremities so as to form a network; union takes place between the several bodies, and in process of time a new individual is formed, which becomes free by the absorption of the external wall." (Berkeley, p. 238.)

Fam. 2. **Pediastreæ.**

Frond green. Zoospore naked, free, oblong or angular, united side by side into an expanded frond.

The passage from the family Hydrodictyeæ to the Pediastreæ is easy by the genus *Serastrum*, in which the cells form a small oblong sphere. Indeed the resemblance is so great, that it has been suggested that the genus *Hydrodictyon* should be removed to the group of Desmidieæ to be near that genus.

** Cells fusiform or elliptical.*

1. *Scenedesmus.* (*S. quadricauda*, Ralfs, t. 31. f. 12.)

*** Cells angular, forming a flat disk.*

2. *Pediastrum.* (*P. ellipticum*, Ralfs, t. 31. f. 10.)
3. *Cœlastrum.*

**** Cells angular, forming a hollow sphere.*

4. *Serastrum.*

Fam. 3. **Volvocineæ.**

Frond green. Zoospores circular or square, enclosed in a membranous or gelatinous cyst of definite form.

"Propagating by the repeated segmentation of the contents of the old cells into a definite number of portions or 'gonidia,' which are either still or for a time mobile, and which are either arranged according to the typical plan within the parent-cell, and by its bursting set free as a new frond or family, or become so arranged without the parent-cell, but still involved in its inner membrane, the whole having emerged by a transverse fissure." (Pritchard, Diatom. p. 753.)

The number of cells is always constant in young fronds without exception. In older specimens one or more cells are lost, and the frond becomes therefore apparently irregular (*l. c.* 26).

1. *Pandorina* (Pritchard, Diat. pp. 157, 517, t. 19. f. 59–69) and *Eudorina* are the same.
2. *Gonium.* (Pritchard, Diat. pp. 152, 517, t. 19. f. 32–37.)
3. *Volvox.* (Pritchard, Diat. pp. 180, 526, t. 20. f. 32–47.)
4. *Stephanosphæria.* (Pritchard, Diat. p. 529, t. 19. f. 38–58.)

According to Dr. Hicks, the *Volvox* is perpetuated in two ways: 1, by the encysted cell or oospore; 2, by the motionless segment of the zoospore, which clearly has its homologue in many Algæ, and is free from motion because without cilia, and thereby distinguished from *zoospores.* (Quart. Journ. Microscop. Science, 1861, p. 283, t. 9. f. 1–11.)

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

June 20, 1861.—Major-General Sabine, Treasurer and Vice-President, in the Chair.

"On the Anatomy and Physiology of the Spongiadæ" (Part II.), by J. S. Bowerbank, LL.D., F.R.S., F.L.S., &c.

This paper is a continuation of the first division of the subject, published in the Phil. Trans. for 1858.

In the second part of this division the author treats of the keratode or horny substance of the skeleton, as regards both its physical and chemical characters, with a view of establishing the animal nature of that substance.

In the third part the membranous tissues are described under two heads:—

1st. Simple membranous tissues analogous to those of the basement membranes of the higher classes of animals; and

2nd. Compound membranous tissues. These structures consist of simple membranous tissue combined with primitive fibrous tissue. Their most simple forms exist in the membranes lining the interstitial cavities of the sponge and in the dermal membrane.

In the fourth part the fibrous tissues are described as consisting of three principal divisions.

1st. Primitive fibrous tissue. These structures are exceedingly minute, and form an important element in the construction of the compound membranous tissues of the animal.

2nd division. The fibres of the skeleton are described under the following heads:—

1st. Solid simple keratose fibre.

2nd. Spiculated keratose fibre, in which the keratode is the primary element.

3rd. Multispiculate keratose fibre,—the spicula being the primary element, and the keratode the secondary or cementing medium.

4th. Inequi-spiculated keratose fibre. Consisting of skeleton fibres constructed of numerous spicula irregularly dispersed, but congregated into a round or oval massive fibre.

5th. Simple fistulose fibre. A keratose fibre having a continuous simple central canal.

6th. Compound fistulose fibre. A keratose fibre with a continuous central canal, from which secondary small canals branch at about right angles to the primary one.

7th. Regular arenated keratose fibre. Constructed of solid cylindrical fibres, in the centre of which there is a series of grains of sand or other extraneous matters.

8th. Irregular arenated keratose fibre. Consisting of grains of sand or other extraneous matters cemented together into a continuous cylindrical fibre.

In the third division the siliceous fibrous tissues are described as solid cylindrical structures, similar in form to the solid keratose fibres of the second division, but consisting of pure silex in place of keratode.

The fifth part contains descriptions of the cellular structures.

The sixth and last part of this division treats of the physical characters of the sarcode or semi-gelatinoid substance lining the interior cavities of sponges.

Part II.—*Organization and Physiology.*

The author treats this portion of his subject under the following heads:—

1st. The skeleton. Its general structure and component parts. Under this head the physiological purposes of the various forms of spicula, treated of in the first part of the paper, are described, and their peculiar offices in the sponge pointed out.

2nd. The sarcodous system is considered by the author as the homologue of the mucous lining of the stomach and intestines of the higher tribes of animals, and probably as the equivalent of the nervous system also.

3rd. The interstitial canals are considered as the equivalents of the stomach and alimentary canals of the higher animals.

4th. The intermarginal cavities, situated immediately beneath the surface, and receiving the incurrent streams from the pores, are believed by the author to be the organs for the secretion of the vital fluids of the animal.

5th. The dermal membrane, enveloping the whole of the sponge, and in which the inhalant and exhalant orifices of the animal are situated.

6th. The pores or inhalant orifices. These organs are not permanent; *i. e.* they are opened and closed at the will of the animal, and when once closed seldom occur again in precisely the same spot.

7th. The oscula or excurrent orifices, usually permanent organs, and capable of being opened or closed in accordance with the necessities of the animal.

8th. Inhalation and exhalation. Two modes of these operations are described; one as occasional or intermittent, but very powerful, for the imbibition of nutriment; the other gentle and continuous, for the purposes of the aëration of the vital fluids, and for the ejection of digested matters.

9th. Nutrition. The modes of imbibition and periods of digestion are treated of; and the author describes a series of contrivances by which some sponges are in possession of peculiar organs which enable them to prey upon annelids or other soft creatures that may crawl over their surface or intrude within their cavities or canals.

10th. Cilia and ciliary action. The accounts of the cilia of the gemmules or ova, as described by Dr. Grant and other writers, are referred to by the author; and the same organs *in situ* in *Grantia compressa* are pointed out as the powers on which inhalation and exhalation are dependent.

11th. Reproduction, gemmules, &c. Under this head the ovaries, ova, and gemmular modes of propagation are described under five heads:—

1st. Ova without an ovarium.
2nd. Ova generated within ovaria.
3rd. Gemmules secreted within the sponge.
4th. Gemmules produced externally.
5th. By spontaneous division of the sarcode.

The remaining portions of the paper, consisting of observations on the generic characters, the specific characters, and on the mode of examination, will form the subject of a future communication.

"Observations on the Posterior Lobes of the Cerebrum of the Quadrumana, with a Description of the Brain of a *Galago*," by William H. Flower, Esq., Demonstrator of Anatomy at the Middlesex Hospital.

After referring to the present state of our knowledge upon the subject, and especially to the descriptions recently given of the "posterior cornu of the lateral ventricle" and "hippocampus minor" in the Orang-Utang by Dr. Rolleston, in the Chimpanzee by Mr. Marshall, and in *Ateles* by Mr. Huxley, and the statement of M. Gratiolet, that the posterior cornu of the lateral ventricle or "*cavité ancyroïde*" obtains an enormous development in Monkeys, the author proceeds to detail his own observations (which are illustrated by drawings and photographic representations) upon the condition of these parts in the brains of animals belonging to the three families of the order *Quadrumana*.

Family 1. Catarrhina.

Orang-Utang (*Pithecus satyrus*).—An account is given of the examination of the brain of a young female of this species, preserved in the Middlesex Hospital Museum. The posterior lobes of the cerebral hemispheres were so far developed that they completely covered the cerebellum, although not prolonged backwards to quite so great an extent as in the human brain. To examine the interior, the right hemisphere was removed to the level of the inferior surface of the corpus callosum, and then further portions were carefully dissected away, so as to expose the lateral ventricle, with its three cornua and their contained structures. It is to be observed that brains which have been long in spirit are in some respects not so well adapted for dissection as when in a recent condition, as the distinction in appearance between the white and grey substance is lost, and the contiguous walls of cavities, which in the natural state would have fallen apart, have now become hardened in such close contact that their real nature may readily be overlooked. In this way only can the statements of Tiedemann as to the absence or rudimentary condition of the posterior cornu in the Simiæ be accounted for. However, the brain of this Orang is sufficiently well preserved to show that its ventricular cavity presents almost the exact counterpart of that in the human subject. The posterior cornu extends quite as far backwards as in an average example in man, its apex being but $\frac{3}{8}$ of an inch ($=\frac{1}{8}$ of the entire length of the hemisphere) from the occipital extremity of the hemisphere; and its direction well answers to the description "backwards, outwards, and then inwards." Upon the inner wall of the cavity is the hippocampus minor, which will bear comparison with a very well-developed specimen of this structure as met with in the human brain, where, as is well known, it is subject to great variations in size and form. Its length is $\frac{5}{8}$ inch, its breadth at the base $\frac{3}{16}$ inch. The portion of the wall of the ventricle situated opposite the junction of the descending and posterior cornua (called eminentia collateralis or pes accessorius) corresponds in configuration and relative size to the similar part in the brain of man. The hippocampus major has no distinct digital marks; these are, however, indicated by a nodulated appearance in the expanded termination. The remaining portion of the ventricle presented nothing requiring special remark. In order to verify these observations by an examination of the corresponding parts of the opposite side, the upper part of the left hemisphere was also removed, and a very good view obtained of the ventricle, with its posterior cornu. It was precisely similar to that just described, the two sides exhibiting in their internal structure a perfectly symmetrical appearance.

Cercopithecus.—Four examples of this genus which have lately died at the Gardens of the Zoological Society were examined while in a recent condition. The first was *C. pygerythrus* (the Vervet Monkey). In order that the brain might be examined *in situ*, the right side of the cranium was removed in the following way. First, a longitudinal incision was made with the saw, a quarter of an inch to the right of the middle line, from the supraorbital ridge to the foramen magnum; then with the bone forceps the whole of the cranial wall thus marked out was carefully cut away down to the base, as were also the right halves of the three upper cervical vertebræ. The dura mater being then removed, a photograph was taken, in which the relative position of the different parts of the brain are well seen. The posterior lobes of the cerebrum project to the extent of $\frac{1}{4}$ inch beyond the cerebellum, covering it more completely than in the Orang, and nearly, if not quite, as much so as in man. The upper part of the remaining portion of the calvarium was now removed, a section made across the hemispheres at the level of the lower surface of the corpus callosum, and the lateral ventricles opened out on both sides. Although in general form and in the arrangement of the structures composing their walls these cavities present a great resemblance to those of the human brain, one remarkable peculiarity immediately strikes the observer, viz. the great development of the posterior cornu, with the contained hippocampus minor. It extends from the commencement of the descending cornu to near the apex of the well-developed posterior lobe, is of considerable vertical depth, being curled round the voluminous projection of the hippocampus minor, and is directed at first somewhat outwards and backwards, then directly backwards, and finally takes a considerable sweep towards the middle line—the characteristic form which has obtained for this part in man the name of "digital cavity." The hippocampus minor is formed, as in the human brain, by the deep involution of a layer of superficial grey cerebral matter, covered internally by a layer of white substance, which is so thin that the surface of this prominence had a darker look than the other parts of the ventricular walls. It differs from a typical example of the corresponding part in the human subject in its great relative size, both as to length and as to the extent to which it projects into the ventricle. The hippocampal sulcus (well marked on the inner surface of the posterior lobe of all apes) is not only very deep, but has concealed within it a convolution of considerable size, in the form of a longitudinal eminence attached to the floor of the fissure. The eminentia collateralis is prominent. The hippocampus major is smooth upon the surface. The anterior cornu is of the same form and extent as in the human brain.

In the brains of *C. sabæus*, *C. mona*, and *C. ruber* a similar disposition of these parts was found. In the last-named, the posterior lobe of the cerebrum is even more prominent, and the hippocampus minor of still greater size, as it tapers less towards its termination; in fact this eminence is here actually larger than the hippocampus major, to which its true relation can be better studied in these apes than in man.

Macacus.—In a monkey of this genus (*M. erythræus*) the posterior cornu and hippocampus minor were observed to obtain almost as large a development.

Family 2. Platyrrhina.

In *Cebus apella* the ventricular cavity resembles in all essential particulars that of *Cercopithecus*. There is the same extent of posterior cornu and the same complex arrangement of anfractuosities, producing the very protuberant hippocampus minor.

It is among the members of this family (e. g. *Saimiris*) that the projection backwards of the posterior lobes of the cerebrum attains its greatest extent.

Family 3. Strepsirhina.

The cerebral anatomy of the Lemurs is still imperfectly known; therefore a detailed description is given in the paper of the brain of a species of *Galago*, the most important part of which is the following note upon its internal structure:—"A horizontal section of both hemispheres was made at the level of the corpus callosum, and the lateral ventricles laid open. A broad and very distinct posterior cornu extends backwards almost to the extremity of the hemisphere, occupying nearly the whole of the posterior lobe. Its floor and inner wall are raised into a prominence, having distinctly the characters of the hippocampus minor as found in man and the higher Quadrumana, and corresponding with the bottom of the sulcus before noted on the under surface of the lobe. The form of this eminence is somewhat triangular, the apex being directed backwards; but the surface is convex, both from above downwards, and in the antero-posterior direction, so that the axis of the cavity that contains it, though directed generally backwards, has first an outward inclination, and finally turns somewhat inwards. The anterior or broad end of the eminence is concave, being adapted to the curved posterior margin of the hippocampus major, from which it is separated by a deep groove. The length of the hippocampus minor is $\frac{1}{4}$ of an inch, its breadth at the base almost as much. The outer wall of the ventricle has a distinct projection into the angle between the hippocampi, nearly corresponding with the 'eminentia collateralis' of the human brain. On comparing the posterior lobe and hippocampus minor in *Galago* with the same parts in the true apes (e. g. *Cercopithecus*), it is seen that though the anterior part is proportionally as broad, the length is considerably diminished, the portion that is wanting being equivalent to that part which, in the apes, covers the posterior third of the cerebellum and projects beyond it."

As none of the authors who have written upon the brains of the Lemuridæ describe a hippocampus minor, as Vrolik expressly states that it is absent in *Stenops*, and as Burmeister alone assigns a posterior cornu to the ventricle (in *Tarsius*), it seemed desirable, after the results of the observation of these parts in *Galago*, to re-examine the brain of some other members of the family. Two specimens in spirit of *Loris* (*Stenops*) *Bengalensis*, placed at the author's disposal for this purpose by Dr. Grant, afforded distinct evidence of the existence of a well-developed posterior cornu and hippocampus minor, though unfortunately in neither instance were the brains in sufficiently good preservation to allow of a satisfactory description or figure of the parts being made.

Galago and *Stenops* being generally considered as not very elevated forms in the Lemurine family, we can have but little doubt as to the presence of the posterior cornu and hippocampus minor throughout the different members of the group; and hence a most important character is supplied for determining the affinities of these interesting animals. It indicates as decisively their position among the Quadrumana, as it separates them completely from the Insectivora, in which order some naturalists have placed them.

Many links are still wanting in the chain of evidence required to determine the true history and classificatory value of the posterior horn of the lateral ventricle, and the peculiar disposition of cerebral substance constituting the hippocampus minor; but the conditions in which they have been found at so many distinct points of the series, appear to lead almost irresistibly to the following conclusions:—

1. That these parts, so far from being (as has been stated by some anatomists) peculiar to the human brain, are common to man and the whole of the Quadrumana, including even the lowest forms.

2. That they attain their maximum of development in species which do not belong to either extremity of the series.

3. That in the lower forms their diminution takes place chiefly in the antero-posterior direction, corresponding with the reduced length of the posterior cerebral lobes, the greater part of which is occupied by them.

4. That in the higher forms they are narrower in proportion to their length, and bear a smaller ratio to the surrounding mass of cerebral substance.

5. That the extreme of the last condition is met with in man, where these parts are also characterized by their variability in size and form, want of symmetry on the two sides, and frequent rudimentary condition, or even entire absence.

Communication received August 20, 1862.

"On the Aquiferous and Oviducal System in the Lamellibranchiate Mollusks," by George Rolleston, M.D., F.L.S., Linacre Professor of Anatomy; and C. Robertson, Esq., Demonstrator of Anatomy, Oxford.

After recapitulating the views which have been held by various authors as to the means by which certain Lamellibranchiata are enabled to distend their muscular foot, the authors of this paper proceed to make a retractation of the opinions they put forward as to the oviducal system in these mollusks in a paper read before the Royal Society, February 3, 1859. But, though they have some reason to agree with M. La Caze Duthiers's views, as expressed in a paper read before the Royal Society, December 15, 1859, so far as the oviducal outlet is concerned, they are not prepared to coincide with that writer in denying altogether the existence in these animals of an aquiferous system distinct from their blood-vessels. Upon this point their views remain much the same as those they enunciated in their paper already referred to, and they may be briefly summed up thus.

They hold that, side by side with, and yet distinct from, the blood-vascular system in the Lamellibranchiata, there exists another system of tubes forming an aquiferous tree, the trunk of which serves as an outlet for the generative products, whilst many of its branches spread throughout the foot into regions not occupied by the organs of reproduction. This system is such a one as the perivisceral chamber has been shown to be by Mr. Hancock in the 'Philosophical Transactions' for the year 1858, spreading itself into ramifications, some of which are, whilst others are not, in connexion with the reproductive glands. The authors allow, and indeed show in the way of experiment, that it is possible for the water in which the animal lives, to become intermingled with the blood within its vessels by the route of the organ of Bojanus, and it will be seen from what has even already been said, that they suppose the aquiferous system to be fed with water by transudation of that fluid from the blood-vessels.

They begin by describing three sets of experiments in the way of injections, to show that water can find its way into the pericardial blood-lacunæ through the organ of Bojanus, and from thence into the vessels which carry the systemic blood towards, and only into those which carry it *towards*, the gills.

The results of two other sets of experiments are next adduced in proof of the non-existence in the blood-vascular system, first, of any lacuna save in this pericardial space; and secondly, of any communication with the exterior by pores, save such as the two sacs of the organ of Bojanus may be held to represent upon a gigantic scale.

What is new, however, in this part of the paper, is not so much the conclusions as the methods the authors have adopted for demonstrating them.

In proceeding to argue for the existence of a system of tubes distinct from the blood-vascular system, the authors begin by contrasting the appearance which the non-generative part of the foot presents when it is injected, as it is easily, from the orifice which serves as generative outlet, with that which it presents when injected from the blood-vessels.

Secondly, they show that it is possible, when the blood-vessels are already fully occupied by an injection of one colour, to cause a second, or when the artery and the vein have been filled with differently coloured fluids, a third system of vessels to make their appearance throughout the foot-mass by throwing a differently coloured injection into the oviducal outlet.

Thirdly, microscopic examination of animals thus treated excludes the idea that the fluid thus interposed between and amongst blood-vessels has found its way simply into interstitial spaces left between them and the tissues, as it shows that it is contained within a system of tubes as well defined and limited off from the surrounding tissues as is the fluid which has been thrown into the blood-vessels themselves.

That the water which has been shown to enter the body by the intermediation of the organ of Bojanus finds its exit by the same route, the authors believe to be rendered in the highest degree improbable by the fact that they have found it impossible to make fluid pass in the direction this hypothesis postulates; that is, from the blood-vessels, into the pericardium.

Similar improbability attaches to a view which supposes a fluid of such chemical and such morphological characters as the blood of the Lamellibranchiata to suffer dilution to such an extent as the observable distention of their foot would necessarily imply, and which argues from phenomena noticed on the sudden removal of the animal from the water as though they could be regarded as identical with normally occurring physiological processes.

As their injections seem to them to prove the existence of a system of vessels distinct from and yet in most close apposition to the blood-vessels and permeating the several tissues of the body in company with them, the facts of the case seem to the authors to necessitate the belief that a transference of fluid takes place, as in other organisms, from the latter to the former set of vessels.

The animals experimented upon were Unionidæ of the two species *Anodonta Cygnea* and *Unio margaritifera.*

MISCELLANEOUS.

On the Larval state of the Muscidæ. By Rud. Leuckart.

It is, I think, a very general opinion that, up to their change into pupæ, the headless larvæ of the flies are subject only to such changes as are brought about by their growth and the formation of their generative organs. Wherever any other differences were observed between the newly-hatched and full-grown larvæ, as in the *Œstridæ* (Joly) and the *Pupipara* (Leuckart), these have hitherto been regarded as exceptional cases.

This view is erroneous. Investigations which I made in the course of last summer upon the development of various *Muscidæ* render it probable that the animals belonging to this group in general, like the above-mentioned *Œstridæ* and *Pupipara*, present several different larval forms. The differences of these larval forms do not, indeed, extend so far as to lead one to mistake their genetic relations, but they are nevertheless sufficiently striking to fix the interest and attention of the naturalist.

The differences of these larval forms are most distinctly indicated in the formation of the buccal organs and of the stigmata. Reserving further particulars for a future communication, I will in the following only indicate in a few words the chief differences of the three larval states observed by me in *Musca vomitoria* and *M. cæsarea.*

First stage (duration in summer about twelve hours).—Anterior stigmata wanting. The truncated posterior end bears on each side two closely approximated, cleft-like air-holes. The oral opening, in repose, is a triangular pit, the lateral edges of which converge in front and bear a chitinous ridge, at the anterior extremity of which a number of small teeth follow. When the mouth is opened, the lateral horny ridges separate at their anterior extremity. The posterior lip of the buccal opening forms a cushion-like projection, near which on each side there is a chitinous plate, from which two curved chitinous filaments run outwards. From the mouth a *single* hook can be protruded; this is situated in the depths of the cavity, and attached to a strong chitinous framework.

Second stage (the duration of which may be estimated at thirty-six hours).—The two posterior stigmata are on each side enclosed in a chitinous ring. On the second segment, on both sides, a series of 7–8 new, small air-holes has been formed; these stand close together and open into the same main trachea. The number of hooks in the mouth is increased to two; and these are connected not only with the framework, which has remained essentially unchanged, but also with a transverse chitinous arc, which belongs to the lower lip, and moves up and down in the same way as the lower jaw of a vertebrate animal. From the lateral extremity of this arc there issues, instead of two, a great number of chitinous filaments, which radiate in a fan-like form to the lateral parts of the cephalic segment. Other solid buccal organs are wanting.

Third stage (up to the pupal change).—With three stigmata on each side at the posterior extremity. The margin of the latter has become drawn out into a number of conical processes. In other respects it agrees with the second stage.

The second and third stages are introduced by a change of skin, which extends to the tracheæ in the manner described by me in the *Pupipara*.—*Wiegmann's Archiv*, 1861, p. 60.

On the Structure of the Brain in Man and the Apes, and its relation to the Zoological System. By RUDOLPH WAGNER, Professor at Göttingen.

The following is a short abstract of a paper recently published in Wiegmann's 'Archiv für Naturgeschichte' (1861, pp. 63–80).

The author commences by giving a detailed account of the publications of Owen, Huxley, and Gratiolet relating to the subject. The latter, who has lately compared the brain of Microcephali with those of Apes*, arrives at the conclusion that Man, in his physical organization, differs as absolutely from the highest animals, as in the developement of his psychical qualities,—a view with which Prof. Wagner entirely agrees.

The author having had little opportunity of examining fresh cerebra either of extra-European races of Men or of Apes, has arrived at his opinion less from his own direct observations than from the study of the works of Tiedemann, Leuret, Owen, and Gratiolet. He has, however, obtained casts of the brains of different races of Man, of a microcephalic individual who attained to the age of thirty-one years, and of several Orangs of different ages, by cutting the skulls in two in the direction of the *sutura sagittalis*, and by filling them with plaster of Paris.

* Comptes Rendus, 1860, no. 18, and Mém. Soc. Anthropol. Paris, i. 1860, p. 64.

With regard to the use of the structure of the brain as a character for systematic division, the author is decidedly of opinion that it will prove to be of no greater value than other isolated characters, like those used by Müller and Agassiz for the classification of fishes. He says that every single character, even when it appears to be constant for long series of animals, suddenly proves to be deficient, leaving wide gaps, forcing us to make exceptions, and thereby destroying the necessary generality. It is the mutual relation of the single organs to one another, the structure of the single parts and elements in their combination, which must guide us in our systematic attempts, rather than the presence of very subordinate internal or external peculiarities of a single organ. There is much that is ingenious and worthy of consideration in Owen's attempt to use the convolutions of the brain, &c., for the classification of Mammals; and we might perhaps expect, from the importance of the organ, to obtain from it general relations, the fluctuations of which in subordinate characters may be more easily explicable.

In the special examination of the convolutions, it will always stand as a strange fact, that animals so highly organized and having so high a psychological development as Birds, have the surface of the hemispheres smooth and without folds, like mammals of low organization. Even in Man, moreover, the fact of the existence of a great number of folds in very intellectual individuals is not without exceptions.

On the other hand, it is true that the typical arrangement of the convolutions and the formation and structure of the individual lobes of the cerebrum are in intimate connexion with the groups, orders, and families of our system, and that only those animals which belong to one natural group can be compared with one another with regard to the higher or lower development, arrangement of lobes, and number and course of the convolutions. Considering this, we are compelled to say that, in a *broad* sense, Man must be placed in one and the same group with the Quadrumana as regards the structure of his brain, but in a *narrower* sense, that he forms a separate group by himself. This applies to the structural *ensemble* of the arrangement of the brain, the stages of development, and the configuration of the principal convolutions; but it is difficult to see how relatively very unimportant parts of the brain, which are subject to great variations even in single human individuals (*e. g.* the shorter or longer *cornua posteriora ventriculi lateralis*, the presence of a *pes hippocampi minor*, simple or double *eminentiæ candicantes*), can be brought forward as more or less essential characters of the human brain, distinguishing it from that of the anthropoid Apes. There is not only a striking similarity between both in the whole of their external appearance, but this similarity also extends to the different stages of development of the human brain, if we compare them with the different forms of the lower-organized small Monkeys and of the highly developed anthropoid Apes.

The author, finally, confirms Gratiolet's observation, that the brain of microcephalic individuals is far from approaching that of Monkeys; it is more dissimilar to the latter than the human brain of normal structure, the occipital and parietal lobes being much reduced, leaving the cerebellum uncovered. There is, therefore, no transition from the human brain to that of Monkeys, any more than from the human skull to that of the Ape. When we take into consideration all that we know of normal and abnormal structure in Man and the Ape, we find that both are as widely separated from each other (*i. e.* without any intermediate forms) as mammals and birds, as *Ornithorhynchus* and *Struthio*. Everything in zoology and physiology contradicts those far-going, genealogical affinities, metamorphoses, and transitions which are demanded by Darwin. "*Man and Monkey are creatures primitively and absolutely distinct, even if we ignore all psychological considerations.*"

On the Spermatophora of some Hirudinei. By M. C. Robin.

The author has discovered the occurrence of Spermatophora in *Nephelis*, in which they present remarkable peculiarities. They pass entirely from the reservoir in which they are produced into the female apparatus before the latter contains any trace of ovules; so that in these animals, contrary to what takes place in others, the fecundating fluid arrives in the female organs before they contain any eggs. It is only after the penetration of the spermatophora that the eggs make their appearance in the interior of these bodies, the size of which increases in proportion to the growth and number of the ovules. From being spermatophora in the male organs, they become ovo-spermatophora in the ovarian tubes.

At the period of copulation each of the ovoid sacs which terminate the male apparatus of the *Glossiphoniæ* is filled with a spermatophore, which nearly exactly reproduces its form, and the two also unite by a common extremity in the simple portion of the canal which opens at the male genital pore.

On separating these Annelides from each other during copulation, the two spermatophora may be seen issuing from the genital pore of the male: sometimes they have only partially escaped; sometimes they are entirely extruded, and adhere to the body of one or other of the animals. They are of a brilliant silvery white colour and of a most elegant form. They are 3 millim. in length and $\frac{1}{3}$ millim. in diameter. They are club-shaped, with the large extremity turned backwards and prolonged into a fine, slightly curved point, the length of which is equal to or greater than the greatest diameter of the spermatophore; they terminate in front in a slender portion nearly as long as the thickened part; they have a common cavity anteriorly for about one-fourth of their total length.

Each spermatophore fills the cavity of the sac which terminates the male generative apparatus. The elongated point of the thick extremity is engaged in the flexuose genital duct; the common portion corresponds with the single duct which opens at the genital pore. The wall of the spermatophore is from $\frac{4}{100}$ to $\frac{6}{100}$ millim. in thickness and formed of a tenacious, dense mucus, which refracts light and gives it a yellowish tint posteriorly, where it is thickest.

As soon as the twin spermatophore comes in contact with the water, a white pearly substance escapes from it continuously in the form of a filament, and becomes gradually disaggregated in the liquid. By a high magnifying power this is seen to consist of spermatozoids, with a certain number of fine molecular granules, which abound especially in the last portions of the matter.

In *Nephelis* a spermatophore of the same kind may be detected in each of the sacs terminating the male organs. They are white, ovoid, and a little flattened; their length is about 1 millim., and their breadth about $\frac{1}{3}$ millim. Each of these is independent of the other, and closed at all points. Their contents are analogous to those of the same bodies in the *Glossiphoniæ*, but their envelope is colourless, and much softer and more delicate.

These spermatophora are found superposed, to the number of two or four, close to the bottom of the slender portion of each of the ovarian tubes. They are similar to what they were in the sacs of the male organ, but their volume has become a little greater and their envelope a little thicker. Besides these, in the dilated ascending portion of the same female organs, there exist two or four other analogous, but vermiform, bodies, 2 or 3 millim. in length, a little inflated in the middle, narrowed to the two extremities. These owe their volume to the ova developed within them. These bodies have a colourless envelope, striated longitudinally, scarcely granulated, thicker and more resistant than that of the preceding ones, from which they are distinguished by the ovules in course of evolution which they contain in the midst of the spermatozoids. They thus constitute true ovo-spermatophora. The ovules are more numerous and more advanced in their evolution in proportion as the spermatophora in which they are seated are nearer to the genital orifice.

The ovules complete the whole of their evolution up to the period of fecundation within the ovo-spermatophora, and in immediate contact with the fecundating corpuscles. In each spermatophore they are seen in every stage of growth. The most developed ones are always seen in the middle and largest part of the bodies, from which they escape as they are fecundated. They escape by dehiscence, in consequence of a gradual thinning of the envelope during the formation of the corneous protective capsules. They are then found free in the oviducts to the number of from four to twelve on each side; between the vitelline membrane and the vitellus they have a considerable number of spermatozoids, which are generally already motionless. If mature ovules be taken in the ovo-spermatophora, the penetration of the spermatozoid into the ovule through certain points of the vitelline membrane may be traced; the spermatozoids are seen moving for an hour or two round the vitellus before the extrusion of the eggs; then some of them become liquefied and unite with the substance of the vitellus.—*Comptes Rendus, August* 12, 1861, p. 280.

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XLII.—*On the Division of the European Seas into Provinces, with reference to the Distribution of Mollusca.* By ROBERT M'ANDREW, F.R.S.

Of the many services rendered to natural-history students by the late Edward Forbes, I have been used to regard as among the most important his observations upon the distribution of marine Mollusca and other Invertebrata, both geographically and vertically, and the consequent division of those seas which formed the field of his researches into zones of depth and into geographical areas marked out by the particular forms or species of Mollusca which had their principal development in each.

I believe that the existence of such natural divisions has been generally admitted by naturalists; but finding, in the abstract of a paper read by my friend Mr. Jeffreys at the last meeting of the British Association, and published in the 'Annals of Natural History' for October last, a statement that, *in his opinion,* such division into provinces is erroneous, I feel called upon to give my testimony in its support, on account of the importance of the question, both in a natural-history point of view and in its bearing on geology. And as I have made rather extensive researches within the area referred to (the seas of Europe and North Africa), with the main object of being enabled to throw light upon the distribution of Mollusca, I hope that I may not be considered over-presumptuous in thinking it probable that no one has had better opportunity of appreciating the correctness of Mr. Forbes's views.

In the first place, it should be clearly understood that the question is one of *fact,* and not to be affected by speculations, however ingenious.

It may be true that naturalists, or, as Mr. Jeffreys terms them, "systematists," are not agreed as to the limits and extent of the zoological provinces; but this is no argument against the existence of such provinces: there have also been differences of opinion as to the line of demarcation between animal and vegetable life.

With regard to Mr. Jeffreys's remark that he considers "the marine fauna of Europe, Northern Asia, the Cis-Atlantic zone of Africa and part of North America to have been closely related at a comparatively recent epoch, and to form one common area of origin," I would beg to suggest that we have no proof of the large area named ever having been *simultaneously* occupied by a fauna more closely related together than the present; and without entering upon the question of the origin of species, I may remark that most philosophers are agreed that these have originally been developed, or made their appearance, at a single point or centre, and consequently that their tendency must have been always at first to expand the limits of their range. The geographical range of the older species (those which have come down to us from Tertiary times) is generally greater now in the case of all the Southern (or Lusitanian) species, while the Arctic species have suffered a diminution of their territory, at least in latitude, since the "Glacial" age of geology.

The assertion that M. Sars has discovered *Cerithium vulgatum* and *Monodonta limbata* upon the coast of Finmark, if it is to be understood that these species were living, must, unless they were previously transported thither, be founded upon a mistake. That they are actually indigenous in those seas is about as impossible as that the Myrtle, Gum Cistus, or Oleander should be found growing naturally on the adjacent land *.

In reply to Mr. Jeffreys's remark that, because the ocean at a certain depth is of uniform temperature, it is only littoral and shallow-water species that can be affected by climate, I would observe that between shallow water, in its ordinary sense, and those depths of the ocean where the temperature is invariable and equal from the pole to the equator, a great interval exists, and that in fact most, if not all the species of marine Mollusca with which we are acquainted, are to be found living at depths within the reach of climatal influence; also that, notwithstanding that the effects of climate become less in proportion to the depth, yet, so far from finding tropical species in the abysses of

* *Cerithium vulgatum* is a littoral and shallow-water species, though a variety is occasionally to be met with as deep as 40 fathoms; it inhabits the coasts of the Atlantic, from Portugal to the Canary Islands, in addition to the Mediterranean. *Monodonta limbata* is a rare Mediterranean species, which I have never had the good fortune to obtain myself, but have received a specimen of from Sicily. The genus *Monodonta* is unknown in northern seas.

the Arctic Sea, or *vice versâ*, the deep-water species, like others, are limited in their range, and characteristic of the region to which they belong. I have myself dredged at depths reaching to about 200 fathoms on the coast of Finmark, and invariably obtained from the deepest water shells of a peculiarly northern character—for example, *Lima excavata, Pecten Grœnlandicus, Leda limatula*, and *Chiton alveolus*; and Dr. Alph. Milne-Edwards, in a paper "upon some Animals obtained at great Depths," quoted from the 'Comptes Rendus,' in the 'Annals of Nat. Hist.' for September last, mentions, as communicated to him by M. Valenciennes, *Voluta Junonia* from 70 fathoms in the Gulf of Mexico, and *Lima excavata* from 264 fathoms on the coast of Greenland, and that, upon portions of a submarine cable which had been recovered from a depth of 1000 to 1500 fathoms between Cagliare and Bona, he had found *Ostrea cochlear, Pecten opercularis* var. *Audouini, Pecten Testæ, Monodonta limbata*, and *Fusus lamellosus*—all species previously known as inhabitants of the Mediterranean Sea.

It is an unquestioned fact that a considerable portion of the species of Mollusca inhabiting any one zoological province may be found in other provinces; but it is not by a simple comparison of the lists of species that we can determine the similarity or divergence of the fauna of separate localities, as the difference between them may consist in a few characteristic forms, which may be especially developed in each. That one and the same marine fauna does not extend from the Mediterranean coast of Morocco to Finmark and Spitzbergen must be patent to the most cursory observer. The former district contains numerous genera peculiar to the warmer region of the earth, where many of them are very widely distributed, including *Conus, Cypræa* (as distinguished from *Trivia*), *Typhis, Marginella* (as distinguished from *Erato*), *Triton, Ranella, Pisania, Fasciolaria, Dolium, Cassis, Turbo, Cymba, Cancellaria* (as distinguished from *Admete*), *Mitra, Fossarus, Columbella, Mesalia, Gadinia, Siphonaria, Haliotis, Sigaretus, Crepidula, Argonauta, Vermetus, Siliquaria, Spondylus, Chama, Cardita*, besides a few supposed to be local, such as *Cassidaria, Lobiger, Pedicularia, Thecidia*, &c., most of which, in the Atlantic, are not to be found beyond the 40th, and none beyond the 50th, parallel of latitude*. The fauna of the Arctic and sub-Arctic regions, though by no means deficient in the number of individuals, is distinguished from that of more southern latitudes by the comparative fewness of its genera and species, likewise by several peculiar genera, as *Trichotropis, Admete,*

* One species of *Mitra* and one of *Cardita* inhabit the Arctic seas of America. *Mangelia nana* and *Holböllii* are related to *Astyris* (*avara*), Adams, a subgenus of *Columbella*. *Turritella lactea* is not a *Mesalia*.

Puncturella, Lepeta, Pilidium, and particularly by a remarkable development of certain forms, such as *Bela, Trophon, Neptunea, Margarita, Astarte, Leda,* and *Crenella.* The intermediate or, as it has been termed, "Celtic" province also offers the most suitable dwelling-place to certain species and genera, most of which extend their range, in diminished numbers, into one or both of the adjacent regions.

Assuming, then, that the fact of the existence of more than one fauna or zoological province within the area referred to (say, north of lat. 32°) is established, it remains to define the limits of each; and this can only be done after careful observation. My own opinion is that the whole area may with propriety be divided into five provinces, sufficiently characterized by the species and genera predominating in each: viz., 1. Arctic; 2. Subarctic or boreal, extending from the Arctic circle to about lat. 55°; 3. Celtic (for which probably a more appropriate name could be found), reaching its southern limit at a point yet to be ascertained in the Bay of Biscay; 4. Cantabrian or Lusitanian, including the north coasts of Spain and west coast of Portugal; 5. The Mediterranean, including the coast of Spain and Portugal as far as Cape St. Vincent and the Atlantic shores of Morocco. For the facts of distribution which have induced me to propose this division, I refer to a report published in the Transactions of the British Association for 1856. It will be seen that these five provinces agree very nearly in their boundaries with those represented by Prof. E. Forbes in his map of "Homoiozoic Belts," published in Keith Johnston's 'Physical Atlas.' The claims of the "Mediterranean province" to be considered distinct are strongly maintained by Milne-Edwards.

It must be explained that the foregoing observations do not apply to the west shores of the Atlantic, which, with the exception of the Arctic and sub-Arctic species, present a fauna totally unlike that of Europe and Africa. The fauna of the Azores, which from its position might be expected to be found intermediate between that of Europe and America, appears, as regards Mollusca, to have no relation with that of the latter continent, but to be in its general character Lusitanian, with the exception of the littoral species, several of which are common to the Madeiran and Canary Islands and to tropical Africa. This fact is particularly deserving of attention, from its apparent relation to an ancient distribution of land different from the present, more particularly as the currents which now prevail across the North Atlantic from west to east, and from the Straits of Gibraltar southward along the African coast, would seem to be opposed to it. As regards the land and freshwater Mollusca of Europe and North Africa, they appear to admit of being divided into no more than two distinct faunas, the more southern including the countries and provinces bordering both sides of the Mediterranean, the other occupying the temperate regions of Germany, France, Britain, &c., the species diminishing in number as you proceed northward, and only a few extending into the Arctic Zone, from which there appears to be a total absence of any peculiar forms*.

It only remains for me to say that, although the results of my observations may differ materially from those arrived at by Mr. Jeffreys, I am by no means insensible to the obligations we are under to that gentleman for his valuable researches in the British seas, particularly in their remote northern limits, where dredging is a much more arduous occupation than in more genial climes or more sheltered situations.

XLIII.—*On* Paramecium ? coli, *Malmsten*. By R. Leuckart†.

[Plate XVIII. figs. 12, 13.]

Under the above name Malmsten of Stockholm some time since described an Infusorial animalcule‡ which occurs in the cæcum and colon of man, but had then only been observed twice, simultaneously with ulcers in the colon. In both cases it was present in innumerable quantities, and in the first case was to be found even after the healing of the ulcers, during the continuance of lientery; so that Malmsten is inclined to think that this latter disease might be referred to the parasitism of our Infusory. The description of the parasite, drawn up by Lovén, runs as follows:—

"The animal is cylindrical, oval, a little pointed anteriorly, broader or narrower according to the quantity of nourishment taken in, and narrower also when it moves through the mucus, turning continually upon its axis. Its length is about 0·1 mill. On the external membrane it has a dense coat of cilia, which stand in somewhat oblique series. In front, on one side of the apex, is the mouth furnished with long cilia; and the œsophagus, which is slightly dilated and somewhat curved, penetrates the interior to a considerable depth. In the interior parenchyma a dark streak sometimes indicates the course of a swallowed morsel.

* Greenland is considered by many naturalists to form part of the same province with Northern Europe, and has a few peculiar land and freshwater shells; but their distinguishing characters are extremely slight.

† Translated from Wiegmann's Archiv, 1861, p. 81, by W. S. Dallas, F.L.S.

‡ Translated in Virchow's Archiv für pathol. Anat. und Physiol. 1857, vol. xii. p. 302, tab. x.

At the posterior extremity, a little towards the ventral side, lies the anus, which sometimes projects a little, is sometimes drawn in, and sometimes forms a passage, furnished with several windings, through the cortical layer. The contour of the nucleus is very faintly marked; it is of an elongate elliptical form, with now and then a median constriction, as if from the commencement of division. Two contractile vesicles are present. The larger one is situated quite posteriorly, close to the anal orifice; the smaller one about the middle of the dorsal side. The vesicles contract very slowly, and change their form considerably. In some individuals they were sought for in vain. Besides these parts, the animals showed in their interior a greater or less number of swallowed nutritive matters, generally more or less digested starch-granules and fat-drops."

The preceding is all that we have hitherto known about this parasitic Infusory; and I am therefore the better pleased that I can here communicate something new upon it. Not that I have been so fortunate as to observe a fresh case of its occurrence in man. Malmsten's cases still stand alone. But I have found exactly the same Infusory in the colon and cæcum of a domestic animal, and indeed so constantly and in such quantities as even to throw some light upon the possibility of its occasional transfer to man. The animal which harbours our Infusory is the pig. In order to observe it, all that is necessary is to draw forth, by means of a long sound, a little dung and intestinal mucus from the rectum and spread it under the microscope. Even with the simple lens the colourless animalcules may then be seen moving through the dung.

What I have established by my observations on these parasites of the pig is essentially confirmatory of the statements of Lovén and Malmsten. I have to contradict them only on one point; and this regards the formation of the mouth. For a long time I believed, with the Swedish observers, that our parasite has a *lateral* mouth, because during the ordinary swimming movements it is usually seen to lie to the right or left near the median line (fig. 12). But this circumstance can prove nothing, because the generally oval body in swimming (both forwards and backwards) continually revolves upon its axis, and consequently presents a median position of the mouth only during the short period of its passage through the median plane. Matters take a very different appearance, however, when we see the animal feed (fig. 13). When this business is going on it applies itself to the nutritive matter with the gaping buccal orifice downwards, and also creeps for some distance forwards with the margins of the buccal orifice, without any change in the position of the body. The two sides of the body then appear perfectly symmetrical, with the buccal funnel and œsophagus in the median line as in a bilateral animal; whilst in the lateral position of the mouth the outlines of the body present unequal curves, and the buccal funnel and œsophagus ascend asymmetrically towards the opposite surface of the body.

Under these circumstances I have no hesitation in explaining the structure of our animal in accordance with the conditions of the laterally symmetrical type, that is to say, in regarding the mouth as an organ of the median plane. The surface which bears it would then represent the ventral surface; and the opposite one would have to be regarded as the dorsal surface. The latter is on the whole more strongly arched; the former, at least in the vicinity of the mouth, is flattened.

If my view be correct, our parasite can of course no longer remain united with the genus *Paramecium* (to which it is with doubt referred by its discoverers), as this is distinguished by the lateral position of the mouth. Still less does it belong to the genus *Plagiotoma*, to which Claparède and Lachmann have recently referred it, as not the smallest trace of a spiral ciliary furrow exists in our animal. It might perhaps be best and most naturally placed in the genus *Holophrya*, if we decline for the present to establish a peculiar genus, until we know more of the allied forms (from the colon of the Horse and the paunch of the Ruminants, the latter of which has recently been described by Stein, under the generic name of *Isotricha*).

In the median position, the buccal orifice of our parasite appears as a triangular, gaping aperture, with an angle directed backward. The anterior side of this triangle belongs to the dorsal surface. It forms as it were a penthouse-like prolongation of this surface—an upper lip, which projects over the mouth and presses down on the ventral surface. The lateral sides or lips project inwards during repose in a curved form into the buccal cavity, whilst in feeding they diverge from the posterior angle. When engaged in feeding, therefore, the buccal orifice has a considerable width (as much as 0·012 mill.), and this the more, as the lips at this time project in a trumpet-like form.

The buccal orifice is followed by a cavity which gradually diminishes, like a funnel, and is at last drawn out into a narrow cylinder—the œsophagus. The buccal cavity, and especially the lips, are covered with cilia, which exhibit a very powerful and almost rotatory movement; they are perhaps twice as long as the hairs of the otherwise perfectly uniform ciliary coat, and force the food into the interior of the body. In the pig the nutritive matters consist chiefly of a finely granular detritus—rarely of starch-granules.

The cuticula, which covers the body and bears the cilia, is very tough and of considerable thickness, without any other marked characters. It lies upon a clear cortical layer, of no great thickness, which, on its part, encloses the finely granular medullary substance, sprinkled here and there with strongly refractive, small corpuscles. It is only at the anterior extremity, in the vicinity of the buccal orifice and œsophagus, that this cortical layer attains a greater thickness. Here a radiate marking is seen in it, as if a layer of diverging fibres was continued into the margin of the upper lip. Where the œsophagus approaches the granular medullary substance, the latter is drawn inwards, as if furnished with a shallow depression.

Of internal organs I observed, like Lovén, only a nucleus and contractile vacuoles. The former lies on the ventral surface, sometimes further forward, sometimes further back, near the median line. Its outlines are not very sharp; it is pale and finely granular, and of a longish form—not straight, but curved somewhat in the form of a horseshoe. The notion of a constriction is due to an optical illusion, caused by the adjustment of the microscope to the extremities of the nucleus. No nucleolus was discovered. Besides the two contractile vacuoles described by Lovén, a third is sometimes seen. I have not observed proper contractions in them, although there is no doubt that their contents change, and especially that they are sometimes so much dilated (up to 0·02 mill.) that they push up the external integuments in the form of a hump. On the other hand, however, I have made another astonishing observation on these structures, namely, that they force themselves in the form of drops through the surrounding parenchyma, and thus gradually wander from place to place.

The length of the Infusoria observed in the pig varies between 0·075 and 0·11 mill., usually amounting to 0·09 mill., with a breadth of 0·07 mill.

Their reproduction is unknown to me. Self-division was never witnessed. The only thing which might possibly indicate such phenomena was the occurrence, although but rarely, of spherically contracted unciliated individuals (as large as 0·11 mill.), of which the parenchyma possessed a tolerably uniform opake consistence, with the exception of a number of large oil-drops. The cuticle was thickened, and the buccal orifice could no longer be detected, although the anterior extremity of the body was still distinctly recognizable by the thickness of its cortical layer; the presence of the horseshoe-like nucleus and of the wandering vacuoles also left no doubt as to the origin of the body. I might almost suppose that the Infusoria in this form quit the intestine of their host in order to propagate externally (by repeated division ?), and finally to migrate again into its descendants.

XLIV.—*Descriptions of several recently discovered Spiders.* By John Blackwall, F.L.S.

Tribe Octonoculina.

Family Lycosidæ.

Genus Hecaerge, Blackw.

Hecaërge nemoralis.

Length of the female $\frac{1}{5}$th of an inch; length of the cephalothorax $\frac{1}{10}$th, breadth $\frac{1}{16}$th; breadth of the abdomen $\frac{1}{15}$th; length of a posterior leg $\frac{3}{10}$ths; length of a leg of the third pair $\frac{1}{4}$th.

The cephalothorax is oval, glossy, thinly clothed with hairs, which are most abundant in the medial line, pointed before, depressed at the base and on the sides, which are marked with furrows converging towards the middle; its colour is yellowish-brown, with a broad dark-brown band extending along each side, whose exterior border presents an irregular outline, and a narrower one of the same hue on each lateral margin; the frontal margin, from which some long hairs are directed forwards, has a red-brown tint. The eyes are seated on black spots on the anterior part of the cephalothorax; the intermediate eyes of the greatly curved posterior row are the largest of the eight, and the intermediate ones of the anterior row are larger than the lateral eyes of the same row. The falces are small, conical, armed with a few minute teeth on the inner surface, and of a yellowish-brown colour, with a dark-brown streak in front, which is palest in the medial line. The maxillæ are short, strong, convex on the under side, rounded at the extremity, and somewhat inclined towards the lip; the sternum is broad and heart-shaped. These parts have a yellowish-brown hue, the sternum having dark-brown spots on its lateral margins and posterior extremity. The lip is small, triangular, but truncated at the apex, and of a dark-brown colour, the apex having a tinge of yellow. The legs are long, robust, and provided with hairs and strong spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; the femora and tarsi have a yellowish-brown hue, that of the genua, tibiæ, and metatarsi being dark brown; the fourth pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by two curved, minutely pectinated claws, below which there is a small scopula. The palpi are of a yellowish-brown colour, and have a small, curved, slightly pectinated claw at their extremity. The abdomen is oviform, hairy, convex above, and projects over the base of the cephalothorax; it is of a yellowish-brown colour, with a dark-brown line on each side of the middle of the upper part, extending from the anterior extremity more than a third of its length; between these lines and the spinners, and also on the sides and under part, there are numerous dark-brown spots and streaks, those on the under part being the most minute; the sexual organs are moderately developed and of a red-brown colour.

The male is smaller, slenderer, much darker-coloured than the female, and its abdomen is densely covered with silky hairs. The cubital and radial joints of its palpi are short; the former is gibbous at its extremity on the outer side, and the latter projects an obtuse apophysis from its extremity on the outer side: the digital joint has a reddish-brown hue; it is convex and hairy externally, concave within, comprising the palpal organs, which are well developed, rather complex in structure, with a filiform spine curved round their base, inner side, and extremity, and a curved process, whose black point is in contact with some prominent semitransparent membrane, at their termination; the colour of these organs is red-brown.

In spring and summer this species may be seen running among fallen withered leaves in the wood sabout Hendre House and Oakland.

Family Drassidæ.

Genus Drassus, Walck.

Drassus pedestris.

Melanophora pedestris, Koch, Uebers. des Arachn.-Syst., erstes Heft, p. 17; Die Arachn., Band vi. p. 82, tab. 200. fig. 489.

Length of the female $\frac{7}{24}$ths of an inch; length of the cephalothorax $\frac{1}{8}$th, breadth $\frac{1}{12}$th; breadth of the abdomen $\frac{1}{10}$th; length of a posterior leg $\frac{1}{3}$rd; length of a leg of the third pair $\frac{5}{24}$ths.

The legs are moderately long and robust, provided with hairs and a few spines, and of a yellow-red colour, with the exception of the coxæ and femora, which have a brown-black hue faintly tinged with dull yellow; the fourth pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by two curved, pectinated claws, and the inferior surface of the metatarsi and tarsi of the first and second pairs, and of the tarsi of the third and fourth pairs, is sparingly supplied with hair-like papillæ. The cephalothorax is short, glossy, somewhat compressed before, and rounded on the sides, which are marked with furrows converging towards a narrow indentation in the medial line; the sternum is broad, flat, glossy, and heart-shaped. These parts are of a brown-black colour. The falces are powerful, conical, vertical, and provided with numerous short black bristles in front, particularly towards the inner side; the maxillæ are short, enlarged where the palpi are inserted, gibbous near the base, obliquely depressed near the extremity, and inclined towards the lip, which is oval. These organs are of a yellowish-brown colour, the maxillæ and apex of the lip being the palest. The eyes are disposed on the anterior part of the cephalothorax in two slightly curved, parallel, transverse rows; the lateral eyes of the anterior row are the largest, and the intermediate eyes of the same row, which are seated on a minute eminence, are the smallest and darkest of the eight. The abdomen is of an oblong-oviform figure, somewhat convex above, and projects a little over the base of the cephalothorax; it is sparingly clothed with short hairs, and is of a soot-colour, with four lighter-coloured minute depressions on the anterior half of the upper part, disposed in a quadrangle; the branchial opercula are large, and have a pale-yellow hue, that of the margin of the sexual organs, which is oval, being red-brown.

The sexes are similar in colour, but the male is rather the smaller. The cubital and radial joints of its palpi are short; and the latter, which is rather the larger, projects a strong, pointed apophysis from its extremity, on the outer side; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, not very complex in structure, with two black, curved, pointed spines and some whitish membrane at their extremity, and are of a red-brown colour, intermixed with pale brownish-yellow.

In the summer of 1860, I received from Mr. Francis Walker adult males and females of *Drassus pedestris,* which he had taken in Guernsey and Serk, two of the Channel Islands; and shortly after, the Rev. O. P. Cambridge transmitted to me specimens of the same species captured by him in Portland. I have been induced to give a detailed description of both sexes of *Drassus pedestris,* as M. Koch, who had no knowledge of the female, has merely described the male in a state of immaturity; consequently he was unable to give several important specific characters connected with its external organization, which are now supplied.

Family Ciniflonidæ.

Genus Orithyia, Blackw.

Orithyia Williamsii.

The male is smaller than the female, which it resembles in colour; but the entire upper surface of the femora of the anterior pair of legs, with the exception of the base, has a dark-brown hue. Its palpi are short and robust, and the humeral joint has two conical processes at its base, on the under side; the cubital and radial joints are short, provided with hairs, and a long bristle directed forwards from their extremity, in front, and, with the digital joint, are of a brown colour; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs; these organs are highly developed, with a strong dark-brown spine, which originates near their extremity, and curving obliquely upwards on the outer side, passes transversely towards the inner side, where it terminates in an acute point; a prominent, convex, yellowish-white piece occurs within the curvature of the spine, and the convex sides of the digital joints are directed towards each other*.

The specimen from which the above description was made was captured in Pernambuco by Mr. Eyton Williams of Denbigh, who had previously supplied me with adult females of the same species.

Family Theridiidæ.

Genus Pholcus, Walck.

Pholcus pallidus.

The sexes are similar in colour, but the male is rather the smaller. Its palpi are short, very robust, and of a pale dull-yellow hue; the humeral joint is somewhat convex on the under side, and the radial, which is much the largest joint, is greatly dilated, and very convex on the upper side: the digital joint has an irregular figure; it is elongated, with a short, slightly curved, pointed black spine at its abrupt termination, and its base, which is prominent on the inner side, and densely fringed with long curved bristles, has a small red-brown process on its inferior margin; the palpal organs are moderately developed and not very complex in structure, having a glossy, yellowish-white, subglobular base attached to the inferior surface of the digital joint, which projects from its convexity, and on the lower side two short, strong processes united at their base, and of a dark-brown colour at their extremity.

Since a description of an adult female of this species was given in the 'Annals and Mag. of Nat. Hist.,' Series 3, vol. i. p. 433, I have received specimens of both sexes, in a state of maturity, from Mr. Eyton Williams, by whom they were collected in Pernambuco.

* For a description of the female, see Ann. and Mag. Nat. Hist. ser. 3. vol. ii. p. 331.

Family LINYPHIIDÆ.

Genus WALCKENAERA, Blackw.

Walckenaëra pratensis.

Length of the female $\frac{1}{8}$th of an inch; length of the cephalothorax $\frac{1}{16}$th, breadth $\frac{1}{20}$th; breadth of the abdomen $\frac{1}{16}$th; length of a posterior leg $\frac{1}{6}$th; length of a leg of the third pair $\frac{1}{8}$th.

The eyes are disposed on the anterior part of the cephalothorax in two transverse rows; the four intermediate ones describe a trapezoid, the two anterior ones, which are the smallest of the eight, forming its shortest side; the eyes of each lateral pair are seated obliquely on a tubercle, and are contiguous. The cephalothorax is oval, convex, glossy, with slight furrows on the sides converging towards an indentation in the medial line; the lip is semicircular and prominent at the apex; and the sternum is broad, heart-shaped, convex, and glossy. These parts are of a very dark brown colour, tinged with red, the lateral margins of the cephalothorax being the darkest. The falces are conical, inclined towards the sternum, and armed with teeth on the inner surface; and the maxillæ are enlarged where the palpi are inserted, and inclined towards the lip. These organs have a red-brown hue. The legs and palpi are provided with hairs, and are of a yellowish-red colour; the fourth pair of legs is the longest, then the first, and the third pair is the shortest: each tarsus is terminated by three claws; the two superior ones are curved and slender, and the inferior one is inflected near its base. The abdomen is oviform, glossy, convex above, and projects over the base of the cephalothorax; it is thinly clothed with short hoary hairs, and has a black hue; the sexual organs are minute and of a reddish-brown colour, that of the branchial opercula being pale yellow.

The sexes are similar in colour; but the male, which is rather the smaller, has the anterior part of the cephalothorax more elevated, and has a narrow indentation directed backwards from each lateral pair of eyes. Its palpi are short, and the radial and digital joints have a dark-brown hue; the humeral joint is curved towards the cephalothorax, and the radial, which is stronger than the cubital joint, has a small, curved, pointed apophysis at its extremity, in front, towards the inner side; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a black filiform spine at their extremity, on the outer side; this spine is curved in a circular form, and within the curvature there is a prominent, pointed, slightly curved spine, at the base of which there is some whitish membrane; the colour of these organs is dark brown, faintly tinged with red.

Females of this species, in a state of complete development, have been found on several occasions among herbage growing in meadows and old pastures near Hendre House; and in May 1860, the Rev. O. P. Cambridge took adult individuals of both sexes on the banks of the Conway.

Tribe Senoculina.

Family Dysderidæ.

Genus Dysdera, Latr.

Dysdera obscura.

The male is smaller and much paler than the female, with the exception of the anterior legs, which have a browner hue; and near the middle of the metatarsus of each, towards the outer side, there is a strong, obtuse, prominent process terminated by a short, fine spine. Its palpi are short, and of a yellowish-white hue; the radial is much larger than the cubital joint and has the appearance of being swollen; the digital joint is small, oval, convex and hairy externally; and the palpal organs, which are subglobular at the base, but prolonged into a slightly curved process terminating in a fine point, are attached to its inferior surface*

This remarkable *Dysdera* was taken in Pernambuco by Mr. Eyton Williams, from whom I had previously received an immature female of the same species.

XLV.—*Further Observations on the Structure of* Foraminifera, *and on the larger Fossilized Forms of Scinde, &c., including a new Genus and Species.* By H. J. Carter, Esq., F.R.S.

Further Observations on the larger Fossilized Forms of Foraminifera in Scinde, &c.

[Continued from p. 382.]

Orbitoides, D'Orbigny.

"*Lycophris dispansus*, Sow." (Ann. Nat. Hist. *l. c.* p. 172), better named by D'Archiac and Haime (p. 349) "*Orbitoides dispansa.*"

Largest size.—Breadth about 1 inch; thickness $\frac{3}{12}$. This specimen is ephippial.

Loc. Lukput, in Cutch. Many parts of Scinde. Valley of

* For a description of an immature female of this species, see Ann. and Mag. Nat. Hist. ser. 3. vol. ii. p. 334.

Kelat (Dr. Cook). Not in Arabia, so far as my observation extends, although I have no doubt it exists there; but I mention expressly that I have not seen it in Arabia, to correct an error which I have made in my Memoir on the Geology of the South-east Coast of that country (Geol. Papers, Western India, p. 592 *et seq.*), in stating that the limestone at the village of Takah, on this coast, which is charged with *Orbitolites Mantelli,* contained also "*Orbitoides Prattii* and *O. dispansa,*" which latter I have since found out to be *Heterostegina,* whose quadrangular chambers, while the fossils were yet in the matrix, led me to assume that they were *Orbitoides,* and thus to make the mistake.

Associates.—*N. exponens* and *N. biaritzensis* at Lukput, in Cutch; *N. Ramondi* at Wasna, in Rajpipla; *N. exponens, Assilina obesa, N. perforata, Alveolina elliptica,* and *Conulites Cooki* in the valley of Kelat (Dr. Cook); the deposit of diminutive Foraminifera, viz. *Operculina, N. kelatensis, Alveolina elliptica, A. meandrina,* and *Orbitolina,* also in the valley of Kelat (Dr. Cook).

Obs.—In my former description of this fossil (Ann. Nat. Hist. p. 173) I went into its structure a little, chiefly to contrast the latter with that of *Orbitolites Mantelli,* Cart. (*Orbitoides Mantelli,* D'Orb.); but having since obtained specimens which elucidate this more fully, on account of the whole of the cavities of the test, which formerly contained animal matter, having become richly infiltrated with red and yellow oxide of iron, while the rest remains perfectly free from it, I will now return to the subject more particularly, in doing which I shall not only be able to show much more strikingly how it differs from *Orbitolites Mantelli,* but also be able to point out the position occupied by the sarcode during the lifetime of the animal, almost as satisfactorily as if I had it living in the test at the present moment.

Structural description.—In structure, *Orbitoides dispansa* (Pl. XVI. fig. 1, &c.) consists of a *horizontal plane* of oblong chambers (*b* 1), from each side of which proceeds a *vertical growth* of compressed columnar ones (*b* 2).

The *horizontal plane,* which is more or less wavy, is composed of a single layer of oblong quadrangular chambers arranged in concentric rows around the germ-cell (Pl. XVII. fig. 1 *m* 1, *n* 1), which is spherical, and may not exceed much its original size or may become very much larger, but always seems to be a little larger than the chambers of the rows which next follow it in development (fig. 1 *m, n*); it is also hardly ever, perhaps never, without a second cell which very nearly embraces it, and this in the section assumes a more or less semilunar shape (*m* 2, *n* 2). To the former, or germ-cell, Dr. Carpenter has (in *Orbitolites*) applied the term "central," and to the latter, "circumambient cell." When the germ or central cell and its accompanying one remain minute, that is, not more than the 1-630th of an inch in diameter, the chambers immediately around it are equally so, but increase in magnitude with their distance from the centre; on the other hand, when they are large, the immediately surrounding chambers are proportionately large, but gradually diminish to the usual size, after which they also begin to increase slightly again with their distance from the centre, in the normal way. Thus the structure of the centre may be compact or open, but, from the open structure diminishing to a certain degree and then enlarging again, it may be assumed that the former or compact structure, where the chambers undergo an uninterrupted and gradual increase in size from the centre outwards, is the normal form. After a certain distance from the centre, the increase in size appears to cease, on account of the maximum size of the chambers having been attained, when they again begin to decrease in magnitude towards the circumference.

The rows of chambers, whether arising from a minute or large central cell and its accompaniment, have a tendency to a cyclical arrangement from the first, and very soon complete one (Pl. XVII. fig. 1 *m, n*); that is, they very nearly surround the central chambers first for a few rows, which tend to keep on one side, and then at last embrace it by completing the circle. Formerly I thought they began multi-spirally, and I gave an illustration of this (Ann. Nat. Hist. ser. 2. vol. xi. pl. 7. fig. 26); but latterly I have found out that this illustration was taken from the centre of a minute *Heterostegina*, as before stated, and that *Orbitoides dispansa* tends to a cyclical arrangement in the centre as much as, if not more than any other discoid Foraminifer. As the rows extend outwards they bifurcate every now and then, and every now and then one seems to stop altogether; so that this causes an increase and decrease in the number of rows respectively; but the latter is of course less than the former, otherwise there would be no extension of the plane at all. This irregularity, therefore, is attended by frequent interruption of the circle, and thus leads to a more or less irregular aspect of the rows generally throughout the plane.

The chambers in the normal form (that is, where they commence from a minute cell) are small and cubical in the centre (Pl. XVI. fig. 1 *h*), but become elongated horizontally and compressed vertically with their distance from it (fig. 1 *g* 1); so that they soon assume a narrow quadrangular form (*k* 1), which is furthermore altered by becoming convex externally and concave towards the centre, in which direction, also, their long axis is at first situated; but as the outermost rows of the full-grown test are reached, they undergo the change common to the discoid Foraminifera; that is to say, their vertical axis becomes the longest, from the diminution of the horizontal one (*i*). The chambers also vary greatly in length, and this causes a corresponding irregularity in the rows of which they form a part,—thus reducing the row gradually almost to a mere line, and then expanding it out again to its full size (Pl. XVII. fig. 1 *n*); at other times the chamber becomes doubled, and thus the row appears to bifurcate as just stated; while on other occasions, again, the opposite takes place, viz. the chamber ceases to be developed, and the adjoining rows closing in, the abortive row thus terminates or ceases to exist. The additional row or bifurcation probably begins in an offset from one of the annular canals which will be presently mentioned, and should be regarded as a "branch," like the branches of the spire in *Nummulites*. (Reference to the figures in the first row of Pl. XVII. will facilitate the explanation of all this.)

Lastly, the chambers are, for the most part, arranged alternately in adjoining rows, and each communicates by two canals or stolons with the two immediately before and behind it; so that every chamber has four others in connexion with it (*k*, *l*). In this we have an arrangement analogous to the "oblique" canal-system in *Orbitolites Mantelli*, which will be described under this head.

Canal-system.—Here and there my horizontal sections present a distinct canal-system (*k* 3, *l* 3), consisting of single annular canals situated between the rows of chambers respectively, connected with each other by straight smaller branches which pass through the interseptal spaces; so that each chamber is thus enclosed in a quadrangular mesh of canals, and the whole together form a meshwork plane which is double; that is to say, one exists on each side the horizontal plane of chambers, on a level with the chambers, so as to have the stolon-processes between them. Why the canal-system should only appear here and there in remnants in my sections, I cannot say, unless it be from variation in their size, from imperfect infiltration, or from total absence in parts. Again, from their being analogous to the annular canals of *Orbitolites Mantelli*, which will be described presently, as well as to the great spiral canals of *Operculina* and *Nummulites*, one would expect the proximal ends of the chambers to be united to them: and this is actually the case; that is, the chambers have often a bond of union of this kind when the entirety of the annular canal is not visible, and are as often without it when the annular canal, in its entirety and separation, is present (*k*); while I know of no other structure of the kind in the horizontal plane but this annular canal-system and the stolon-process, except, perhaps, some delicate canals of union between the chambers through the interseptal spaces, too small, in my specimens, to be satisfactorily seen.

Vertical growth.—This, on the other hand, is composed of columns of compressed chambers of an irregular shape (*d*), which grow out vertically from the layers of the horizontal plane, and beginning from the central cell, increase in number, vertically and horizontally, with the extension of the horizontal plane, which thus causes them to be most numerous in the centre, and so assume a convex form, which is most prominent at this part. Besides this, the difference in degree of vertical compression, in these cavities, leads to the centre in one specimen being abruptly raised and in another almost flat, viz. where they are inflated and compressed respectively; added to which the prominence in the centre may also depend more or less on the size of the central and circumambient cells.

With the layers of compressed chambers a number of opake white columns, consisting merely of condensed shell-substance, are developed (*d* 1), which, arising in points situated on the interseptal spaces of the horizontal plane, gradually increase in thickness vertically, as they radiate also, slightly, from their origins, to terminate on the surface (*b* 2).

The compressed chambers of the vertical structure, as before stated, are very irregular in form (*a* 2, *c* 2), and much larger than the chambers of the central plane, from which they are developed partly through the medium of minute vertical tubes extended through the shell-substance of the test, in the same way as in *Operculina* and *Nummulites* (*d* 3, *g* 4), and partly by stolon-processes passing obliquely upwards through the intercameral spaces (*e* 5, *f* 3, 4). Thus each compressed chamber is seen to be united to those immediately above and around it by several of these processes; and thus these cavities assume a columnar arrangement radiating from the central plane, while part of the interspaces between them is filled up by the opake columns. But the opake columns, as well as the columns of chambers, bifurcate, and thus become multiplied to fill up the intervals which would otherwise be caused by their radiation, whereby also the chambers become diminished in size, and thus, on the surface, appear subordinate in this respect to the peripheral ends of the columns (*a* 1); so that the convex surface of the fossil presents a number of white points, which are the ends of the opake columns of shell-substance, surrounded by polygonal divisions which, on their part, are the ends of the columns of the compressed chambers (*a*), the interspaces between which, again (that is, between the chambers), form the radiating straight stellate lines of connexion between the columns (*a* 3, *c* 3), across which linear interspaces, lastly, the stolon-processes pass that unite the chambers (*c* 4). The stellate lines, from their transparency, are frequently not seen; but when opake and white, they give the surface and horizontal section a star-like appearance; their apparent absence, therefore, does not constitute a specific difference. I have never seen any of the stolon-processes passing through the opake columns; neither have I ever been able to detect a point of yellow ochre in the peripheral extremities of the columns in the infiltrated specimens, indicative of their having been pierced by a vertical canal, although I have had infiltrated specimens in which this must have been the case, had there been one.

Here it is necessary for me to correct an error in my former communication on this subject (Ann. Nat. Hist. *l. c.* p. 173), where I have stated that the "opake columns" are "columns of cells." In *Orbitolites Mantelli* there are *no* opake columns, as will presently be seen, but there are *columns of compressed chambers*, as in *Orbitoides dispansa*; and the only way in which I can account for my misstatement is, that the resemblances between *Orbitoides dispansa* and *Orbitolites Mantelli*, on superficial examination, are so great that I must have been describing from a specimen of the latter in my hand when I committed this error. The best distinguishing character, indeed, between these two fossils, for field purposes, is the presence of the opake columns in *Orbitoides dispansa* and their absence in *Orbitolites Mantelli*.

Spherules or propagative agents.—As in *Operculina* and *Nummulites*, so in *Orbitoides dispansa*, these bodies are frequently observed throughout the cavities and canals of the test (Pl. XVII. fig. 1 *o*), equally filling the central as well as the peripheral chambers, and equally traversing the vertical tubuli as well as the intercommunicating canals between the chambers; so that in this way they readily find a passage from even the most internal cavities of the organism to the exterior. In their development, judging from the full-grown specimens, the spherules may grow considerably beyond the size which they have at their exit from the parent, or very little exceed it, but are almost, if not always, followed by the development of a much larger chamber, viz. the "circumambient" one, as before stated, previous to the development of the rows of small chambers. They vary in size from 1-2000th of an inch downwards.

Orbitoides asterifera, n. sp. (Pl. XVII. fig. 3).—The only difference between this form and that of *O. dispansa* is that it is much smaller, has an asteroid elevation on the surface consisting of six or eight rays extending from the centre towards the circumference, where they bifurcate; the surface-ends of the opake columns, too, are separated from each other by many chambers, while in *O. dispansa,* for the most part, they are only separated by a ring of single chambers.

Largest size.—Breadth $\frac{4}{12}$ inch.

Loc. Valley of Kelat (Dr. Cook).

Associates.—From the same bed of diminutive Foraminifera as *N. kelatensis,* under which see its associates.

Obs.—Excepting the asteroid growth of this fossil, there is nothing but the greater number of chambers which intervene between the peripheral end of the columns to make it differ from *O. dispansa.* Plane, expanded, and asteroid forms exist, indiscriminately mixed together in the same deposit, but all diminutive, like the rest of the Foraminifera of which this bed is composed. The rays or ridges are occasioned by the "vertical growth" of the test having been arrested between them.

Note.—On comparing the sectional figures of *O. Prattii* given by Dr. Carpenter (Quart. Journ. Geol. Soc. vol. vi. pl. 8) with *O. dispansa* (*Lycophris dispansus,* Sow.) and *L. ephippium,* I can see no difference whatever between them, and therefore must consider all as *O. dispansa,* while the asteroid form just described hardly differs sufficiently from any to deserve a separate specific appellation. Hence, at present, I know but one type of all these *Orbitoides,* viz. *O. dispansa.*

Orbitolites Mantelli, Cart.

"*Orbitolites Mantelli,* H. J. C." (Ann. Nat. Hist. *l. c.* p. 174).—Is it this fossil that D'Archiac and Haime state, in their "Table" (p. 363), "est bien l'espèce des Etats-Unis," viz. that called *Orbitoides Mantelli* by D'Orbigny? To this question I have already answered "Yes." It corresponds with the figures of this fossil given by Dr. Carpenter (Quart. Journ. Geol. Soc. *l. c.*); and having obtained specimens of it almost as richly infiltrated with yellow oxide of iron as those of *Orbitoides dispansa,* I will now also describe its structure much more minutely than I have before done, as much for the purpose of still further contrasting the differences between these two fossils as for recording the minute anatomy of the fossilized test itself, which the infiltration enables me to do almost as well as that of *Orbitoides dispansa.*

The test of *Orbitolites Mantelli* (Pl. XVI. fig. 2, &c.) consists of a *horizontal plane* of globular and cylindrical chambers (*b* 1), from each side of which proceeds a *vertical growth* of columnar ones (*b* 2).

In the *horizontal plane,* everything is the same—in respect of waviness, mode of growth around a minute or large central cell (Pl. XVII. fig. 2, *n* 1) and its circumambient chamber (*n* 2), the relative size of the chambers, their arrangement in rows, the bifurcation and effetation of the rows, and their consequent multiplication and disappearance, the incomplete and lateral growth at first, their subsequent entire concentricity, and the plane being only one chamber deep—as in *Orbitoides dispansa.* But the chambers are quite different in shape from those of *O. dispansa*, different in the direction of their increase in size and in the arrangement of the canal-system or sarcodal bands which accompany them. They also frequently present an arrangement like that of the interspaces and lines on an engine-turned watch-case, at the commencement (*m*); and although I believe they become as much concentric as the rows in *Orbitoides dispansa*, still, out of many successful sections in other respects, I have never been able to trace a row completely round, that is, forming an entire circle; it has always bifurcated or thrown off another row, or become diminished to the annular canal, which could be traced on for some distance and then disappeared, or began again to bear chambers which could not well be identified with those of the original row (*n*).

The chambers in the normal form, that is, where they commence from a minute cell, are small and globular in the centre (*h*), but become larger and elongated *vertically* with their distance from it (*h'*); so that they soon assume a cylindrical form, which presents a curve towards the centre and a corresponding convexity in the opposite direction: thus the plane becomes much thicker towards the circumference, indeed is thickest there (*g* 1), although, as in all other instances, the horizontal diameter of the chambers is diminished (*i*). The chambers are also arranged alternately in adjoining rows, and united together by systems of *oblique* and *annular* canals, which were originally filled with sarcode, and to which we will now particularly direct our attention.

The *oblique system* (*l* 4) consists of canals or bands which pursue an oblique course from the centre to the circumference, like the lines on an engine-turned watch-case, that is, making each a semi-gyration from the centre to the circumference; and as there are two (?) sets of these canals at the commencement, situated respectively in two distinct and separate planes, and the canals of each plane gyrate in opposite directions respectively, so their interstices are quadrangular, and have their angles circularly and radiatingly opposite to each other, also like the interstices of the figure on the watch-case; while in the inner angle of each of the spaces is placed the chamber, in contact with the two canals, as they cross each other on different planes at this point (*k*, *l*). At first there are only two planes of these canals or bands, but as the chambers become elongated vertically they may be increased to four and six (*g* 4). The largest infiltrated specimen of *Orbitolites Mantelli* in my possession presents six at the circumference, all of which communicate in the way mentioned with the outer rows of chambers (*g*).

The *annular system* (*k* 3, *l* 3), on the other hand, consists of two planes only of canals, arranged in concentric circles, which are situated respectively on either side of the horizontal plane, on a level with the end of the chambers, with which they are in contact on the inner side, one to each row (*g* 4). Why these canals should not be scolloped or wavy in the infiltrated specimens, as they are in the uninfiltrated ones and in *Orbitolites* (Pl. XVII. fig. 2 *o*), I cannot say.

In connexion with these, again, there are other indistinct sets of more delicate canals, one of which unites the annular bands transversely, that is, passing between the chambers (*l* 4), another unites them vertically (*g* 6), and a third set, which is only seen here and there, proceeds vertically outward between the cells of the *vertical growth*, where it appears to be lost. The first set corresponds with the transverse branches between the annular canals in *Orbitoides dispansa* and to those which, in *Orbitolites*, appear to give origin to the chambers of the following row.

Vertical growth.—This, again, in its mode of increase, convexity of the layers of which it is composed (Pl. XVI. fig. 2 *b* 2), consequent compression and columnar arrangement of the chambers (*d*), their being larger than the chambers of the horizontal plane with which they are in contact and from which they are developed, the occasional bifurcation of the columns, and the successive development of the compressed cavities of which they are composed being due to minute vertical tubular communications which pass through the shell-substance exactly like those observed in *Operculina* and *Nummulites* (*d* 1), together with the lateral stolon-processes traversing obliquely outwards the intercellular spaces (*d* 3),—all exactly resemble the same parts in *Orbitoides dispansa*. But there is a total absence of the opake columnar structure; and the columns of compressed cavities, not having this obstruction to their lateral development, are wider at their peripheral ends, while the intercameral spaces are consequently smaller than the same parts in *Orbitoides dispansa* (see sections *c*, *d*). The peripheral ends of the chamber-columns are also more or less circular, and in the little angular spaces between them may be seen the ends of one or more of the *ascending* intercommunicating canals which connect the columnar chambers vertically, and thus complete the line of transit between the centre and surface, besides affording stolons, perhaps, for the formation of new chambers (*c* 3, *c* 4, *f* 4).

Hence there is a great difference between this fossil and *Orbitoides dispansa*, while no one can help seeing that it is most closely allied to *Orbitolites* in the structure of its horizontal plane (see Dr. Carpenter's sections of *Orbitolites* in Phil. Trans. *l. c.*) any more than one can help seeing that *Orbitoides dispansa,* in the structure of its central plane, is most closely allied to *Cycloclypeus,* Carp.

Alike, therefore, as *Orbitoides dispansa* and *Orbitolites Mantelli* may be in other respects, they are, in the structure of the central or horizontal plane, as strikingly different as *Orbitolites* and *Cycloclypeus.*

For field-service, the absence of the white columns and increasing thickness of the horizontal plane towards the circumference, as above stated, at once distinguish *Orbitolites Mantelli* from *Orbitoides dispansa.*

Dr. Carpenter (Phil. Trans. 1856, p. 195, foot-note) states that I have fallen into an error, which has been corrected by D'Archiac and Haime (p. 349), in placing what M. d'Archiac considered before as "*Orbitolites*" under the head of *Orbitoides dispansa* and *Orbitoides Fortisi* seu *Prattii,* with reference, I suppose, to my having changed the name of the fossil first described from "*Orbitoides Mantelli*" to "*Orbitolites Mantelli.*"

I have, however, just stated that *Orbitoides dispansa* and *Orbitoides Fortisi* seu *Prattii* are the same, and have *always* done so. That *Orbitoides Mantelli,* D'Orb., is very different, I have also shown; but I question, now that Dr. Carpenter has so clearly defined *Orbitolites,* whether *Orbitoides Mantelli* ought to retain the name under which I have described it, any more than *Orbitoides dispansa* should be called "*Cycloclypeus dispansus.*" I think it had better even have retained the old name of *Orbitoides Mantelli,* D'Orb. But it must be plain now, that if *Orbitoides dispansa* is to be considered the type of the genus, our *Orbitoides Mantelli,* D'Orb., is not of this type, and therefore should still have another name. It has already had three, viz. 1. *Nummulites Mantelli,* D'Orb.; 2, *Orbitoides Mantelli,* D'Orb.; and 3, *Orbitolites Mantelli,* Cart.

Propagative spherules.—I have observed these bodies in some of the cells of the infiltrated specimens of *Orbitolites Mantelli,* but they are not numerous; and it is only here and there that I have been able to observe them in the specimens of *Nummulites sublævigata,* with which they are imbedded; while the imperfect infiltration of the whole, compared with the specimens of *Orbitoides dispansa,* &c., from Wasna, in which these "spherules" abound, seems to indicate that the former were imbedded long after death, while the latter must have been imbedded almost alive.

"2. *Orbitolites* —— ?" (Ann. Nat. Hist. *l. c.* p. 175, pl. vii. figs. 40, 41).—The specimen thus noted and alluded to by D'Arch.

and Haime (p. 350) as being perhaps *Orbitoides Fortisi* is the fossil from which I have made out the structure above given, the only difference between it and *Orbitolites Mantelli* being that the columns of cells terminate at the convex part or periphery in polygonal instead of circular cells,—a difference which is hardly enough to make it more than a variety, as the cells are anything but circular in the assumed typical form.

Associates of Orbitolites Mantelli.—*Heterostegina* and *Cycloclypeus,* in white limestone at the village of Takah, on the south-east coast of Arabia; *Nummulites sublævigata,* in yellow argillaceous limestone, in Scinde. (This is the specimen to which I have just alluded as being but a variety of *Orbitolites Mantelli,* and from which the structural description above given was taken. It is imbedded with the richly infiltrated mass of Nummulites, from which the diagram of Nummulitic structure given in the plate accompanying my description of the structure of *Operculina arabica* was compiled.)

Obs.—I have never found *Orbitolites Mantelli* with any other Nummulite than *N. sublævigata,* and this only in the specimen above mentioned from Scinde, although it is very common in Scinde.

Like *Orbitoides dispansa,* it is sometimes small and prominent in the centre, at others more or less flat, twisted, and expanded, like the ephippial varieties of *O. dispansa.* The latter, from the wavy and fragmentary state in which it occurs in the matrix, led me into the conjectural error of stating that it sometimes seems to spread itself out in a thalloid form, like the Polyzoa, whereas subsequent examination tends to the conclusion that it always assumes a discoid form, although much more expanded and thinner in some instances than in others*.

* Since the above was written I have had the opportunity of further confirming the opinion I have given, that the expanded forms of *Orbitolites Mantelli,* Cart., are never indefinitely thalloid like the polypidom of the Polyzoa, but always discoid, in a mass of these fossils sent to me by Dr. Cook, which he obtained from a small series of limestone strata overlying serpentine and diorite rock close to the village of Nal, in Beloochistan, about eighty miles S.S.W. of Kelat.

This mass, which is a specimen of the stratum from which it was taken, is so foliated in structure, that it looks like a deposit of leaves; but when examined, it is found to consist of nothing but *Orbitolites Mantelli, Heterostegina, Cycloclypeus,* and *Orbiculina,* all together and lying parallelly upon each other, in a softish yellow marl.

The largest specimen of *O. Mantelli* forwarded to me is $2\frac{1}{2}$ inches in diameter, $\frac{1}{5}$ inch thick in the centre, and the central prominence or vertical development not more than $\frac{1}{3}$ inch wide; while the horizontal portion, extending 1 inch beyond this all round, is not more than $\frac{1}{16}$ inch thick half-way between the margin and the centre, and increases but a very little more even up to the vertical development. It is this small vertical and great horizontal development, which led me formerly, when I had

If, as I have before inferred from its being confined to the lowest deposits of the Nummulitic Series, *N. sublævigata* be the oldest form of Nummulites, then this may be the locality and age of *Orbitolites Mantelli*; but if, as subsequently stated, this be a Middle Tertiary Series, then *O. Mantelli* and *N. sublævigata* would belong to the youngest or latest-formed species of larger Foraminifera,—which I now think most likely, as the bed of *Orbitolites Mantelli, Heterostegina,* and *Cycloclypeus,* together with that containing the reticulated Nummulite *N. masiraensis,* in the island of Masira, on the south-east coast of Arabia, and that containing *N. sublævigata,* at Muskat, would then all be in the littoral division of the Nummulitic series of this part of the coast of Arabia, the other or lower division forming the summits of the great scarps a little more inland.

CONULITES, nov. gen.

Conulites Cooki, n. sp. (Pl. XV. fig. 7, &c.).—Conical, discoidal, more or less depressed, consisting of a cortical layer of rhomboidal chambers (*d*) filled with a columnar structure which slightly projects in a convex form beyond the base (*c, e*). Cortical layer composed of a spire of chambers commencing from the apex and terminating at the circumference of the base (*d*); septal lines of the chambers oblique; chambers rounded internally (*l* 2, *g* 1). Columnar structure radiated (*c, e*), consisting of convex layers of compressed chambers, which are more or less arranged in columns, united by stolon-processes, and interspersed with opake white columns (*f*). Opake columns conical, growing from points on the inner aspects of the chambers and terminating in dilated extremities at the base, which thus acquires, when weather-worn, a granular surface (*b, e*). Apex surrounded externally by a thin columnar growth of shell-substance, which extends about halfway up the side of the cone, and there gradually subsides into small granular projections situated on the points of contact between the septa and the spire (*e* 1).

only a fragment or two of this variety without the centre, to infer that the fossil sometimes had a thalloid growth, like the polypidom of the Polyzoa.

The *Heterostegina* is very small, and the *Cycloclypeus* and *Orbiculina* under half an inch in diameter, so far as I have seen; but probably there are much larger specimens of all these fossils in the deposit.

In a geological point of view, it is interesting to find *Orbitolites Mantelli, Heterostegina,* and *Cycloclypeus* occurring together in a bed overlying serpentine and diorite rocks in the locality above mentioned, since they are found together in a bed in the middle of the south-east coast of Arabia, where the Nummulitic series also reposes conformably on rocks composed of diorite and serpentine.—Bombay, Oct. 12, 1861.

Largest size.—Breadth at base $\frac{5}{12}$ inch; height of cone $\frac{2\frac{1}{2}}{12}$ inch.

Loc. Scinde, locality unknown. Valley of Kelat (Dr. Cook).

Associates.—*N. exponens* (var. *b*), *Assilina obesa*, *N. perforata*, *N. biaritzensis*, *N. spira*, *Alveolina elliptica*, and *Orbitoides dispansa* in the Valley of Kelat; *N. Carteri* and *N. spira* in Scinde.

Obs.—I first recognized this fossil amongst some Nummulites sent from Kelat by Dr. Cook, and then in the mass in some specimens from Scinde previously in my possession. The spire is generally single throughout, but sometimes bifurcated so as to become double; and the same with the septal lines, which have a radiating spiral tendency from the apex towards the circumference; while the columnar structure, in respect of the chambers and columns, is almost identical with that of *Orbitoides dispansa*. As yet, I have met with no specimens sufficiently infiltrated with yellow oxide of iron to enable me to follow out the internal structure minutely. This fossil is very like the conical forms of *Orbitolina*, but differs in the cortical layer consisting of a *spire* instead of *concentric rings* of chambers, and in the columnar structure being accompanied by the white opake columns. Thus *Conulites* belongs to the "Hélicostègues" of D'Orbigny.

Orbitolina, D'Orb.

1. *Orbitolina lenticularis*, Lamk. (Pl. XVII. fig. 5, &c.).—Conical, obtuse, slightly excavated or patulous; margin everted, external surface presenting concentric rings; patulous surface presenting granulations, which are more or less confused in the centre, but arranged in radiating lines towards the circumference.

Size.—Breadth $\frac{2}{12}$ inch; height $\frac{1}{20}$ inch.

Variety *a*. Conical, acute, deeply excavated.

Size.—Breadth $\frac{1}{8}$ inch; height $\frac{1}{20}$ inch.

Variety *b*. Flat, circular, wavy, thick; thinning towards the circumference.

Size.—Breadth $\frac{2}{12}$ inch; height $\frac{1}{32}$ inch.

Variety *c* (fig. 6). Discoidal, almost flat, very thin, papyraceous.

Size.—Breadth $\frac{8}{12}$ inch; thickness $\frac{1}{48}$ inch.

Loc. All from the south-east coast of Arabia, at Ras Fartak, with fossils of the Cretacean age.

Obs.—These Foraminifera I first described under the name of "*Orbitolites*" in my "Memoir on the Geology of the South-east Coast of Arabia" (Journ. Bombay Asiat. Soc. vol. iv. p. 71), and then again under that of "*Orbitolina patula*" (Geol. Papers Western India, pp. 549 & 603), since which I find that the species, when compared with Pictet's figure (Traité de Paléontologie, pl. 109. fig. 7), is distinctly that of the "perte du Rhône," viz. *Orbitolina lenticularis*, Lam., under which name it is now given; and I cannot help thinking, with Messrs. Parker and Jones (Ann. Nat. Hist. ser. 3. vol. vi. p. 36), that D'Orbigny's *Cyclolina* must be intended for the flat and expanded variety (*c*) of this fossil. Perhaps, also, his figures of it were taken, by mistake, from *Orbitolites*; but of this more hereafter.

These fossils abound to such an extent at the place mentioned, that a bed of stratified blue limestone upwards of 100 feet in thickness is almost entirely composed of them; while the presence of Ammonites and Cretacean fossils in the superincumbent strata, also more or less richly charged with *Orbitolina*, proves the whole to be of Cretacean age.

Structure of Orbitolina lenticularis.—This fossil, like *Conulites Cooki*, is composed of a cortical layer of chambers externally (*g* 2), which is more or less conical in shape, and more or less filled internally with a columnar chamber-structure (*g* 3). The cortical layer here, however, is composed of concentric rings of chambers, which begin in a central cell at the apex (*d* 4) and terminate at the circumference of the base. Each annulus is divided into a number of chambers with straight septa (*d a*), faced superficially by a reticular subseptal structure (*d* 1), which extends into the chambers a certain distance, but not throughout; so that when this facing or superficial reticulation is removed by acid, the larger divisions beneath come into view (*d* 2).

The columnar structure, again, as in *Conulites*, is composed of layers of compressed cells which more or less fill the cone, according to the species (*g* 3), and sometimes extend even beyond the base so as to give this a convex surface. But there are no opake-white columns here, as in *Conulites*, and the granulations on the patulous surface and convexity of the base respectively (*e*) represent the ends of the columns of cells as in *Orbitolites Mantelli*. While, therefore, *Conulites* is most like *Orbitoides dispansa*, *Orbitolina* more resembles *Orbitolites Mantelli*; but *Conulites* still differs from both in the great chamber-layer being helical, instead of cyclical, as before stated.

2. *Orbitolina* —— ? (Pl. XVII. fig. 7, &c.).—Conical; base convex; annular spaces wider and more reticulated than in the foregoing species. Internal structure the same as that of *O. lenticularis*.

Largest size.—Height $\frac{2\frac{1}{2}}{12}$ inch; breadth at base, a little more.

Loc. Valley of Kelat (Dr. Cook).

Associates.—*Alveolina elliptica*, in white limestone; the diminutive Foraminifera in the bed before mentioned, valley of Kelat (Dr. Cook).

3. *Orbitolina* —— ? (fig. 8, &c.).—The same as the foregoing, but with no reticulation on the surface, and the septa indistinctly developed.

Largest size.—Height $\frac{7}{48}$ inch; breadth at the base about the same.

Loc. Buran River, in Scinde, in limestone charged with *Orbitolites pedunculata*, Cart.

Associate.—*Orbitolites pedunculata.*

4. *Orbitolina* —— ? (fig. 9, &c.).—Of the same shape as the last, but the cortical layer consisting of long chambers twisting round the cone, and interdigitating with each other at their commencement and termination.

Largest size.—Height $\frac{6}{48}$ inch.

Loc. South-east coast of Arabia, close to Ras Sajar, in white limestone richly charged with *Orbitolites.*

Associate.—*Orbitolites.*

Heterostegina, D'Orb.

Heterostegina pleurocentralis, n. sp. (?).—Elliptical, thin, flat, wavy. Surfaces presenting a corresponding prominence on each side, situated laterally and towards one end of the ellipse; covered with minute tubercles, which, becoming larger eccentrically, pass off into moniliform rows that, after a subspiral course, terminate on the margin. Internally consisting, except at the prominence, of a single plane of oblong chambers filling up the intervals between the rows of tubercles, with their long axes horizontal and across their subspiral course. Margin inflated, round, smooth.

Largest size.—Longest diameter $\frac{3}{8}$ inch.

Loc. Village of Takah, on the south-east coast of Arabia, in white limestone.

Associates.—*Cycloclypeus* and *Orbitolites Mantelli.*

Obs.—This and *Orbitolites Mantelli* are very numerous together in the white limestone at the place mentioned. Although smaller, it differs so little from the species found at Malta, that I think they should be regarded as the same.

Note.—Misled by the figure of Lamarck's *Orbiculina adunca* (Encyclop. Méthod. tab. 468), I called this fossil "*Orbiculina pleurocentralis*" (Geol. Papers on West India); but on receiving Dr. Carpenter's kind present of a copy of his second valuable Memoir on the Foraminifera (Phil. Trans. 1856, p. 547), I saw my mistake, and made the necessary correction (Journ. Bombay Asiat. Soc. vol. v. p. 634).

I have designated this Foraminifer "*pleurocentralis*" here, because I had given this name to it formerly; but having since obtained some of the fossil *Heterosteginæ* from Malta, I find the resemblance between the two so close, that I hardly think that it should be considered otherwise than as a variety of the latter. It scarcely differs more (that is, in the specimens in my possession) than in being a little smaller than the *Heterostegina* of Malta.

The resemblance of the horizontal face of this fossil to *Orbitoides dispansa* seu *Prattii* while in the matrix, led me to think that it was that Foraminifer—an error in both editions of my Memoir on the Geology of the south-east coast of Arabia (*loc. cit.*) which I thus take the opportunity of correcting. As before stated, I did not meet with *Orbitoides dispansa* in Arabia, nor have I ever found *Orbitoides dispansa* together with *Orbitolites Mantelli*; and as I have also before stated, it was the mistaking of the small specimens of this *Heterostegina* among those of *Orbitolites Mantelli* for *Orbitoides dispansa* which led to my giving a section of *Heterostegina* as illustrative of the "multispiral" commencement of the chambers in the latter.

Cycloclypeus, Carp.

Cycloclypeus mammillatus, n. sp.—Circular, thin, presenting a prominence in the centre surmounted by a large tubercle, which is again surrounded by a number of minute ones, the latter passing off in broken lines to terminate in a radiating spiral manner upon the margin. Margin thin, not inflated. Chambers circular in the centre, becoming oblong and quadrangular towards the circumference, arranged in rows, with their long axis in the direction of the horizontal or long radius of the fossil.

Largest size.—I could only obtain one specimen entire, which was $\frac{2}{12}$ inch in diameter.

Loc. Takah, on the south-east coast of Arabia, in white limestone, with *Orbitolites Mantelli* and *Heterostegina.*

Obs.—Here the minute granulations, instead of being on the lines separating the rows, are over the septal divisions between the chambers themselves. Thinking, from my limited means of examination, and from its being associated with *Heterostegina,* that this fossil must be considered one of the same genus, I gave it the above specific designation; but having lately cut away a little of its surface, to examine its internal structure, I find that it is distinctly a *Cycloclypeus.*

The cells of this specimen diminish in size towards the centre and become almost globular; but this may be because the central cell happened to be minute instead of large. In Dr. Carpenter's typical form, however, the cells are deeper in the centre and become shallower outwards; and if this be always the case, then *C. mammillatus* follows what I have considered to be the normal form of the horizontal planes in *Orbitoides dispansa* and

O. Mantelli, especially when commencing with a minute cell, rather than typical *Cycloclypeus*, which, contrary to all the other Foraminifera, appears to *begin* in the centre with large chambers, which go on decreasing in size outwards, without first going down to the smaller size of their situation and then increasing again towards the circumference. But for this, and the chambers exchanging their quadrangular for a globular form towards the centre, together with the smallness of the fossil, there is no difference that I can see between the fossil *Cycloclypeus* of the south-east coast of Arabia and the recent one described by Dr. Carpenter (Phil. Trans. *l. c.* pl. 30. fig. 1).

Orbiculina, D'Orb.

Orbiculina malabarica, Cart.—This fossil, which I had described under the name of "*Orbitolites malabarica*" (Ann. Nat. Hist. ser. 2. vol. xi. p. 425), I found afterwards to be an *Orbiculina*, from its resemblance to *Orbiculina angulata*, Lamk. (Encycl. Méthod. t. iii. pl. 468. fig. 3), and I therefore made this correction in the fifth volume of the 'Journal of the Bombay Asiatic Society,' p. 634, immediately after which (that is to say, before the sheet in which my correction occurred had passed through the press), I had the pleasure to receive, through Dr. Carpenter's kindness, his second 'Memoir' on the Foraminifera, in which I found that he had also made the same correction. I mention this chiefly to point out the great resemblance between the figure in the 'Encyclop. Méthod.' to which I have alluded and *Orbiculina malabarica*. For a description and illustration of the fossil itself, see Ann. Nat. Hist. *loc. cit.*

Variety *a.*

Largest size.—Breadth $\frac{8}{12}$ inch.

Loc. Khattyawar, on the coast near Poorbunder, in yellow compact limestone (Capt. Constable, H.M.I.N.).

Associates.—Fossils of the Middle Tertiary epoch, like those accompanying *O. malabarica* (typical form).

Obs.—The only differences between this fossil and the typical form are that the chambers are much smaller in the specimens from Khattyawar; the structure appears to be finer, and from being in a purer, more compact, and fawn-coloured limestone, which is densely charged with them, they appear, from their light colour and fine structure, to be identical with *Orbitolites complanata*; but the distinct spiral arrangement in the centre, which is very evident under even a strong magnifying lens, establishes the difference directly.

Orbitolites, Lamk.

Cyclolina pedunculata, Cart. (Ann. Nat. Hist. *l. c.* p. 176).—

Since I have had the advantage of Dr. Carpenter's clear and valuable exposition of the structure of *Orbitolites* (Phil. Trans. 1855), there is no longer any doubt of my false identification of this fossil with D'Orbigny's *Cyclolina*, nor of the true one being with *Orbitolites*; and therefore, if it be really a new species, which I also doubt very much, it might now go by the name of "*Orbitolites pedunculata*." I expect, after all, it will be found to differ very little from *Orbitolites complanata* of the "Paris Basin."

Associates.—Alveolina elliptica and a small Nummulite belonging to the *Striatæ*, on the Buran River, in Lower Scinde, and, on the same river, the *Orbitolina* before mentioned, "No. 3;" *Alveolina sphæroidea* and *Operculina* in the white limestone forming the summits of the great cliff-scarps behind Morebat; and also *Orbitolina* "No. 4" *ante*, in broken masses under the great promontory of Ras Sajar, on the south-east coast of Arabia.

Internal structure of Orbitolites pedunculata.—This is the same as that given by Dr. Carpenter in his vertical sections 8 and 9, pl. 6, and in his horizontal surface-view, fig. 8. pl. 7. The chambers in the centre have not run into each other vertically, as shown in Dr. Carpenter's "ideal representation," fig. 6. pl. 5, neither are the chambers of the surface oblong, but globular, while in the centre the rows are frequently oval instead of circular. Both these differences, however, as Dr. Carpenter observes, are no more than marks of variety.

The peduncle at the base in the centre is composed of amorphous shell-substance, through which a number of branched transparent lines extend upwards into the centre of the disk, indicative of their once having been canals, perhaps occupied by sarcode. Dr. Carpenter observes that the fossil was probably attached during its lifetime to some marine body, and therefore the peduncle here may be of very little specific value,—thus reducing the species to *Orbitolites complanata*.

"*Cyclolina arabica*, Cart." (Geol. Papers on W. India, p. 550). —This, if it be a new species, should have its name changed to "*Orbitolites arabica*." The only difference between it and the Scinde Orbitolite is its larger size and finer structure, which are by themselves worth nothing as specific distinctions: hence, perhaps, this also had better be considered as a variety of *O. complanata*.

Associates.—They have been given above under *C. pedunculata*.

Note.—Feeling satisfied now that these fossils are *Orbitolites*, and not *Cyclolina*, D'Orb., and that I have not found "*Orbitolites*" in the Cretacean strata of the south-east coast of Arabia, I had first to correct my errors in nomenclature to accord with this conclusion, which has been done above, and next my inferences, which were based on the assumption that this *Orbitolites* was identical with D'Orbigny's *Cyclolina*.

My inference (Geol. Papers, &c., p. 627) that the white limestone forming the summit of the great cliff-scarps on the south-east coast of Arabia was of Cretacean age, because it contained a discoid fossil identical in appearance with *Cyclolina cretacea*, D'Orb. (this fossil, according to D'Orbigny, being confined to the Cretacean period), is perceived to be wrong, since it is now proved to be *Orbitolites*, which brings back the summit-portion of these scarps to Eocene age, as assumed in the first edition of my Memoir on the Geology of this coast (Journ. Bombay Asiatic Soc. vol. iv. p. 95), wherein the fossil itself was also first called "*Orbitolites*."

Again, at p. 701, foot-note, the mistaking of this *Orbitolites* for *Cyclolina* has led to a similar error; for, finding the Scinde Orbitolite associated with fossils of the Eocene period in that country, and considering it also a *Cyclolina*, I inferred that D'Orbigny himself was wrong in restricting the existence of this fossil to the Cretacean period; whereas, now that it is known to be an Orbitolite, the inference is in the opposite direction, and in support of D'Orbigny's assertion.

What, then, is D'Orbigny's *Cyclolina*?—a question which may be first met by stating that "had D'Orbigny made plain what *Cyclolina* is, there would have been no occasion for such a question."

From what Dr. Carpenter has stated, it is evident that he was inclined to view *Cyclolina* as a species of *Orbitolites* (first Mem. p. 226, pl. 7. fig. 14), while Messrs. Parker and Jones (Ann. Nat. Hist. 1860, vol. vi. p. 36) consider it an "excessively outspread" form of *Orbitolina*, "judging from D'Orbigny's description and figures" in his 'Foram. Foss. de Vien.' p. 139, pl. 21. figs. 22–25.

In the latter view I acquiesce now, and even applied the name of "*Cyclolina*" to one of those outspread forms of *Orbitolina* (var. *c*. Pl. XVII. fig. 6) which I found in the great deposit of *Orbitolinæ* on the south-east coast of Arabia (Geol. Papers, &c. p. 549), from its resemblance to D'Orbigny's figures, but wrongly identified it with the "discoid fossil" of the scarp 2000 feet above, now seen to be *Orbitolites*,—the former in company with Cretacean, and the latter among a type of Eocene fossils.

All this confusion has arisen from the imperfect way in which D'Orbigny has described and figured his *Cyclolina cretacea*. It would have been better if he had never written anything about it, than just enough to mislead.

He states that it is "equilateral:" this is a character of *Or-*

bitolites, and not of *Orbitolina*: that the chambers are concentric, "making each a complete circle round the others of the same form;" by which I understand him to mean an *annular* chamber without septa,—in fact, a hollow ring. But, so far as my observation goes, the concentric ring-spaces of *Orbitolina*, if not divided into chambers like those of *O. lenticularis*, should interdigitate with each other as in *Patellina corrugata* (Ray Soc. Pub., Monograph by Prof. Williamson, p. 46, pl. 3. figs. 86–89). This annular form, however, according to D'Orbigny, is the peculiar characteristic of his *Cyclolina*, viz. "circular chambers."

Again, as regards D'Orbigny's figures (*loc. cit.*), nothing can be more like the expanded flattened disk of *Orbitolina lenticularis* than his horizontal view of *Cyclolina* (fig. 22). It has also, according to the shading, an elevated centre, which, however, does not appear in the lateral view (fig. 23). Again, if it were like *Orbitolina lenticularis*, the margin should be rounded and thin, for that of the latter fossil is thin and everted; instead of which it is flat and, if anything, thickened, for it obscures the rest of the fossil when viewed edgewise—if D'Orbigny's figure 23 be correct. If equilateral, it should have the same annular markings on *each* side (see my figures, var. 6, &c. *l. c.*). How, then, can it be an "excessively outspread" form of *Orbitolina annularis*, as assumed by Messrs. Parker and Jones? It is needless to conjecture further; for until the fossil is better illustrated and more satisfactorily described, we shall never know what it is. The peculiarity of "annular chambers," and the discrepancy in D'Orbigny's figs. 22 & 23, where the former represents an elevated centre, and the latter does not show it edgewise, while there is nothing in the short meagre description accompanying it to show that the disk was excavated, render the record almost worse than useless, and show that when anything is to be described it should be done satisfactorily, or a statement made to the effect that the data were not sufficient for the purpose.

EXPLANATION OF THE PLATES.

Plate XV.

Fig. 1. *Assilina exponens*, D'Orb. (*Nummulites exponens*, Sow.), variety *b*: *a*, vertical section; *b*, central portion of spire, nat. size; *c*, specimen of the largest chambers, magnified four times.

Fig. 2. *A. obesa*, n. sp., marginal view: *a*, view of flat surface; *b*, spire; *c*, vertical section, nat. size; *d*, specimen of the largest chambers, magnified.

Fig. 3. *Nummulites broachensis*, Carter: *a*, marginal view, nat. size; *b*, spire and chambers; *d*, flat surface; *e*, specimen of the largest chambers: all magnified.

Fig. 4. *N. makullaensis*, n. sp.: *a*, marginal view, nat. size; *b*, spire and chambers; *c*, flat surface; *d*, specimen of largest chambers: all magnified.

Fig. 5. *N. Ramondi*, mihi: *a*, marginal view, nat. size; *b*, flat surface; *c*, spire and chambers; *d*, specimen of largest chambers: all magnified.

Fig. 6. *N. kelatensis*, n. sp.: *a*, marginal view, nat. size; *b*, flat surface; *c*, spire and chambers; *d*, specimen of largest chambers: all magnified.

Fig. 7. *Conulites Cooki*, nov. gen. et sp., lateral view: *a*, conical surface; *b*, basal surface; *c*, vertical section, nat. size; *d*, central portion of the spire and chambers magnified, as seen on the surface after the incrustation of the apex has been removed.

e, vertical section of half the fossil, showing—1, incrustation; 2, lateral view of chamber-layer; 3, horizontal layers of chambers; 4, opake white columns of condensed shell-substance, as in *Orbitoides dispansa*.

f, Basal surface, showing—1, ends of the columns of white substance; 2, ends of the columns of chambers; 3, lines of separation between the chambers.

g, Horizontal section, showing—1, part of the spiral chamber-layer; 2, truncated ends of opake white columns; 3, ditto of columns of chambers.

N.B. *d*, *e*, *f*, *g* are all diagrams.

Plate XVI.

Fig. 1. *Orbitoides dispansa*, magnified twice the size of the specimen.

a, Portion of surface, magnified, showing—1, ends of the columns of white condensed shell-substance; 2, ends of columns of chambers; 3, lines of separation between the columns of chambers.

b, Vertical section of entire fossil, the lower part not shaded, showing—1, the horizontal chamber-layer, and, 2, the radiated arrangement of the columns of chambers and opake white columns of condensed shell-substance. This figure has been more or less proportionally magnified for comparison with the corresponding figure (opposite) of *Orbitolites Mantelli*.

c, Portion of surface greatly magnified, showing—1, ends of the opake white columns, in which are seen points representative of still smaller columns, of which the larger ones are composed; 2, ends of the columns of chambers; 3, lines of separation between them; 4, tubular communications between the chambers.

d, Vertical section of part of one of the columns of condensed shell-substance (1) with portions of columns of chambers on each side (2, 2); 3, vertical tubuli of the test uniting the chambers.

e, Horizontal section, still more magnified, showing—1, column of condensed shell-substance; 2, chambers laid open; 3, section through the test, showing the truncated ends of the vertical tubuli; 4, tubes of intercommunication between chambers of the same layer; 5, truncated ends of ditto ascending to the chambers of the next layer, or terminating upon the surface, as the case may be.

f, Vertical section of columns of chambers, to show the tubes of intercommunication between the chambers passing up in a zigzag form to reach the surface: 1, column of chambers; 2, vertical tubuli of the test; 3, tubes of intercommunication between the columnar chambers; 4, ditto, terminating by open mouths on the surface, thus ultimately enabling all the interior chambers to communicate with the surface.

g, h, i. Vertical sections of different parts of the horizontal plane or chamber-layer, to show the various forms of the chambers at these parts respectively.

g. Portion midway between the centre and circumference, showing—1, chambers of the horizontal plane; 2, tubular communications between them; 3, chambers of the columnar structure; 4, vertical tubuli of the test passing between them; 5, truncated ends of the annular canals; 6, ascending tubes of intercommunication between the chambers of the horizontal and columnar layers.

h. Form of chamber near the centre.

i. Form of chambers in the external rows.

k. Horizontal section of portion of the horizontal chamber-layer, showing—1, chambers; 2, tubes of intercommunication; 3, annular canal above the chamber-layer; 4, ditto below ditto; 5, transverse canals uniting the annular ones.

l. More magnified view of a portion of the same, showing—1, chambers; 2, tubes of intercommunication; 3, annular canals; 4, transverse canals uniting the annular ones.

Fig. 2. *Orbitolites Mantelli*, Cart., magnified twice the size of the specimen.

a. Portion of the surface magnified, showing—1, ends of columns of chambers; 2, shell-substance between them. Observe that there are no columns of condensed shell-substance here.

b. Vertical section of entire fossil, the lower part not shaded, showing—1, the horizontal plane or chamber-layer much thicker at the circumference than in the centre, with, 2, the radiated arrangement of the columns of chambers above, and the *absence* of the opake white columns of condensed shell-substance. This figure has been more or less proportionally magnified, for comparison with the corresponding figure of *Orbitoides dispansa* on the other side.

N.B. Here it should be remembered that the contour of the vertical sections of these fossils respectively only represents that of the specimens from which they are taken, viz. figs. 1 and 2. Either may be compressed almost to flatness, or raised in the thick part to semisphericity. Hence the impossibility of distinguishing them without reference to their minute structure.

c. Portion of surface greatly magnified, showing—1, ends of the columns of chambers; 2, intercameral shell-substance traversed by the tubes of intercommunication between the chambers; 3, truncated ends of some of these tubes ascending to the chambers of the next layer. The latter of course open on the surface when there is no other layer above them, and thus ultimately enable the chambers to communicate with the exterior.

d. Vertical section, showing the absence of the opake white column of condensed shell-substance seen in the opposite figure: 1, columns of chambers; 2, vertical tubuli between them; 3, intervening shell-substance; 4, tubes of intercommunication between the chambers.

e. Horizontal section still more magnified, showing—1, chambers laid open; 2, section through the test, showing the ends of the vertical tubuli; 3, tubes of intercommunication between the chambers of the same layer; 4, truncated ends of ditto ascending to the chambers of the next layer, or terminating on the surface if there be no other layer above them; 5, intercameral shell-substance.

f. Vertical section of columns of chambers to show the tubes of intercommunication between the chambers passing up in a zigzag form to reach the surface: 1, columns of chambers; 2, vertical tubuli; 3, tubes of intercommunication between the columnar chambers; 4, ditto terminating by open mouths on the surface.

g, h, i. Vertical sections of different parts of the horizontal chamber-layer, to show the various forms of the chambers at these parts respectively.

g. Portion near the circumference, showing—1, chambers of the horizontal layer elongated vertically; 2, chambers of the columnar structure; 3, vertical tubuli of the test uniting them; 4, truncated ends of the annular canals; 5, truncated ends of the oblique canals in union with the chambers of the horizontal layer; each chamber has six uniting with it, viz. three on each side, passing in opposite directions; 6, vertical canals which unite the annular canals above and below the horizontal layer.

h. Form of central chambers; *h'*, ditto, a little further from the centre.

i. Form of chambers of the external rows.

k. Horizontal section of portion of the horizontal chamber-layer, showing—1, chambers; 2, oblique canals of the upper layer; 3, annular canals.

l. More magnified view of a portion of the same, showing—1, chambers; 2, oblique canals; 3, annular canals; 4, transverse canals uniting the annular ones.

N.B. All the figures of this Plate, with the exception of 1 and 2, are diagrams.

Plate XVII.

Fig. 1. *Orbitoides dispansa*: *m*, central portion of horizontal plane or chamber-layer magnified to show the cyclical growth of the rows: 1, central or germ-, and 2, circumambient cells, very small, the latter about 1-630th of an inch in diameter (septal divisions of the chambers omitted; intervals between the dotted lines showing the "rows"); *n*, ditto, ditto, with the central (1) and circumambient (2) cells, very large; the former spherical, the latter almost oblong. Septal divisions of chambers *inserted*.

o. Some of the central chambers of the horizontal plane and columnar chambers charged with propagative spherules. Propagative spherule 1-3000 to 1-2000th of an inch in diameter.

Fig. 2. *Orbitolites Mantelli*: *m*, central portion of the horizontal plane or chamber-layer magnified, to show the cyclical growth of the rows: 1, central or germ-, and, 2, circumambient cells, very large. Chambers omitted; intervals between the dotted lines showing the "rows;" *n*, ditto, ditto, showing the engine-turned arrangement of the rows at the commencement. Central and circumambient cells very small, the largest not more than 1-4000th of an inch in diameter. Chambers *inserted*.

o. Fragment of horizontal chamber-layer, to show how an additional row (1) commences by a stolon from the preceding annular band. From an uninfiltrated specimen.

N.B. All these figures are more or less magnified, unproportionally.

Fig. 3. *Orbitoides asterifera,* asteroid variety (?) of *O. dispansa,* twice the size of the specimen.

Fig. 4. *Alveolina meandrina,* n. sp., nat. size: *a,* magnified view of surface, showing the tortuous form of the chambers; *b,* longitudinal section through the centre, showing the spiral arrangement of the layers of chambers (the fine lines across the layers represent the vertical canals of the reticulated structure); *c,* transverse section near the centre, showing the spiral manner in which the chambers depart from the longitudinal axis; *d,* transverse section much more magnified, showing the spiral commencement of the layers; *e,* magnified view of a portion of the surface, showing, on one side (1) the reticulated plexus of canals which occupies the external aspect of the chamber, and corresponds to the "marginal plexus" in the "spicular cord" of *Operculina arabica*; 2, portion from which it has been removed, showing the vertical canals between the chambers on which the reticulated portion rested, and thus communicated with the reticulated plexus below (better seen in the next diagram).

f. Diagram to show the canal-structure surrounding the chambers: 1, chambers; 2, marginal plexus or reticulation; 3, vertical canals uniting the marginal plexuses, and corresponding to the "interseptal canals" in *Operculina.*

Fig. 5. *Orbitolina lenticularis,* nat. size: *a,* conoidal surface; *b,* base or patulous surface; *c,* lateral view.

d. Diagram showing—1, arrangement of chambers at the centre or apex, which is at first more or less confused, and then cyclical; 2, external or reticulated chamber-layer; 3, subjacent or large chamber-layer; 4, engine-turned arrangement of chambers below the last-mentioned layer.

e. Magnified view of portion of patulous surface, to show the arrangement of the ends of the columnar chambers in the form of granulations.

f. Horizontal section, showing—1, reticulated layer; 2, large chamber-layer; 3, columnar chamber-structure.

g. Vertical section of half the fossil, showing—1, reticulated layer externally; 2, large chamber-layer; 3, columnar chamber-structure. This section corresponds to fig. 7 *e* of *Conulites Cooki,* but is without the opake white columns of condensed shell-substance, thus bearing the same relation in this respect to *Conulites* that *Orbitolites Mantelli* does to *Orbitoides dispansa.*

Fig. 6. *Orbitolina* ——?, flat variety, nat. size, resembling *Cyclolina cretacea,* D'Orb.: *a,* conoidal surface; *b,* concave surface or base; *d,* vertical section through the centre. The structure is exactly the same as that of *O. lenticularis.*

Fig. 7. *Orbitolina* ——? (No. 2), nat. size: *a,* base; *b,* diagram showing on one side the reticular layer, and on the other the large chamber-layer. The reticulated structure is more dense here, and the large chambers larger, than in *O. lenticularis.*

Fig. 8. *Orbitolina* ——? (No. 3), nat. size: *a,* horizontal section; *b,* portion of surface magnified to show the absence of reticulated structure and imperfectly developed septa of the large chambers.

Fig. 9. *Orbitolina* ——? (No. 4), nat. size: *a*, diagram showing long chambers of surface in upper part, and vertical section through the centre, below.

Fig. 10. *Operculina arabica*: spicule magnified, showing shreds of the interspicular substance (*a*) attached to it.

Fig. 11. The same. Truncated end of the "spicular cord," the arrangement of the great horizontal canals of the "marginal plexus," and the spicules in alternate layers more or less radiating from a central point: *a*, spicular cord; *b*, spiral laminæ; *c*, cavity of chamber; *d*, truncated ends of canals; *e*, truncated ends of spicules; *f*, vertical tubuli of spiral laminæ; *g*, projection of a portion of the spicular cord into the chamber.

Here it will be observed that all the truncated ends of the spicules are not of the same size, which arises from their being so arranged as to interdigitate and overlap each other longitudinally in the general structure, the point of one ending over the middle of another, &c. The projecting portion into the chamber (*g*) only happens where the cord is prolonged inwards to receive the "interseptal canals."

[This diagram, in its prominent features, is drawn from nature, with the minor and unimportant detail supplied from imagination and memory.]

Fig. 12. The same. Portion of the outer part of a chamber (taken from a dried specimen in which the animal was living when it was taken) relieved from its calcareous matter by a very weak solution of nitric acid and alcohol: *a*, lateral portion of chamber made up of small bodies having a hole or depression in the centre, being the remains of the vertical tubuli; *b*, "bodies" more magnified; *c*, septal boundary of chamber in which these bodies are absent, but presenting canals of communication between the cavity of the chamber and the interseptal canals, all now rendered membranous; *d*, interseptal vessel; *e*, chamber laid open, showing small and large reproductive spherules in its cavity, and passing through the canals of intercommunication (*f f f*) into the interseptal canal.

Fig. 13. The same. Small reproductive spherule, composed of a globe of glairy substance surrounded by a transparent spherical capsule. 1-5400th of an inch.

Fig. 14. The same. Large reproductive spherule similarly composed, but with the central portion become opake and granular. Size 1-1800th of an inch.

Compare these two figures with the propagative spherules of *Amœba verrucosa*, Ehr., and *Euglypha pleurostoma*, Cart. (figs. 12 & 19, pl. 1. vol. xx. Ann. Nat. Hist. 1857) and of *E. alveolata* (figs. 32 & 33. pl. 5. vol. xviii.).

Fig. 15. *Nummulites Ramondi*, mihi; vertical section of some of the outer chambers highly magnified to show the presence of the propagative spherules and the two great "spiral canals" of Dr. Carpenter: *a*, spicular cord; *b*, spiral laminæ; *c*, chambers; *d*, continuation of the chamber towards the centre; *e*, spherules; *f f*, truncated ends of the great spiral canals; *g*, interseptal canal sending off two branches to communicate with the great spiral canals respectively.

XLVI.—*Contributions to an Insect Fauna of the Amazon Valley.* Coleoptera : Longicornes. By H. W. Bates, Esq.

[Continued from p. 219.]

c. Fore tibiæ neither dilated nor compressed.

10. *Acanthoderes albolinitus*, n. sp.

A. elongatus, subcylindricus, tenuiter tomentosus, fulvo-brunneus: elytris apice conjunctim rotundatis, pone medium plaga communi antice biramosa griseo-alba et vitta abbreviata nigra utrinque ornatis. Long. $8\frac{1}{2}$ lin. ♀.

Head dingy fulvous, punctured. Antennæ stout, as long as the body, fulvous brown, each joint from the third ringed with dusky near the apex. Thorax with the lateral tubercles large, conical, and pointed; the two dorsal tubercles connected by ridges with the hind margin; the dorsal line strongly elevated, the interstices coarsely punctured. Elytra elongate, very slightly narrowed posteriorly; the apices scarcely perceptibly truncated, somewhat convex, the centro-basal ridges strongly raised at the base, subsiding before the middle; the whole surface punctured, each puncture having a greyish-white scale: the colour is light yellowish brown; behind the middle, over the suture, is an ill-defined greyish-white patch, prolonged on each side in front into an oblique streak: on the disk of each elytron, behind the middle, there is also a short inwardly curved black vitta connected by a zigzag line with the lateral margin. Body beneath and legs black, shining, clothed with thin ashy pile; apex of tibiæ and tarsi fulvous. The prosternum is simply rounded; the mesosternum bituberculate in front.

One individual only of this aberrant species occurred: I found it at Ega, on a slender dead branch.

11. *Acanthoderes longispinis*, n. sp.

A. elongatus, subconvexus, tenuiter tomentosus, brunneo-fulvus: elytris plagis pallidioribus, maculis nonnullis punctisque numerosis nigro-brunneis ornatis, apice sinuato-truncatis, angulis externis in spinam longissimam productis. Long. 8 lin. ♀.

Head dingy fulvous, impunctate, front uneven, channeled; lower lobe of the eyes very large for this genus, reducing therefore the breadth of the forehead. Antennæ slender, as long as the body, piceous brown, each joint ringed with testaceous at the base. Thorax fulvous, varied with dark brown; lateral tubercles large, very acute, dorsal ones very large, elongated, and obtuse; the disk with a few coarse punctures. Elytra curvilinearly attenuated posteriorly, the centro-basal ridges slightly raised towards the base only, the surface faintly punctured, the punctures numerous only near the sides towards the base; on the disk they are accompanied by granulations; the colour is fulvous brown; there is an oblique ochreous spot on each, near the base, and a waved transverse patch of the same colour near the apex, both edged behind with dark brown; the punctures are covered by small dusky spots; there is a strongly waved transverse spot behind the middle, and three or four smaller ones on the margins, also dark brown; the suture is tessellated with black and grey. Body beneath black, clothed with shining silvery pile. Femora piceous, clothed with grey pile; tibiæ dusky, with two pale rings, their apices and the first tarsal joint covered with silvery pile; second and third joints black, tip of the latter and claw-joint reddish testaceous; the third joint fulvous beneath. The prosternum is simply rounded; the mesosternum vertical in front, and bituberculated.

Taken in the forest on the banks of the Cupari, Tapajos region. One example.

12. *Acanthoderes pigmentatus*, n. sp.

A. elongatus, subparallelus, depressus, tenuiter tomentosus, violaceo-brunneus, flavo nigroque variegatus: antennis crassis corpore multo longioribus, articulis 3–4 fortius sulcatis: elytris apice truncatis, angulis externis productis. Long. 8 lin. ♂.

Head plane in front, punctured, dusky brown, vertex paler and ornamented with two round black spots. Antennæ thick, brown, each joint from the third with two pale rings. Thorax with the lateral tubercles prominent, their apices produced and acute; the dorsal tubercles strongly raised, but obtuse, interstices punctured; violet-brown, with fulvous patches. Elytra gradually but very slightly narrowed posteriorly, the centro-basal ridges very feebly raised, granulated; their whole surface sparingly but coarsely punctured; the colour is violaceous brown, varied on each elytron with three discoidal angular dark-brown patches, viz. one near the base, one behind the middle, and the third near the apex; there is, besides, a transverse bowed yellowish streak behind the basal patch; the apical spot is also broadly margined with yellow; each elytron has a short white streak on the disk; the punctures are each covered with a dusky spot; the suture is tessellated with black and grey. Beneath and femora black, slightly shining, but clothed with yellowish-grey pile; tibiæ brown, with three pale rings; tarsi fulvous, second joint dusky. The pro- and mesosterna are both simply rounded, their surfaces closely punctured. The fore tarsi of the ♂ are slightly dilated; the first joint of the middle and hind tarsi are remarkably elongated for this genus.

One individual, taken at Tabatinga, on the Peruvian frontier. In the slenderness of the tarsi this species differs greatly from the rest of its congeners. This, however, is evidently merely a specific character, as the species is extremely nearly allied to *A. cylindricus* (*Ægomorphus* id., Dj. Cat.)* of Rio Janeiro, which possesses tarsi constructed as in the rest of the genus.

13. *Acanthoderes phasianus*, n. sp.

A. modice elongatus, depressus, tenuiter tomentosus, fulvo, flavo-griseo, cano nigroque multifariam variegatus: thoracis tuberculis dorsalibus fortissime elevatis: elytris apice late sinuato-truncatis, angulis externis in spinas longas productis. Long. 6 lin. ♂.

Head piceous, varied with paler shades, two rounded fulvous spots on the vertex, front uneven. Antennæ much longer than the body; basal joint black, with grey pile, remaining joints piceous, third and fourth with two greyish rings, the rest pale at their bases. Thorax with the lateral tubercles large, acute, the dorsal ones very large, conical, the interstices punctured; dusky brown, with fulvous streaks and spots. Elytra very slightly narrowed posteriorly, very sparingly granulate-punctate near the base; the centro-basal ridges produced forwards at the base, thence gradually subsiding towards the middle: the colour towards the base is brownish-black, varied on each elytron with four rounded fulvous spots edged with grey; the apical third is fulvous, edged in front with greyish, but near the apex with brownish black; there is a comma-shaped whitish mark on the disk of each before the middle, a large dark-brown V-shaped mark behind the middle; the rest is a combination of dusky brown, light grey, and fulvous minutely commingled. Body beneath shining black, clothed with grey pile. Femora dusky, each with a large fulvous spot: tibiæ and tarsi spotted with fulvous and dusky, the third and fourth tarsal joints being clear fulvous. The fore tarsi of the ♂ are strongly dilated and fringed. The prosternum is simple and rounded, the mesosternum subvertical and bituberculated.

One example taken at S. Paulo, on the Upper Amazon.

* *Acanthoderes cylindricus*, n. sp.—Elongatus, parallelus, depressus. Caput fuscum; fronte plana, punctata, opaca; vertice punctis duobus ocellaribus nigris iridibus flavis. Antennæ corpore longiores, piceæ, griseo-maculatæ. Thorax punctatus, fuliginosus, sericeus fulvo-variegatus, tuberibus lateralibus magnis, spiniferis, dorsalibus conicis acutis. Elytra perparum attenuata, apice sinuato-truncata, angulis internis acutis, externis productis, passim granulato-punctata densius prope basin, utrinque obsolete bicarinata; fulvo-brunnea, apices versus griseo-varia, utrinque pone medium macula angulata nigra notata. Subtus niger, pilis cinereis vestitus. Pedes fusci, griseo-maculati. Sterna ut in *A. pigmentato*. Long. 8 lin. ♀.

14. *Acanthoderes meleagris*, n. sp.

A. modice elongatus, depressus, postice attenuatus, tenuiter tomentosus, griseo, fulvo nigroque læte variegatus, capitis thoracisque lateribus griseis: elytris trigonis, breviter truncatis, angulis externis in spinas longas productis. Long. $5\frac{1}{2}$–$6\frac{1}{2}$ lin. ♂ ♀.

Head sparingly punctured, varied with black and fulvous, sides clear pale grey. Antennæ rather short, black, the base of each joint from the second grey. Thorax with the lateral tubercles prominent and acute, the dorsal ones large, but only slightly elevated, interstices with a few large punctures; black varied with fulvous, the sides clear pale grey. Elytra briefly truncate at the apex, the outer angle armed with a long spine; centro-basal ridges prominent at the extreme base, each prolonged posteriorly as a smooth flexuous carina to the apical spine; sparingly punctured near the base and on the sides; pale grey, numerous small spots and three larger transverse patches brownish black, varied also with fulvous spots, chiefly near the scutellum, at one-third and at two-thirds the length. Body beneath, and legs black, spotted with light grey; the third and fourth tarsal joints fulvous. The opposing faces of the pro- and mesosterna are steeply inclined and bituberculated.

Taken at Ega and S. Paulo, on dead branches of trees.

15. *Acanthoderes Swederi*, White.

Acanthoderes Swederi, White, Cat. Long. Col. in Brit. Mus. ii. p. 360, pl. 9. fig. 6.

This is a common species near Pará, on dead trees; it is also found on the Upper Amazons and at Cayenne. In most collections it stands as *A. Daviesii* of Swederus and Olivier; but the descriptions of these authors, according to Mr. White, apply to a distinct Columbian species. The excellent description and figure quoted above are sufficient to make the insect perfectly well known. I will only add that the opposing faces of the pro- and mesosterna are steeply inclined and bituberculated, and that the fore tarsi of the ♂ are widely dilated and densely fringed.

16. *Acanthoderes chrysopus*, n. sp.

A. parum elongatus, valde depressus, postice paulo attenuatus, tenuiter tomentosus, rosaceo-fulvus maculis pallidioribus variegatus: elytris subtrigonis, apice late truncatis, angulis externis modice productis: tarsis aureo-fulvis. Long. 6 lin. ♂.

Head silky fulvous. Antennæ twice the length of the body, ferruginous, silky, base of each joint (from the third) greyish. Thorax with the lateral and dorsal tubercles equal in size and shape, large, conical, produced at their apices, rusty brown, punctured only on the fore and hind margins. Elytra with the centro-basal ridges much produced at the base, prolonged behind as smooth flexuous carinæ, to the apex; sparingly granulate-punctate on the ridges and on the sides near the base; the colour is fulvo-ferruginous, with a rosy tinge; near the base of each are two fulvous-yellow spots, and near the apex a large spot of the same colour, all encircled with dark brown; there are, besides, a few hoary-white specks scattered over the surface. Beneath, the body is black clothed with hoary pile, the apical half of the abdomen being yellow spotted with white pile. Femora black at the base, rusty-yellow on their apical halves; the tibiæ and tarsi are silky orange-yellow, the former ringed with dusky, the latter shining. The fore tarsi of the ♂ are broadly dilated and densely fringed. The opposing faces of the sterna are vertical and bituberculate.

At Ega, on severed and hanging woody lianas in new clearings. I consider it a local variety of the following, from which it differs in the more vivid coloration.

17. *Acanthoderes lotor*, White.

Acanthoderes lotor, White, Cat. Long. Col. in Brit. Mus. ii. p. 362.

The shape, sculpture, form of sterna, &c., are precisely the same as in *A. chrysopus*. I met with it only at Carepi, near Pará.

18. *Acanthoderes lateralis*, n. sp.

A. modice elongatus, subdepressus, postice attenuatus, tomentosus, cinereo-brunneus, thoracis lateribus, maculisque duobus elytrorum, altera magna triangulari pone medium, altera parva prope apicem sæpe obsoleta, fuscis: elytris apice truncatis, angulis externis spina longa armatis. Long. 6–8 lin. ♂ ♀.

Head sooty-black, front and vertex ashy-brown. Antennæ about as long as the body, dusky, the third joint ringed with grey, 4–11 joints at the base testaceous grey. Thorax with the lateral tubercles prominent and acute, the dorsal ones prolonged into ridges, the dorsal line also forming a narrow ridge generally denuded; interstices punctured, ashy-brown, the sides sooty-black. Elytra narrowed to the apex, which is briefly truncate, the external angles being produced into long spines; the centro-basal ridges are feebly raised at the base, but prolonged behind each as a flexuous carina, which subsides at two-thirds the length; the basal half is rather thickly granulate-punctate; in colour they are ashy-brown, with a large triangular spot on the side behind the middle, and a small irregular one near the tip, silky dark brown. Beneath and legs black, clothed with ashy pile; tibiæ with two pale rings. The fore tarsi of the ♂ are widely dilated and densely fringed. The prosternum is simply rounded, the mesosternum steeply inclined in front and bituberculated. The terminal joints of the male antennæ are moderately slender and ciliated beneath.

This is a common species throughout the Amazon region, on felled trees in the forest; it is also common, apparently, in French Guiana. I have seen it in collections under the name of *A. lateralis*, Dej., which appellation I have adopted. *A. Jaspideus*, Germar (Sp. Nov. p. 475), and *A. consentaneus*, Dej., according to specimens sent to me by M. Deyrolle of Paris, are closely allied to *A. lateralis*; but their pro- and mesosterna are strongly convex. Our species is also near *A. satellinus*, Erichs. (Consp. Insect. Peru., p. 143); but the latter is described as having the apex of the elytra armed with a very short spine.

19. *Acanthoderes bivitta*, White.

Steirastoma bivitta, White, Cat. Long. Col. in Brit. Mus. ii. p. 354.

This species was placed by Mr. White, whose description otherwise is a very good one, in the genus *Steirastoma*. It differs from that group in having simple instead of complex lateral thoracic tubercles. It stands in certain French collections as *A. tardigradus* of Dejean's Catalogue. It is a common insect, in the Upper Amazons, on the trunks of felled trees of a certain species, to whose bark its colours are assimilated. It is found also in French Guiana. It is inactive in its habits, but appears to be extremely prolific. The opposing faces of the pro- and mesosterna are steeply inclined and bituberculated.

§ 2. Antennæ with the terminal joints thickened and ciliated in the males, or triangularly dilated in both sexes; the third or third and fourth joints often furnished with tufts of hairs. (*Pteridotelus*, White, in part.)

[Although so diversified in structure and ornamentation of antennæ, this group is homogeneous in the form of the body, sterna, and in other respects.]

20. *Acanthoderes spectabilis*, n. sp.

A. elongatus, subdepressus, postice attenuatus, niger, velutinus, maculis magnis albis ornatus: antennarum articulo tertio scopa magna nigra instructo. Long. 8 lin. ♂ ♀.

Head black, with a triangular white spot in the middle of the forehead, two between the antennæ of the same colour, and two rounded on the vertex. Antennæ black, base of the fourth and following joints grey, the third joint encircled by a thick brush of black silky hairs, which extends nearer to the base on one side than on the other. Thorax with the lateral and dorsal tubercles large, conical, and acute; velvety-black, with two large rounded spots on each side, two elongate ones on the fore part, which are divergent behind, and another in the middle of the hind margin, white. Elytra elongate-trigonal, depressed together down the suture, the apex obliquely sinuate-truncate, outer angles acute; the centro-basal ridges much raised at the base, projecting over the hind edge of the thorax, prolonged behind to the apex, and granulated at their commencement; the surface impunctate, except on the suture near the base; the colour is velvety-black, each elytron having two spots along the suture behind the scutellum, a broken sutural stripe from the middle to the apex, a spot near the shoulders, a large rounded one near the lateral margin before the middle, a small one near the apex, and one in the middle of the disk, all of a white colour. Body beneath black, sides of the sterna and abdomen having large white spots. Femora and tibiæ black clothed with grey pile; tarsi fulvous. The opposing faces of the prosternum and mesosternum are subvertical and sharply bituberculated. The four apical joints of the antennæ in the ♂ are shortened and ciliated.

This extremely beautiful species occurred only at Caiçara, a village near Ega, on the Upper Amazons, on the trunks of felled trees in the forest.

Genus Dryoctenes, Serv.

Serville, Ann. Soc. Ent. Fr. iv. 24.

As already remarked, there is no character to distinguish this genus from *Acanthoderes*, with which it will eventually have to be incorporated. The species have a much broader and more depressed form of body, and the antennæ are much longer, than is the rule in the genus alluded to. The proportions of the antennal joints, form of muzzle, legs, male tarsi, and thorax are the same as in *Acanthoderes*. In the style of coloration and markings the species resemble most *A. bivitta* and its nearest allies.

Dryoctenes scrupulosus, Germar.

Lamia scrupulosa, Germ. Insect. spec. nov. 470, 619.

There appear to be two somewhat distinct forms or geographical races of this species. The example before me, taken on the banks of the Tapajos, differs considerably in colours and in the shape of the elytra at the apex from the form found at Rio Janeiro. The description of Germar with reference to the elytra ("glauco-tomentosa, apice truncata, intus dentata") applies to the Amazonian example better than to those I have seen from the south of Brazil. I do not know whether the latter may not be the form described by Serville as *D. caliginosus,* his description not being sufficiently exact to decide. *D. caliginosus,* however, is generally considered to be synonymous with *D. scrupulosus* of Germar.

Genus Ozotroctes, nov. gen.

Head somewhat narrow, antenniferous tubercles raised and oblique. Palpi obliquely truncated at their apices, the labial more strongly so than the maxillary. Thorax obtusely unituberculate on the sides, furnished with two very distinct tubercles on the disk. Prosternum simply rounded; mesosternum much narrowed behind, steeply inclined in front. Elytra very slightly truncated at the apex. Legs and tarsi constructed as in *Acanthoderes*: the male sex, however, is as yet unknown. The antennæ are simple, the basal joint pyriform-clavate, shorter than the third; the second and third joints slightly furrowed above.

The truncation of the palpi and the attenuation posteriorly of the mesosternum amply distinguish this genus. The shape of the palpi is an anomaly amongst the Lamiaires, the pointed terminal joints being one of the very few characters which distinguish the tribe from the Cerambycides. The facies of the insect composing this genus, however, is entirely that of a Lamiaire, the shape of the thorax and elytra being almost precisely that of certain abnormal species of *Acanthoderes,* e. g. *A. hebes.*

Ozotroctes punctatissimus, n. sp.

O. oblongo-ovatus, subdepressus, obscure brunneo-ferrugineus: corpore supra punctis rotundis innumerosis impresso. Long. $4\frac{1}{2}$ lin. ♀.

Head brown, punctured. Antennæ about as long as the body, rufo-piceous, all the joints ringed with a paler shade. Thorax with the dorsal tubercles very distinct, conical, the rest of the surface almost even, punctured. Elytra very slightly truncated at the extreme apex, the centro-basal ridges short, the whole surface covered with punctures of a uniform size, partly arranged in rows. Beneath ashy-brown, shining. Legs dull ferruginous, spotted with a paler shade.

One individual, beaten from dried twigs in woods near Santarem.

[To be continued.]

XLVII.—*On the* Scalidæ *or "Wentletraps" of the Sea of Japan; with Descriptions of some new Species.* By Arthur Adams, F.L.S. &c.

The Japanese Islands form a portion of that great submarine chain of mountains, upwards of six thousand miles in length, which extends from the Philippine Islands on the south to the Kurile and Aleutian Islands on the north. It is therefore natural to suppose that species of Mollusca hitherto found only among the Philippine group should be discovered among the Japanese Islands, especially when the influence of the Gulf Stream is taken into consideration, which extends as far as Niphon, and even induces a current through the Korea Strait into the Sea of Japan.

I have observed in the waters of Japan numerous species of *Bullidæ, Cithara,* and *Mangelia,* brought by Mr. Cuming from the Philippines; and the same is the case, as we shall now show, with the *Scalidæ* or "Wentletraps."

1. Genus Scala, Klein.

Shell solid, turbinate or turreted; whorls ribbed. Aperture circular; peritreme with a marginal varix.

1. *Scala Pallasii,* Sow. Mon. Scalaria, figs. 14, 15, 16.

Hab. Korea Strait; 46 fathoms.

Found also by Mr. Cuming in the Philippines.

2. *Scala aculeata,* Sow. Mon. Scalaria, figs. 35, 36, 37.

Hab. Tsu-Sima; 16 fathoms.

Found by Mr. Cuming in the Philippines.

3. *Scala replicata,* Sow. Mon. Scalaria, figs. 23, 24.

Hab. Mino-Sima; 63 fathoms.

Brought by Mr. Cuming from Lord Hood's Island.

4. *Scala obliqua,* Sow. Mon. Scalaria, fig. 69.

Hab. Mino-Sima; 63 fathoms.

No locality is given by Mr. Sowerby.

5. *Scala muricata,* Kien., Sow. Mon. Scalaria, figs. 29, 31, 32.

Hab. Mino-Sima; 63 fathoms.

"A common West-Indian species." (Sow.)

6. *Scala pulcherrima,* Sow. Mon. Scalaria, fig. 92.

Hab. Mino-Sima; 63 fathoms.

Found by Mr. Cuming in the Philippines.

7. *Scala rubrolineata,* Sow. Mon. Scalaria, figs. 83, 84.

Hab. Mino-Sima; 63 fathoms.

No locality is given by Mr. Sowerby.

8. *Scala irregularis,* Sow. Mon. Scalaria, fig. 40.

Hab. Mino-Sima; 63 fathoms.

Brought by Mr. Cuming from the Philippines.

9. *Scala turricula,* Sow. Mon. Scalaria, figs. 61, 68.

Hab. Korea Strait; 46 fathoms.

Stated by Mr. Sowerby to be found both in the Philippines and West Indies.

10. *Scala eximia,* Adams & Reeve, Zool. Voy. Sam. pl. 11. fig. 16.

Hab. Mino-Sima; 63 fathoms.

Found also in the Yellow Sea.

11. *Scala trabeculata,* A. Adams.

S. testa elevato-turbinata, imperforata; anfractibus convexis; suturis profundis; costis prominentibus, tenuibus, fimbriatis, distantibus, ad latera sinistra transversim liratis, ad suturas productis et angulatis, interstitiis trabeculis transversis prominentibus distantibus instructis; regione umbilicali lira conspicua circumcincta; apertura circulari, varice marginali lato, lamellari, dilatato, fimbriato.

Hab. Mino-Sima; 63 fathoms.

12. *Scala fimbriata,* A. Adams.

S. testa turrito-turbinata, imperforata; anfractibus 7, convexis; suturis profundis; costis lamellatis prominentibus, fimbriatis, distantibus, postice valde angulatis, interstitiis liris transversis elevatis distantibus ornatis; regione umbilicali carinula nodulosa circumcincta; apertura circulari, varice marginali lato, lamellari, fimbriato, antice producto et vix everso, postice late angulato.

Hab. Mino-Sima; 63 fathoms.

13. *Scala optabilis,* A. Adams.

S. testa pyramidato-turbinata, perforata, sordide alba, maculis irregularibus rotundis fulvis pallidis picta; anfractibus $5\frac{1}{2}$, convexis; suturis profundis, longitudinaliter costatis; costis tenuibus, prominentibus, distantibus, ad suturas obtusim angulatis, interstitiis creberrime transversim striatis; apertura subcirculari, varice marginali tenui, subexpanso, everso, et umbilicum partim obtectante.

Hab. Mino-Sima; 63 fathoms.

This species requires to be minutely examined before all its beauty can be discovered. The pale clouded spots between the ribs and the delicate striation of the surface are its most distinguishing features.

14. *Scala elegantula,* A. Adams.

S. testa turrito-turbinata, imperforata; anfractibus 7, convexis, superne contabulatis; suturis profundis; costis tenuibus, distantibus, prope suturas angulatis, interstitiis valde transversim striatis; apertura circulari, varice marginali crasso, rotundato, postice oblique angulato.

Hab. Mino-Sima; 63 fathoms.

Most like *S. fimbriata* in form, but very much smaller; the nucleolar whorls, however, are different, showing it to be an adult shell.

15. *Scala spiralis,* A. Adams.

S. testa turrito-turbinata, alba; anfractibus $6\frac{1}{2}$, convexis, disjunctis; suturis valde profundis; longitudinaliter costata, costis prominentibus, reflexis, distantibus, prope suturas rotundate angulatis, interstitiis valde transversim striatis; anfractu ultimo soluto; apertura circulari, varice marginali crasso, expanso, antice dilatato.

Hab. Mino-Sima; 63 fathoms.

This elegant species resembles in form *S. obliqua,* Sow.; but it is thick and solid, and transversely striated; the ribs also are fewer and stronger. It also resembles in form *S. cochlea*; but that species is a varicose *Cirsotrema.*

16. *Scala præclara,* A. Adams.

S. testa pyramidali-acuminata, imperforata; anfractibus numerosis, prope suturas elevatis; suturis profundis; varicibus lamellatis distantibus replicatis, superne acute angulatis, interstitiis valde liratis, liris distantibus; apertura subcirculari; labio incrassato; labro postice dentato.

Hab. Korea Strait; 46 fathoms.

In form this very beautiful species somewhat resembles *S. gradata,* Hinds, from Amboyna; but the varices are thin and lamellar, and the interstices are transversely lirate.

17. *Scala liliputana,* A. Adams.

S. testa parva, ventricosa, globoso-conica, late umbilicata, alba; anfractibus $3\frac{1}{2}$, valde convexis; suturis profundis; varicibus tenuibus, distantibus, interstitiis spiraliter transversim liratis; apertura circulari.

This charming Liliputian species most nearly resembles in form *Scala scalaris*, Linn.; but the varices are thin, and the interstices conspicuously lirate.

Subgenus *Clathrus*, Oken.

18. *Scala hexagona*, Sow. Mon. Scalaria, fig. 67.

Hab. Awa-Sima; in shell-sand.

If I am right in the identification of the species, it is also found, according to Mr. Sowerby, at Acapulco.

19. *Scala elenensis*, Sow. Mon. Scalaria, fig. 102.

Hab. Mino-Sima; 63 fathoms.

Found, if I am right in my determination of the species, also in West Columbia.

2. Genus Amæa, H. & A. Adams.

Shell thin, turreted; whorls cancellated. Aperture irregular; peritreme simple, acute.

1. *Amæa magnifica*, Sow.

Scalaria magnifica, Sow. Mon. Scalaria, fig. 103.

Hab. Mino-Sima; 63 fathoms.

Also from China, Yellow Sea, &c.

2. *Amæa decussata*, Lamk., Sow. Mon. Scalaria, fig. 140.

Scalaria cancellata, Rumph.

Hab. Mino-Sima; 63 fathoms.

"Coast of Arabia," Mr. Sowerby.

3. Genus Cirsotrema, Mörch.

Shell solid, imperforate; whorls striated or cancellated, often with irregular varices. Aperture circular; peritreme with a marginal varix.

1. *Cirsotrema sulcatum*, Sow. Mon. Scalaria, fig. 111.

Hab. Mino-Sima; 63 fathoms.

Brought also from the Philippines by Mr. Cuming.

2. *Cirsotrema bicarinatum*, Sow. Mon. Scalaria, figs. 113, 114.

Hab. Mino-Sima; 63 fathoms.

Brought also by Mr. Cuming from the Philippines.

3. *Cirsotrema suturale,* Hinds, Sow. Mon. Scalaria, fig. 120.

Hab. Korea Strait; 46 fathoms.

Found also by Mr. Hinds at Malacca.

4. *Cirsotrema undulatum,* Sow. Mon. Scalaria, fig. 136.

Hab. Korea Strait; 46 fathoms.

No locality is given by Mr. Sowerby.

5. *Cirsotrema crassilabrum,* Sow. Mon. Scalaria, figs. 115, 116.

Hab. Mino-Sima; 63 fathoms.

Also from the Philippines and Central America, according to Mr. Sowerby.

6. *Cirsotrema cribrarium,* A. Adams.

C. testa elongata, crassa, turrita, imperforata; anfractibus 7, planulatis, inferne subnodosis, longitudinaliter costatis; costis validis, distantibus, undulatis, interstitiis minutissime cancellatis quasi cribrariis; apertura ovata; labro incrassato.

Hab. Tsu-Sima; 26 fathoms.

Most nearly resembles *C. crassilabrum,* Sow.; but the whorls are punctate-cancellate, and the peritreme is not broadly marginate.

7. *Cirsotrema Turbonilla,* A. Adams.

C. testa elongata, turrita, crassa, imperforata; anfractibus 7, convexis, longitudinaliter costatis; costis crassis, undulatis, prominentibus, interstitiis crebre striatis, striis transversis, elevatiusculis; apertura late ovata; labro margine incrassato, antice vix producto.

Hab. Mino-Sima; 63 fathoms.

A thick-ribbed turreted species, most like *C. crassicostatum,* Gray, the locality of which is not given by Mr. Sowerby.

4. Genus Constantia, A. Adams.

Shell thin, ovate or turbinate, imperforate; whorls decussate or cancellate. Aperture oblong; peritreme simple, acute.

1. *Constantia elegans,* A. Adams, Ann. Nat. Hist. 1860, vol. v.

Hab. Mino-Sima; 63 fathoms.

2. *Constantia Tantilla,* A. Adams.

C. testa parva, tenui, semipellucida, imperforata, albida; anfractibus $4\frac{1}{2}$, convexis, plicis tenuibus longitudinalibus distantibus et liris transversis decussatis; regione umbilicali impressa; apertura subcirculari; labio vix incrassato; labro simplici.

Hab. Tabu-Sima; 25 fathoms.

A small thin species with plicate whorls crossed by regular elevated transverse liræ.

5. Genus Scaliola, A. Adams.

Shell thin, turreted, perforate; whorls rounded, agglutinate. Aperture circular; peritreme simple, acute.

Scaliola bella, A. Adams, Ann. Nat. Hist. 1860, vol. vi.

Hab. Tabu-Sima; 25 fathoms.

An examination of fresh specimens of this little genus proves that it has the faculty, like *Helicina agglutinans* and the species of *Onustidæ*, of covering the surface of the valves with foreign bodies.

Shanghai, China,
May 3, 1861.

XLVIII.—*Additional Notes on some new Palæozoic Star-fishes.* By J. W. Salter, Esq., F.G.S., Geol. Survey of Great Britain.

[Plate XVIII. figs. 9, 10, 11.]

To the Editors of the Annals of Natural History.

Gentlemen,

In the Notes I sent you on the Silurian Starfishes (Annals, ser. 2. vol. xx. p. 321, pl. 9) one of the most doubtful points was the true position of the long-armed genus *Protaster* (fig. 4). It had all the appearance of an *Ophiura*, and yet there was so much apparent similarity to the accompanying genera of *Asteriadæ* as to suggest the expectation that they might be found nearly allied.

A fresh set of specimens of these beautiful fossils has cleared up the point, at least so far as it shows that *Protaster* possessed the usual madreporic plate of the *Asteriadæ*. Its position, and a slightly magnified view of the plate are given in the sketch, fig. 9.

There were also some important differences, when *Protaster* was compared with the *Ophiuridæ*, in the structure of the arms themselves; for the number of plates in a circuit of the arm was six in *Protaster*, four in all ordinary Ophiurids. This number, indeed, is constant; or if, as in *Ophiolepis*, the upper plate be sometimes divided, this is accidental, no species being known in which it is normally so. The six plates in a circuit were therefore supposed to result from the division of the upper and lower plates each into two pieces. But there was a manifest resemblance in the lower plates of the arm to the corresponding ambulacral plates or ossicles of *Palæocoma* (*ib.* fig. 3), and even *Palasterina* (fig. 2). Again, the passages for the ambulacral feet were supposed to be *outside* these two plates, between them and the marginal plates, which would be the right position for *Ophiura*, or a modified form of *Ophiuridæ*, as this was supposed to be.

Our fresh specimens clear up this point likewise, and show that in the structure of the ambulacra, as well as in the form, *Protaster* was only imitative of the *Ophiuridæ*.

The real shape of the ambulacral bones (fig. 11) is given from a perfect specimen; and a comparison between figs. 10 and 11 will show how the passages may *appear* to be outside the ossicles, and yet be really *between* them, as usual in *Asteriadæ*. The great size of the apertures encroaches so much on the length and breadth of the ossicle as to excavate it in the manner shown in fig. 11, which is a magnified view of two pairs of these bones. There is manifestly no room for the feet to protrude at *b*; and hence, till the narrow overhanging piece (*c*) was shown by these specimens, the aperture appeared to be outside the plate, as in *Ophiura*.

It is curious enough, but should hardly be surprising, to find a form belonging to one family so closely simulating those of another, even to minute details. No one, I am persuaded, looking merely to the general shape of these long-armed species, with their round disks apparently covered with scales *, and the twisting arms fringed with stiff spines, but would have referred them to the Ophiurid group. If he looked closer, he would find the plates composing the arms flattened squamæ, rather than thick ossicles, bearing combs of spines exactly like those borne by *Ophiuridæ*. The oral apparatus, if not quite like that of an Ophiurid, is at least very unlike that of a Star-fish; and there are even the pencils of spines which are conspicuous on the oral ossicles of the former group. Every character of the Asteriad group has been distorted, so to speak, in order to simulate that of another group; and when we detect Nature's innocent fraud, we can but wonder the more at her ingenuity.

I may just mention, in passing, the presence of the madreporiform tubercle on those curious forms figured lately by Prof.

* They are not really so, though Prof. E. Forbes described and figured them as such in Decade I. of the Geological Survey. The skeleton even of the disk is closely reticular, and the disk is membranous between the bones.

Wyville Thomson (New Edinb. Phil. Journal, new series, 1861, pls. 3, 4), which he calls *Echinocystites*, and considers to be a a passage-form from the *Cystideæ* towards the *Echinida* proper. I do not see why they may not be rather a passage-form from the Star-fishes to the *Echinida*; for *Agelacrinites* and *Edrioaster* were shown by Mr. E. Billings to be inflated star-fishes; and *Paleodiscus*, which Prof. Thomson admits to be allied to his new genus, has both a flattened form and transverse ambulacral ossicles with grooves between them. The position of the anus, near to the apical pole, as in many *Asteriadæ*, the higher development of the masticatory apparatus, and the thick clothing of the surface with spines might all receive explanation readily if this curious form were considered as a globular Star-fish, passing, by many of its characters (the perforated ambulacral plates especially), towards the *Echinida*.

I am, your obedient Servant,
J. W. Salter.

EXPLANATION OF PLATE XVIII.

Fig. 9. *Protaster Miltoni*, with magnified madreporic plate; from Leintwardine, Shropshire, in Lower Ludlow rock.
Fig. 10. Arm, under side: *a*, proximal end. The large passages for the feet are covered with a light tint.
Fig. 11. Ambulacral ossicles, magnified.

XLIX.—*On a Microzoal Bed in the Carboniferous Limestone of Clifton, near Bristol.* By W. W. Stoddart.

[Plate XVIII. figs. 1–8.]

The bed of limestone now to be described is, without exception, the most extraordinary and interesting that it has ever been the author's lot to examine. Numerous as are the small shells and fossils in many of the Tertiary beds of the Isle of Wight, Hampshire, and other places, yet they are all very far surpassed by the immense number of organisms in the Clifton bed; and so minute are these, that it is a rare occurrence to find one the eighth of an inch in diameter. The casts are so exquisitely perfect, that the cell-aperture of the zoophyte or the hinge-markings of the Entomostracan are frequently to be met with in a very good state of preservation.

The extensive section of the Carboniferous Limestone displayed at Clifton has for a long period been well known and frequently described by various geologists. The facility with which all its different beds may be reached has always afforded good opportunities for their study.

The section may be completely followed from the Upper Devonian beds, through the lower shales, massive beds, and upper shales of the Carboniferous series into the Millstone-grit.

As far as the author can ascertain, the fossil contents of the beds in question have never before been noticed.

The beds also, with the succeeding ones, cannot be identified with those enumerated in Mr. Williams's section as published by the Government Survey. They most probably ought to be placed between those numbered 419 and 430; but Mr. Williams's measurements differ so materially, that neither can be identical with the microzoal bed, which, for the sake of convenience, the author has named the "Bryozoa-bed." This discrepancy has very likely arisen from Mr. Williams having taken his section through some other part of the range, where the beds have thinned out.

The Bryozoa-bed is a well-marked red crystalline bed of limestone, and very ferruginous. It reaches 12 feet in thickness, and dips to the S.S.E. at an angle of about 60°.

The Bryozoa-bed is undoubtedly one deposit, because not the least bedding is observable, nothing more than the usual cleavage-joints of the limestone being visible. Another fact is that a piece taken from any part of the bed will exhibit the same kind and number of fossils, which is not the case with the two underlying beds, one 2 feet four inches and the other 2 feet 9 inches in thickness. Although the two latter have to the eye exactly the same appearance as the Bryozoa-bed, yet they are both unfossiliferous, or nearly so.

The absence of alumina in these beds is very remarkable, because the Lower Limestone shales are very argillaceous.

The fossils are casts, or else pseudomorphs, composed of peroxide of iron and silica. They are very brittle and porous, and insoluble in cold nitric and hydrochloric acids. About one-third consists of the most exquisite casts of infundibulate Bryozoa, showing the cells and their details in the most beautiful manner. The greater part of the remaining fossils are those of Encrinital ossicula, which generally are found detached from the column. When these are examined under a power of 60 diameters, their surface appears to be porous, the pores being arranged in a radiate order. Sometimes, though rarely, the ossicula occur attached to the central axis. Very few pelvic plates are met with, and those correspond to the genus *Poteriocrinus*. Besides the above, moulds quite as perfect of Entomostraca and Gasteropods are present.

The Bryozoa-bed is situated at the base of the Lower Shales, about 100 feet above the termination of the Old Red series.

The immense mass of fossil remains in this bed is almost incredible. Taken from any part, they constitute, at the very lowest calculation, 20 per cent. of the entire rock. From one avoirdupois pound of the rock the author obtained 1,600,000 distinct and perfect fossils, besides a large quantity of broken shells and other *débris*. Indeed the whole bed may truly be said to be composed of an immense mass of Microzoa united together by a crystalline calcareous cement.

The most remarkable feature is that, although the fossils are of genera that are usually found of a tolerably large size, and are so found in the superincumbent beds of the shales, yet here they are species so minute that they average from $\frac{1}{100}$ inch to $\frac{1}{20}$ inch in diameter. When separated from the limestone, their appearance is exactly that of having been sifted through a fine sieve.

This extraordinary deposit was evidently a submarine bank in the Carboniferous Sea, exposed to currents which would wash away the larger shells and zoophytes, from their offering a greater resistance to the water. The smaller organisms would be left as a deposit in the hollows or adhering to the ground, forming a smooth floor, over which the water could flow with unimpeded velocity.

Many instances of this action are now occurring on our own coasts. On the west side of Caldy Island is a sand-bank most singularly analogous to that of the limestone-bed in its contents. There the author collected a very numerous series of small shells which (with the exception, of course, of the Encrinites) very closely resembled the contents of the Bryozoa-bed both in numbers and size. Among others were small *Turritellæ*, *Cytheridæ*, young *Trochi*; and, what made the analogy more striking still, the only zoophytes were the *Salicornariæ*, which lay strewed about in great abundance, broken into joints exactly resembling the Carboniferous *Ceriopora*. Very probably, therefore, the Bryozoa-bed was once a bank similarly situated, and exposed to the same influences as this and many others that are equally well known. The Encrinites must, however, have been a very small species, from the perisomic plates being so diminutive. This fact alone would negative the supposition of some, that the remains may be those of the arms only, the larger columnar portions being washed away. The structure also precludes that idea, as the ossicula are those of the columnar as well as the brachial apparatus.

Very many more species of fossils occur than those given in the engraving (Pl. XVIII.), they being those most commonly met with. They are represented as they appeared with a power of 60 diameters, and sketched by means of a camera lucida. The measurements were taken in the usual way with an eye-piece micrometer.

Serpula omphalodes (Goldf.), Pl. XVIII. fig. 1.

Volutions from one and a half to two, the last rapidly enlarging; aperture acutely oval; shortest diameter $\frac{1}{25}$ inch, longest diameter $\frac{1}{17}$ inch.

Pleurotomaria pygmæa (n. sp.), figs. 2 & 2 *a*.

Trochiform; whorls three to four, slightly keeled at outer edge of the last volution, which last has a slight depression on its upper surface; height and breadth nearly equal, viz. about $\frac{1}{30}$ inch; the last whorl also more extended than the others. Some specimens exhibit traces of a raised ornamented band. Aperture semilunar.

These casts remind the observer strongly of those so often found in the Inferior Oolite; but as here they exist as casts only, they cannot be identified with any of the larger and more perfect Carboniferous forms figured by Portlock or Phillips, and must, at any rate for the present, be regarded as a distinct species, both from the constancy of their size and some marks distinctive from those species more commonly known.

Turritella suturalis (Phill.), fig. 3.

Shell elongato-conical; whorls broad, prominent at upper and lower edges; base slightly swollen; about four volutions in $\frac{1}{22}$ inch; aperture somewhat semicircular.

These casts so nearly resemble the full-sized specimens in the Bristol Museum, which occur not far from the same spot, that the author has no hesitation in regarding them as identical, the only difference being that of age.

Euomphalus triangulatus (n. sp.), fig. 4.

Whorls three to four, slightly keeled at the upper part of each volution, which is there slightly swollen, giving the aperture a subtriangular shape.

This peculiarity is so different from any in the same section as to induce the author to give it the above specific term.

Cythere ovalis (n. sp.), figs. 5, 5 *a*, 5 *b*.

Valves oval, very convex; longitudinal ridge very distinct; ends of valves thickened and extending inwards, forming a kind of flange. In a few instances traces of denticulation occur at each end of base. Length $\frac{1}{19}$ inch; height $\frac{1}{28}$ inch.

This is undoubtedly a *Cythere*, both from its form and the strictly marine origin of the bed.

Cytherella lunata (n. sp.), fig. 6.

Ovato-oblong; dorsal edge slightly concave, giving the valves a tendency to a semilunar figure; valves unequal; length $\frac{1}{30}$ inch, height $\frac{1}{45}$ inch.

The very strong resemblance these Entomostraca have to the subgenus proposed by Mr. T. R. Jones in his Monograph on the Cretaceous species, as well as the constant and great peculiarity of one valve projecting beyond the other, give the author no hesitation in placing it among the *Cytherellæ*. It is a much smaller species than the last.

Ceriopora rhombifera (Goldf.), figs. 7, 7 *a*.

Polypidom cylindrical, jointed, dichotomous; cells rhomboidal, immersed, diverging from the axis, arranged in quincuncial order, and opening on the surface; aperture in centre of cell, labiate; cells $\frac{1}{90}$ inch long, $\frac{1}{180}$ inch broad; branches from $\frac{1}{57}$ inch to $\frac{1}{36}$ inch in diameter.

Poteriocrinus ——? fig. 8 *a, b, c, d, e, f*.

Ossicula (*a, b, c*) round, with a central aperture or depression, striated; striæ distant about $\frac{1}{300}$ inch; the largest ossicula about $\frac{1}{8}$ inch in diam., and the smallest $\frac{1}{12}$; the central aperture $\frac{1}{30}$ inch; the cast of the columnar cavity (fig. 8 *e, f*) = $\frac{1}{90}$ inch; perisomic plate (*d*) granulated, granulations $\frac{1}{480}$ inch in diameter, and distant about the $\frac{1}{300}$ inch.

From the almost universal dismemberment of the specimen, the species has not yet been determined. It is about the size of Major Austin's *P. isacobus*; and as this species occurs not far from the locality, it may very likely turn out eventually to be identical. Unfortunately, no measurements are given in Major Austin's very beautiful monograph.

A great many more forms abound in this remarkable deposit, and may with equal facility be separated from the matrix and removed in a perfect condition.

L.—*On the Influence of the Venation in the Reproduction of Monstrosities among Ferns.* By W. Kencely Bridgman, L.D.S., R.C.S.E.

In the propagation of Ferns, most of the "sports," or natural deviations from the typical form, may be reproduced from their spores; but, in thus multiplying them, it is well known that many of the plants so obtained revert to the ordinary normal character of the species.

The venation in these monstrosities being equally inconstant and variable in its arrangement—differing considerably in the same leaf in the amount of its departure from the normal direction—and the spore-cases being so intimately connected with it by springing directly from the back of the vein, these experiments were undertaken with a view to discover, if possible, how far the former circumstance might be dependent upon the condition of the veins and position of the receptacle from which the respective spores had been obtained.

In the first instance, a leaf from the multifid variety of the common Hart's-tongue (*Scolopendrium vulgare*, var. *multifidum*) had been procured, selecting one of the most distorted, and the spores from it collected indiscriminately and sown. The plants coming from these, to the extent of many hundreds, presented every grade of variation, from the simple ligulate with a single acute apex up to the complex form of the parent, and beyond, or, as fern-fanciers express it, "greatly improving the sport," and this not in one direction only, but resulting in the production of three distinct varieties. The direction of the veins in the lower portion of the leaf from which the spores had been taken was all but normal, some parts entirely so, upon which several of the sori had been placed. But towards the upper and above the middle portion of the leaf, the veins, losing their regularity and parallelism, became somewhat zigzag and reticulate, the indusium only partially developed, the sori smaller, more numerous, and nearer to the external margin. In the extreme upper or multifid and crisped terminal expansion, the mid-vein became broken up into a number of nearly equal divisions, and these again dividing and subdividing into a reticulate mass of veins and venules. Instead of the regularly formed sori, the spore-cases were distributed about in patches, without the slightest trace of an indusium, and attached by their pedicels to the back of some of the larger bundles of veins, and also, in the axils, in scattered masses, the indusium having become perfectly obsolete.

Another variety, the "*laceratum*" of Moore ('Nature-printed Ferns,' 8vo edition, vol. ii. pl. xcii.), was now selected, having the two characters of venation separate and distinct. The sori from all the reticulate portions of the leaf were carefully scraped off, and the spores sown in baked peat in a pan by themselves. The plants resulting from these (which were pricked out from a seed-pan 4 inches in diameter, where they had come up as thick as they could grow) *contained not a single plant which had not the* *strongly marked characteristic of the variety, and some far more crested and crisped than the parent.*

The spores from the remaining part of the leaf were sown in another pan, at the same time, and have produced an equally abundant crop. *There were not a dozen plants of the same character with the preceding; and, until the leaves were several inches long, with the exception of here and there a twin leaf, there were no external characters in the bulk of them to render their parentage recognizable.* A very large proportion of them were discarded as normal; and the only peculiarity at present shown among the remaining ones, the leaves of which average from 6 to 9 or 10 inches in length, and from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in breadth, is in a slightly sinuous margin, an occasional division of the apex into two or more lobes, and a disposition to become somewhat ragged—and this by no means general, but only one or two leaves on a plant.

But as these were planted out, not singly, but in little tufts, a number of plants grew together, thus giving the stronger ones the opportunity of outgrowing their weaker companions: this they speedily did; and whenever any of the previous type, which had been left to take their chance, were allowed to remain, they became weakly and made no way, while the others grew with great rapidity, showing the tendency by "selection," in this instance, to be strongly in favour of *retrogression*.

Similar experiments with other varieties and species have been attended with corresponding results. The tufted end of the variety "*Crista Galli*" of the same species (*Scolopendrium vulgare*) produced many hundreds of plants, all, with scarcely an exception, equally complex with the original, or more so; and, what is more remarkable, the parent plant was upwards of two years old before it began to develope its peculiar character, while the progeny raised from it were all prominently characteristic in the first leaves.

With such forms as *Nephrodium molle corymbiferum, Lastræa filix mas cristata, Scolopendrium marginatum*, &c., where the entire frond has become deformed and the whole of the venation abnormal, the plants raised from spores procured from any part of the leaf reproduce the variety with little or no variation. Out of some thousands of *Filix-mas-cristata* seedlings, only one reverted to the normal form, and two others closely approach the *angustata* of Sim, all the remainder being identical with the parent.

BIBLIOGRAPHICAL NOTICE.

A Manual of the Subkingdom Cœlenterata. By Joseph Reay Greene, B.A., Professor of Natural History in Queen's College, Cork. London, 1861. Longmans. 12mo.

After an interval of about two years, we have to notice the appearance of the second of Messrs. Galbraith and Haughton's series of scientific manuals; and it is not too much to say that in the execution of the present little work Professor Greene has fully equalled, if not surpassed, his former effort. The length of time that has elapsed between the publication of the two manuals is perhaps to be regretted; but our knowledge of the interesting animals now commonly known as Cœlenterata is in such a progressive state, and even the literature of the subject requires such careful study to enable one to see one's way at all clearly through the obscure labyrinth of errors, misconceptions, and confusions of all kinds, gradually set up by different authors, that we can hardly wonder that Professor Greene has found it impossible to get through his task with less delay. It is evident, indeed, throughout the work, that it is the result of a patient and conscientious study, both of the literature of the subject and of the animals themselves; and as Professor Greene belongs to the most advanced school of zoologists, we have in the present manual an excellent epitome of the views of that school upon the second great division of the animal kingdom.

Of the necessity for the establishment of a distinct group for the gelatinous Radiata of Cuvier there can hardly be two opinions, although, perhaps, there may be some doubt amongst naturalists as to the position to be assigned to the Echinodermata. The difficulty, however, is not to be got over by ignoring, as has been done recently in some cases, the great divisions or subkingdoms altogether, and treating classes as the highest groups in the animal kingdom. This is simply shirking the question; and it has the great disadvantage of obscuring or altogether throwing out of sight many of those interesting points of morphology which it has been the object of the researches of some of our leading naturalists to bring to light. This view is evidently that of Professor Greene, who regards the Polypes and Acalephs of Cuvier as constituting a primary division of the animal kingdom, distinguished by "a plan of structure, or relative position of parts, peculiar to itself," for which he adopts Leuckart's name of Cœlenterata.

The members of this group are divided by our author into two great classes, the Hydrozoa and Actinozoa,—the former including the Hydroid polypes and the greater part of the Acalephs; the latter the Helianthoid and Asteroid polypes, with the *Ctenophora*, which are removed from their previous association with the Acalephs. This is the greatest departure from the old system to be found in Professor Greene's classification; and although it may at first sight seem like a violation of old-established relations, it appears to us that the elimination of the *Ctenophora* is necessary to give homogeneity to the class Hydrozoa. Whether they ought to be placed in such intimate alliance with the true Polypes may still be questionable, although the relationship of *Beroë* to the Helianthoid polypes through *Ilyanthus, Peachia* and *Philomedusa* seems to be pretty clearly established.

In the classification of the Hydrozoa, our author, following the lead of Professor Huxley, divides these animals into seven orders. These are, 1. *Hydridæ*; 2. *Corynidæ*; 3. *Sertularidæ*; 4. *Calycophoridæ*; 5. *Physophoridæ*; 6. *Medusidæ*; and 7. *Lucernaridæ*. Of these the first includes only the genus *Hydra*; the second and third the Tubularian and Sertularian Zoophytes of older writers; the fourth and fifth the Siphonophorous Acalephs; and the last two the Discophora, with the addition of the genus *Lucernaria*. The *Medusidæ*, however, contrary to the expectations which might be raised from their name, do not include the higher *Medusæ*, but constitute a provisional order for the reception of those of the Gymnophthalmata of Forbes of which the derivation from polypestocks has not yet been proved. Amongst these a few, belonging to the families *Æginidæ* and *Trachynemidæ*, are stated by Gegenbaur to produce Medusoid progeny directly from the egg; and it seems probable that the same phenomenon may occur in *Geryoniadæ*. Under any circumstances, considering the numerous gaps which still exist in our knowledge of the life-history of many of these organisms, Professor Greene has certainly exercised a sound discretion in retaining, at all events for the present, a special group for the Naked-eyed Medusæ. The higher forms of Discophora are placed in the order *Lucernaridæ*.

The classification of the Actinozoa presents less divergence from the views of former writers. We find the orders *Zoantharia* and *Alcyonaria*, which require no explanation; the *Rugosa*, or tabulated corals of the older rocks; and, lastly, the *Ctenophora*, of whose transfer from the Acalephs we have already spoken.

The general structure and development and the geographical and geological distribution of the members of these groups are described in much detail, and with admirable simplicity and clearness; and the text is illustrated by numerous excellent woodcuts: in fact, the amount of information condensed into the comparatively few pages of this little book is quite astonishing; and it will certainly prove a most valuable handbook in the investigation of the lower forms of marine animals.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

June 11, 1861.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

On the Habits of the Pipe-fish and other Fishes. By Dr. J. E. Gray, F.R.S., V.P.Z.S., etc.

In examining the tanks in the Zoological Gardens, I was struck with the habits of the Pipe-fish, and induced to take a few notes. There are three species now exhibited there.

They swim with facility, but not very rapidly, and they seem to move chiefly by the action of the dorsal and pectoral fins. The former is fully expanded when they move, and in very rapid motion, the action being a kind of wave, commencing at the front end and continued through its whole length, continually repeated, so as to form a kind of screw propeller. The tail seems to be used rather as a foot than as an organ of propulsion; and the specimen that is furnished with a rayed tail expands the rays when it uses this part, giving the end of the tail the appearance of a webbed foot.

They remain in a quiescent state in different positions, sometimes horizontal, at others pendent, but generally more or less ascending from the place on which the tail rests; sometimes even nearly in a perpendicular position, merely resting on the tip of the tail: at these times the fins are generally at rest.

I saw one specimen of the Serpent Pipe-fish with a simple acute tail, which was resting in an erect perpendicular position with the tail loosely curled round some shells of a *Purpura* that were attached to the surface of the glass of the tank.

This is an approach to the prehensile tail of the *Hippocampi*, but still very different from the habit of that genus.

Mr. Bartlett informs me that, whatever may be the colour of some of the fishes, such as Flounders, Plaice, Soles, and Thornbacks, when placed in the tank, they soon modify their colours so as to be very like that of the shell or sand which forms the ground of the tank; and as shells and shell-sand are now generally used to make the ground of the tank, the fish become of a pale-brown, more or less mottled colour.

The flat fish, as Flounders, Plaice, and Soles, lie tranquilly at the bottom of the tank, on the sand, with their eyes prominent, and their mouth usually rather exserted and partly open; but they swim with facility, bending the side (or, rather, what in other fishes we should call the dorsal and ventral edges) down; so as to raise the central line of the body, and propel themselves with their tails. The pectoral fins seem to be but little used, and they are often very rudimentary; the ventral fins, which are also small when present, are usually expanded when the fish lies on the sand.

It is much to be regretted that persons who have the leisure and opportunity of observing these and other fishes in tanks do not give us more particulars of their manners, and especially of the means by which they propel themselves through the water, which is evidently very different in the various families and genera. The elongate, cylindrical, subcompressed, or many-angled *Syngnathus* is generally straight and stiff while moving from place to place; while the elongated rather compressed Blennies, as *Gunnellus* and *Zoarces*, propel themselves forward with a horizontal serpentine motion, apparently keeping their bodies erect by the dorsal fin and the expanded pectorals.

There is one circumstance connected with the fishes in these tanks which I have never been able to understand ; that is their apparent blindness to any external object that is presented to them from the outside of the tank, when it is offered to them on a level with their eyes or apparent range of vision. I have attempted to disturb them with my hand, with a red handkerchief, and with many other bodies ; but I have never observed them show the slightest idea of there being any danger, or even take the slightest notice of the approaching body ; yet they are easily disturbed if the object is so presented to them as to appear to descend towards them.

Note on the Lernæa cyclopterina occurring in the Gills of the Cyclopterinus spinosus, a Fish from Greenland. By W. Baird, M.D., F.L.S., etc.

In the 'Fauna Groenlandica,' O. Fabricius shortly describes a species of *Lernæa* as occurring in the *Cyclopterinus spinosus*. Kröyer in his 'Tidskrift' figures the same parasite ; but his figure varies so much from a specimen lately added to the collection of the British Museum, that I think it advisable to give a short account of it.

Kröyer mentions that the specimens from which he has figured the species are young individuals ; and to this, in all probability, is owing the discrepancy between his figure and the specimen in the possession of the Museum, which evidently is an adult. The neck agrees pretty well with his figure, but the head in our specimen is strongly tubercled. The body is somewhat thin and elongated in Kröyer's figure. In the Museum specimen it is shorter and much thicker ; and at the bend of the body from which the ovaries are sent off, there are on each side two strong tubercles. Kröyer does not figure the ovaries ; it is evident, therefore, that the specimens in his possession, and from which his figures were made, are immature. The ovarian tubes, as seen in the Museum specimen, are beautifully coiled in a spiral, are strong, and marked with small bands of a brown colour. M. Milne-Edwards, in mentioning this species, says that Kröyer does not figure the cephalic horns which distinguish the genus *Lernæa* ; and he suspects that this is only owing to a mutilation of the individual observed by that naturalist. It is curious that I have not been able to discover the cephalic horns in our specimen either ; but upon a close examination there is to be seen a rupture of the parts to which, if they existed, these horns would have been attached. In all probability they have been torn away when the specimen was dissected from the fish.

Description of a New Species of Cancer obtained at Madeira. By James Yate Johnson.

Cancer Bellianus, sp. n.

Carapace of a pale brown, suffused and spotted with red ; its surface rough, with small tubercles, and strongly marked with the regional divisions ; transversely oblong, with the middle portion moderately elevated. Latero-anterior margin divided into ten quadrate lobes, alternately broad and narrow; the outer edge of each lobe armed with three teeth, of which the middle one is larger. On the broader lobes the lateral teeth are frequently bifid. The hindmost lobe on each side has only one principal tooth, but there are three or four small ones. This lobe passes into the posterior marginal line of the carapace, and this line is beaded with a series of tubercles. The front of the carapace has two dotted lobes or flattened teeth, with a narrow triangular tooth projecting between and beyond them. The superior margins of the ocular orbits are denticulated, and have a strong triangular tooth over the inner canthus, which does not project quite so far as the two principal lobes of the interocular front. The margin between the two superior fissures is denticulated, but has no predominating tooth. Inferior margin of the ocular orbit armed with three teeth, of which the innermost is large and stout. The external antennæ have their basal joints much elongated, and terminating forwards in an obtuse tooth. The second joint is club-shaped, and the third cylindrical. The anterior half of the internal antennæ is folded directly backwards when at rest.

The sternum is minutely punctated, and its entire surface in the male is set with longish stiff hairs; in the female the hairs are chiefly confined to the posterior portion.

Feet.—First pair subequal, stout, and longer in the male than in the female. Fingers black, marked with longitudinal furrows, and having two or three large tubercles near the extremity of their prehensile edges. Upper surface of hand marked with seven low longitudinal crests or rows of tubercles, some of which bear minute spines; and in the female with a good deal of stiffish hair; under surface minutely punctated. The wrist has the superior surface studded with three or four rows of short sharp spines with broad bases. The inner inferior edge has two stout black spines, the strongest of which is near the anterior extremity of the joint. The arm bears two sharp spines on its upper edge near the anterior extremity; and these are separated by a deep transverse furrow which crosses each of the adjacent surfaces. Remaining feet slightly compressed, irregularly angular, marked with longitudinal spinous crests, and clothed with long stiff hairs. The last joint is remarkably long, spineless, but marked with deep longitudinal grooves, in some of which is a dense line of hair. The terminating spine is reddish. The order of length of the feet in the male is 1, 3, (2, 4), 5.

Abdomen.—The third segment is the broadest in the male, the sixth in the female. In both, the sides of the seventh segment are somewhat sinuated. In the female the margins of the abdomen are thickly fringed with hair, and the surface also bears a good deal of shorter stiff hair.

The measurements of two specimens, a male and female, are subjoined, the figures signifying inches.

	Male.	Female.
Carapace: Length	$4\frac{3}{8}$	$4\frac{3}{16}$
Breadth	7	$6\frac{3}{16}$
Feet: First pair—Length	7	5

		Male.	Female.
Feet: First pair—Width of hand		2	0
Third pair		$6\frac{3}{8}$	5
Abdomen: Total length		3	$3\frac{2}{3}$
Width of third segment		$1\frac{5}{16}$	
Width of sixth segment			$1\frac{7}{8}$

This species will take its place in the neighbourhood of *Cancer plebeius*, Poeppig, a Chilian species, from which, however, it is distinguished by the stoutness of the first pair of feet, the less prominence of the tubercular spines on the hand, the greater prominence of the middle tooth of the lobes at the margin of the carapace, the greater abundance of hair, the absence of the scroll of white spots which paint each side of the upper surface of the carapace in *Cancer plebeius*, and the much greater unevenness of the carapace, arising from the deeper cutting of the divisions between the regions.

Only two specimens of this Crab have fallen in my way. One is in the British Museum, and the other is in my own collection at Madeira. To both were attached numbers of the rare cirripede *Pœcilasma crassum*, Darwin. I have named it in honour of that learned carcinologist the President of the Linnæan Society, and the author of a memoir on the genus *Cancer*, printed amongst the Transactions of that body.

On the Island-hen of Tristan d'Acunha. By Philip Lutley Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

The fact of the existence of a bird of the family *Rallidæ*, with imperfectly developed wings, in the Island of Tristan d'Acunha has already been recorded by more than one writer*. One of the objects most interesting to naturalists in the fine collection of living animals lately received by the Society from His Excellency Sir George Grey, to which I especially called the attention of the Society at their last meeting †, was a single example of this bird—the first of its kind that has reached Europe alive or dead. It appears to belong to a new species of the genus *Gallinula*, closely allied in general aspect to our Common Water-hen (*G. chloropus*), though readily distinguishable on accurate comparison.

Five living examples of this bird were brought from the Island of Tristan d'Acunha to Cape Town by a person formerly in the service of Sir George Grey. Two of them were accidentally killed at Cape Town, but their skins, except the heads, were preserved by Mr. Benstead, and are now before the Meeting. Of the three that were shipped for England for the Society, two died on board, but their bodies were placed in spirits and brought to England. Fortunately the remaining individual reached our Gardens in safety, and may now be seen in excellent health and condition in the large Aviary.

* See Mr. J. H. Gurney in Zoologist, p. 4017 (1853), and Capt. Carmichael in Linnean Trans. xii. p. 496.

† See P.Z.S. 1861, pp. 208, 209.

The name "Island-hen" given to this bird by the inhabitants of Tristan d'Acunha has suggested to me the specific term *nesiotis* (*νησιῶτις, insularis*), under which I propose to characterize this species as

GALLINULA NESIOTIS.

Capite et collo undique cum corpore subtus saturate nigris: dorso toto, alis extus, tectricibus caudæ superioribus et hypochondriis brunnescenti-olivaceis: crisso nigro, tectricibus subcaudalibus pure albis circumdato: striis lateralibus, sicut in G. chloropode, *albis; campterio alari et remigis primi margine externo albidis: rostro et clypeo frontali coccineis, illius apice flavo: pedibus flavicantibus.*

Long. tota 9·0, alæ 5·5, caudæ 3·3; rostri a rictu 1·25, tarsi 1·9, digiti med. cum ungue 2·7.

Hab. In Ins. Tristan d'Acunha.

Obs. Sp., quoad colores, *G. chloropodi* haud dissimilis, sed capite et ventre valde obscurioribus, et forma crassiore, alis minoribus et pedibus robustioribus facile nota.

The coloration of this bird is much the same as that of the Common Moor-hen, but generally darker, and the head and body beneath are of a dull black, not ash-coloured. The form of the present species is, however, much shorter and thicker, and the legs generally more stout, though the toes are not longer than in *G. chloropus.* The characteristic red garter, which surrounds the base of the thigh in the Moor-hen, is also partially seen in the new species. On comparing the wings together, we find that of *G. nesiotis* nearly an inch shorter, and the feathers remarkably soft and inferior in size to those of *G. chloropus.* The primaries appear to be all present, but their barbs much less developed, and the stems are likewise much less in size. As far as can be judged from the specimen in our Gardens, the bird can flutter a little, but obviously uses its legs and not its wings as a mode of escape from its enemies.

On dissection of one of the examples in spirits, the general appearances of the soft parts coincided with those of the *G. chloropus.* The length of the whole intestine was about 29 inches: two large cæca, of about 3 inches in length, were situated $2\frac{1}{2}$ inches from the anus; the intestine was of nearly uniform size throughout; the gizzard was large and muscular; the thighs were remarkably large and fleshy.

On comparing the skeleton of *G. nesiotis* with that of *G. chloropus* we find a development of the *femora* and *pelvis* corresponding with the outward appearances and change of habits. The total length of the femur in *G. nesiotis* is nearly four lines greater, and its whole size is larger than that of *G. chloropus.* The difference in the size of the pelvis is shown by the accompanying outlines (see next page), fig. *a* representing the *pelvis* of *G. nesiotis,* and fig. *b* that of *G. chloropus.* There are also conspicuous differences noticeable on comparing the sterna of the two species, as will be visible on examination of figs. *c* and *d*, which give the outlines of this part of the skeleton of *G. nesiotis* and *G. chloropus*. The sternum of

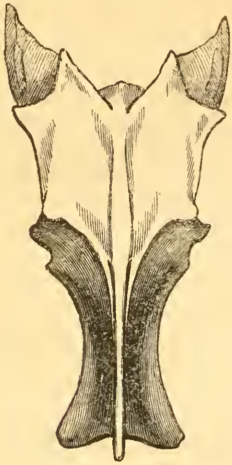


Fig. *a*.

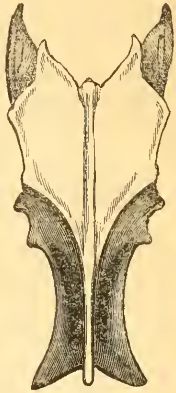


Fig. *b*.

G. nesiotis is much shorter, broader, and the keel is not nearly so deep. The following are some of the most important corresponding

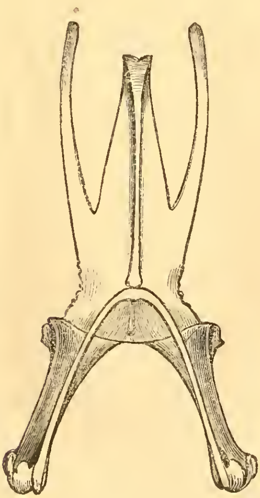


Fig. *c*.

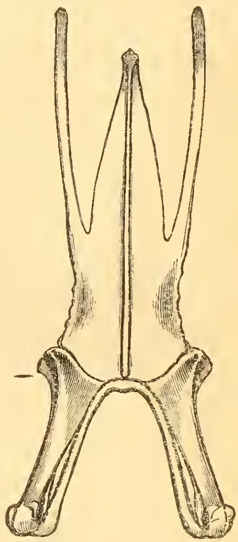


Fig. *d*.

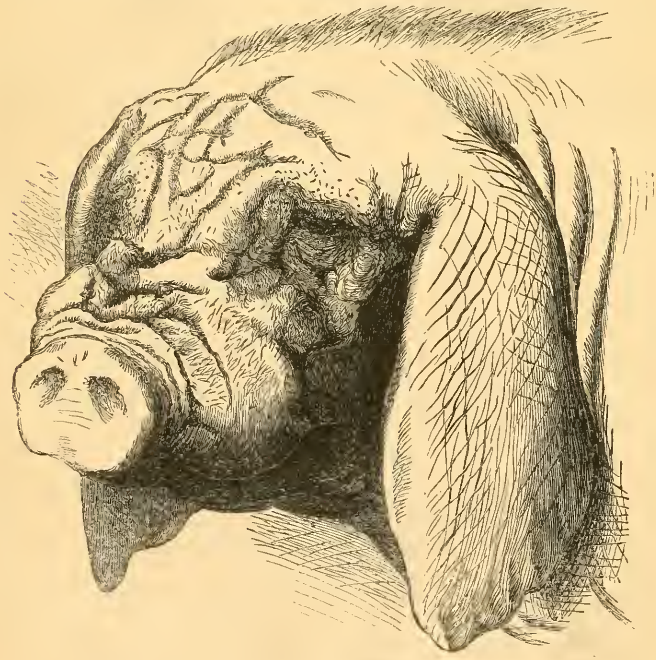
dimensions of this part of the two birds in inches and decimal parts:—

	G. nesiotis.	*G. chloropus.*
Length of sternum and coracoids[1]........	2·45	2·90
Distance between outer ends of coracoids..	1·35	1·15
Depth of keel.........................	0·35	0·55
Length of keel along the base	1·50	1·85
Length of keel along the crest..........	1·35	1·95

I may remark that the only other known land-birds of Tristan d'Acunha are the singular Thrush described by Mr. Gould (P. Z. S. 1855, p 65) as *Nesocichla eremita* and a Bunting referred by Capt. Carmichael to *Emberiza* (*Sycalis?*) *brasiliensis*. The latter's *Turdus guianensis* is doubtless intended for *Nesocichla eremita.*

Remarks on the Japanese Masked Pig.
By A. D. Bartlett.

This remarkable animal differs so much from all the varieties of domestic pigs, that I am inclined to believe its origin must have been from some species distinct from our common stock.



The singular form of the head and face (see woodcut), together with the enormous development of skin, and the regular arrangement of the wrinkles, the large and pendulous ears, the drooping muzzle, together with its intelligent eye, give this animal a dog-like appearance; in fact, the frequency of the remark made by persons seeing these animals for the first time confirms this opinion.

Apart, however, from this, the whole structure of this animal is well worthy of consideration: the sides of the rump, and also from the top of the shoulders downwards, are thick folds of skin, which are much harder on those parts than elsewhere, and hang about in the same position and manner as the plates on the same parts of the Indian Rhinoceros.

Having placed with the male of this animal two or three young sows of the Berkshire breed, I have succeeded in obtaining a mixed race. These half-bred pigs very closely resemble the male, being black with white feet, and exhibit the wrinkles on the face, but in a less degree.

In what way our domestic breed of pigs has been produced it is difficult to imagine. It is, however, very remarkable that in the *Wild Boar of Europe*, *Africa*, and *Asia* the young are always striped at birth, and in no instance is this marked character found in any of our domestic breeds; but the colour and markings that appear at birth continue during life unaltered. Not so with the wild species, whose young, although striped at first, gradually lose these markings as they grow to maturity.

The skeleton of this animal has not, at present, been examined. I can say, however, that the form of the skull is strikingly different from that of any of the species of *Sus* that I have seen.

June 25, 1861.—Dr. J. E. Gray, V.P., in the Chair.

Notice of the Occurrence of Sclerostoma equinum? in the Testicle of the Horse. By W. Baird, M.D., F.L.S.

The entozoon known by the name of *Sclerostoma equinum* or *armatum* has long been known as infesting the Horse. According to Rudolphi, Dujardin, and Diesing, it is very common at all seasons of the year in the large intestines of that animal, as well as in the Ass and Mule. It occurs also, though more rarely, in the duodenum and pancreas; and a smaller varity is not uncommon in the aneurismal sacs of the mesenteriac and cœliac arteries of these animals, which appear to be liable to that disease. As far as I am aware, however, this parasitic worm has only been once observed (and that by Gurlt) as occurring in the testicle of any of these animals. This author has recorded his having found it in the tunica vaginalis of the Horse. Lately a specimen of what appears to be another variety of this species was received by Professor Owen from a gentleman who had taken it from the substance of the testicle of a young colt which had just been gelded. Only one individual was sent—a female; and though it differs somewhat from the ordinary specimens of the *Sclerostoma equinum* in the horse as characterized by the authors mentioned above, I am unwilling to describe it from a single individual as a distinct species. The specimen is about an inch in length, and is strongly marked with transverse rings, which encircle the body, but appears destitute of the longitudinal striæ which Rudolphi and Dujardin describe as distinguishing the *S. equinum*. The circular rings on the centre of the body are about the fourth (but nearer the head only a third) of a millimetre apart from each other; whilst in the ordinary specimens of *S. equinum* they are described as being very fine, and according to Dujardin only 0·0043 mill. The tail, too, is much more obtuse than in the ordinary specimens of the *S. equinum*, and the whole animal is more robust, though not longer. The specimen appears to be an immature individual; and as I have not been able to refer to Gurlt's notice of the specimens he found in the tunica vaginalis of the testicle of the horse, I must satisfy myself at present with merely recording the fact of its being found in this country also, trusting to have an opportunity at some future time of examining additional specimens.

CAMBRIDGE PHILOSOPHICAL SOCIETY.

ON THE FEN CLAY FORMATION.

The following notice is a brief abstract of a paper read by Mr. Harry Seeley at the annual general meeting of the Society, on Monday, October 28th.

Extending under the peat of the fen district, and far beyond, is a great clay formation. It includes the Oxford and Kimmeridge clays, and an intervening clay (replacing the Coral-rag) which imperceptibly graduates upwards and downwards into those deposits. It is for this series of strata, ranging from the Great Oolite up to the Portlandian beds, that the term Fen-clay or Fen-formation is proposed. The fact of such a succession in some degree interferes with existing views of the division of the lower secondary strata into Upper, Middle, and Lower Oolites; so that henceforth it will probably be found more convenient to abandon those terms, and to speak of the secondary formations below the Cretaceous series as Lias, Inferior Oolite, Great Oolite, Fen-clay, and Portland beds. In this district the Fen-clay extends from the line of Peterborough to Bedford, across easterly to the line of Ely and Lynn, within which limits it has been chiefly studied, though known to have an extensive development further south.

The various subdivisions were worked out in the country around Elsworth, near St. Ives. That village is built on a limestone to which it gives a name, the Elsworth Rock, which consists of three subdivisions, an upper and lower rock, and a middle clay which abounds in *Ostræa Marshii*. The rock dips to the south, and maintains its thickness (14 feet) unchanged for the three miles over which it could be traced, though at that distance the middle clay is replaced by sandstone.

Passing to the north, another rock is met with, at St. Ives; and this was shown to be 130 feet below the Elsworth rock, coming out from under it, being brought up by an anticlinal axis, so that further to the north, at Bluntisham, the Elsworth rock is again met with. The

St. Ives rock dips to the east, and appears to be found again at High Papworth, west of Elsworth. As the St. Ives rock dips to the east, so will the Elsworth rock also; and therefore the clay to the east and south will be superior to it, while that to the west is inferior. Passing west to St. Neots, another rock occurs; and this would seem to be very low down in the series, and not far removed from the zone of the Kelloway rock. The St. Neots rock consists of thin layers of limestone which alternate with thin beds of clay.

Among the fossils in the Oxford clay at St. Neots are *Ammonites Duncani, A. spinosus, A. athletus, A. coronatus*, &c. The commoner forms at St. Ives are *Ammonites Mariæ, A. cordatus, A. Eugenii, A. Goliathus*, &c., &c. Of the Ammonites in the clay above the St. Ives rock no good list is known; but among them are *A. alternans* and *A. Babeanus*. Both at Elsworth and Bluntisham above the rock the *Gryphæa dilatata* is found abundantly, and occasionally with it *Ostrea deltoidea*; but to the south the latter fossil is more abundant, so that at Tetworth they occur in equal profusion and in combination with *Ammonites Achilles, Belemnites eccentricus, Lima pectiniformis, Serpula tetragona*, &c., &c. At Tetworth there is a thin band of rock, as there is also at Gamlingay; at Boxworth, nearly if not quite in the same position, there is a rock of the same thickness; and to the east, beyond this, the clay seems to graduate imperceptibly up into the Kimmeridge clay of Cottenham.

There is thus a great thickness of strata between the Oxford and Kimmeridge clays, in which the fossils of both those deposits are intermixed, and which represents the Coral-rag. That such a clay did exist might have been inferred from the presence of the Coral-rag at Upware, and its limited extension beyond. The Upware limestone was a coral-reef out in an old sea; and it must have necessarily happened that beyond the narrow limits of the reef a deposit of a different kind would have been forming on the sea-bottom, far more widely spread than the limestone. This formation is named the Tetworth Clay*.

A difficult question then arose as to the limits of this clay; for if it were replaced by Coral-rag, it would result that the Elsworth rock would be immediately beneath the Coral-rag on the one hand, and above the Oxford clay on the other, and so would appear to be rather a member of the former series than of the latter. However, the presence of such forms as *Belemnites tornatilis, B. hastatus, Ammonites vertebralis, A. biplex, A. perarmatus, A. Henrici, A. canaliculatus, A. Goliathus*, &c. were held conclusive evidence that it ought rather to be regarded as the uppermost zone of the Oxford clay. The upper boundary of the Tetworth clay cannot be given with any certainty. And from the want of sections it has not been found possible to subdivide the strata above, as has been done with those below.

Such is the Fen Clay. The rocks of its lower part, excepting the Kelloway, do not appear to occur in the south of England, though

* At the Manchester meeting of the British Association the name Bluntisham Clay was suggested for it; but as the section there is no longer visible, it has been thought better to name it from a locality where it may be seen and worked.

there are divisions in the clay corresponding to those so strongly marked by their occurrence here. The Tetworth clay has long been known to have an extensive southern development; a portion of it appears to have been mapped by the Geological Survey as Oxford clay, just as in our district Mr. Lucas Barrett mapped it with the Kimmeridge clay.

MISCELLANEOUS.

On the Larva of a Brachiopod. By F. Müller.

In the 'Annals' for October 1860 (p. 310) we gave a short abstract of a description of the larva of a Brachiopod observed by Dr. F. Müller at Santa Catharina, on the coast of Brazil; he now adds some further details from repeated observations in the summers of 1859 and 1860. The larva appears to occur late in the summer, from February to April.

When the little animals are placed in good-sized vessels with pure sea-water, they soon ascend slowly; the slightly gaping shells stand perpendicularly, the hinge-margin downwards; close to the anterior margin the eight arms spread out horizontally like rays, with their tips slightly bent downwards; and the roundish knob situated between the uppermost pair projects beyond the plane of the arms. In this posture they move slowly about near the surface. When strongly shaken, or sometimes without any perceptible reason, they retract the arms and close the shells, which then slowly turn over and sink to the bottom with the free margin downwards. If the arms be again protruded, the hinge-margin also again turns downwards.

The duration of this state never exceeded five to six days; and in general the larvæ adhered to the bottom or sides of the vessel in a still shorter time. When they adhered to the sides, the mouth was always directed downwards; the ventral shell was strongly drawn forward, until its anterior margin reached or passed that of the dorsal shell; the transversely oval plate, previously concealed within the shells (the peduncle), was protruded, apparently twisting round the notched hinder margin of the ventral shell, so that its anterior margin became posterior. For a day or more the animal remains contracted and quiet; then, the shells being slightly opened, the arms are half extended, and strike inwards, one or more at a time, just as in the marine Bryozoa.

In a few days new bristles appear at the anterior margin, in the space left between the more delicate setæ of the dorsal shell. In a week the author counted twenty of these, mostly belonging to the dorsal shell. The longest were 0·8 mill. in length, straight, colourless, 0·006 mill. in thickness at the base, terminating in a fine point, unjointed, and distantly feathered with fine lateral setæ 0·02 mill. in length. The principal change in the soft parts consisted in the retrogression of the organs of sense. The eyes had become broken up into groups of about ten black points; the previously spherical auditory vesicles were shrunken into longish sacs, closely surrounding the otoliths. In somewhat older animals there was no trace of the organs of sense, although they had not lost their sensibility to light.

One of the larvæ lived for a month after its adhesion; but from the lapse of a day before its death was noticed, the soft parts had become greatly decomposed. The older bristles of the free larva appeared to be still present, as also the plumose bristles of the anterior margin. Besides these, there was on each side, about in the middle between the median line and the origin of the great bristles of the fourth pair, a straight smooth bristle, 0·2 mill. in length, projecting obliquely backward, little thicker than the strong posterior setæ, but with a much stronger outline.

It is remarkable that in two years the author has repeatedly captured free-swimming larvæ which had evidently advanced further in their development than the oldest of those which had already fixed themselves. They were all destitute of the transversely oval plate, and of every trace of organs of sense; the plumose setæ of the anterior margin were also wanting, as were, more or less entirely, the older bristles. Of the more delicate bent bristles, some were usually still present, and these appeared to be unabbreviated, so that the missing ones had probably been lost by shedding. The stronger bristles, on the contrary, are gradually absorbed at the base; at least this is the case with the fourth pair: these were repeatedly met with of about half their proper length; the stalk, with its fusiform dilatation, had disappeared, whilst the apex remained readily recognizable by its peculiar curvature and denticulation. In a still older animal about a fifth of the length was still present, so that it no longer extended beyond the margin of the shell. This animal (the oldest examined by the author) had lost all the older setæ except this small residue. On the other hand, the two straight smooth bristles, which, in the oldest attached animals, scarcely began to protrude from the shell, had attained a length of double the diameter of the shell, and being inserted into thick muscular sheaths were strongly and rapidly moved by the animal, sometimes spread out horizontally, sometimes again crossed backwards.

During this complete change of the setæ the soft parts had undergone no essential alterations. The roundish stomach, reaching from the front to the middle of the longitudinal diameter, still showed the two dark spots of the young larva, which remind one of the similar spots in the larvæ of some Bryozoa. From the back of the stomach sprang the intestine, which bends under the margin of the stomach to the right, and then forwards, terminating about the middle of its right side. The œsophagus goes from the front of the stomach straight forward halfway to the front of the shell, and then bends downward, so that the mouth lies close to the stomach. The arms, especially the two middle pairs, had become longer and slenderer, and the knob between the anterior pair had diminished in size. No vessels or pulsating heart were recognized.—*Wiegmann's Archiv*, 1861. p. 53.

On the Foraminifera of the Vienna Tertiary Basin.

M. F. Karrer has examined the Foraminifera of the Vienna Tertiary Basin with respect to the differences stated by Messrs. Forbes and Godwin-Austen ('Nat. History of the European Seas,' 1859, p. 135, &c.) to exist between the forms of this class at present living in the Mediterranean, as to whether they inhabit greater or less depths. Nearly all the marine deposits within the Vienna Basin may be considered as contemporaneous as far as the Foraminifera are concerned; for the species occurring in them present no more differences than what are found to exist between the forms at present inhabiting different depths of the Mediterranean. The Foraminifera fossil in the blue plastic clay (generally known as the "Baden Tegel") are analogous to those at present living at considerable depths.—*Vienna Imp. Acad. of Sciences, Meeting* July 4, 1861.

The Gorilla.

The Rev. A. Busnell a resident missionary in the Gorilla country, observes, "The Gorillas are found on the south side of the river, and some thirteen or fourteen years ago, were first brought to notice by Dr. Wilson, one of our missionaries; and, soon after, we owned a live young one, which ran about the station; and *we have frequently purchased* from the natives full-grown ones, within twelve hours after their being killed in the forest, for about a pound's worth of goods. These we dissected, and forwarded to colleges and museums in the United States."—'*Good Words,*' *edited by* NORMAN MACLEOD, Nov. 1, 1861, p. 624.

Obituary Notice of GEORGE BARLEE, Esq.

Another member of the band of working naturalists has passed away, but not without leaving many memorials of his scientific labours. Although Mr. Barlee seldom wrote for publication, the services he rendered to the cause of science will not be the less appreciated by posterity. For many years his indefatigable zeal and energy in the investigation of our native fauna have been well known to all who have been engaged in this fascinating pursuit; and every branch has been enriched by his numerous discoveries. His liberality was worthy of his scientific repute, and it was experienced by all who had any communication with him. The writer of this, who enjoyed his friendship during all the time that the deceased followed the pursuit of natural history, and who was his companion or partner in nearly every one of the annual excursions which he took for this purpose, feels some consolation in the reflection that not the slightest misunderstanding ever existed between them. Mr. Barlee commenced his career as a naturalist about eighteen years ago, when he had passed the prime of life. He had up to that time practised as a solicitor in his native town, Yoxford, in Suffolk, which profession and place, however, he quitted in consequence of the death of his only child (a son), whom he lost at an early age. Mr. Barlee died at Exmouth, on the 19th of November, in his 68th year.—J. G. J., Nov. 26, 1861.

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END OF THE EIGHTH VOLUME.

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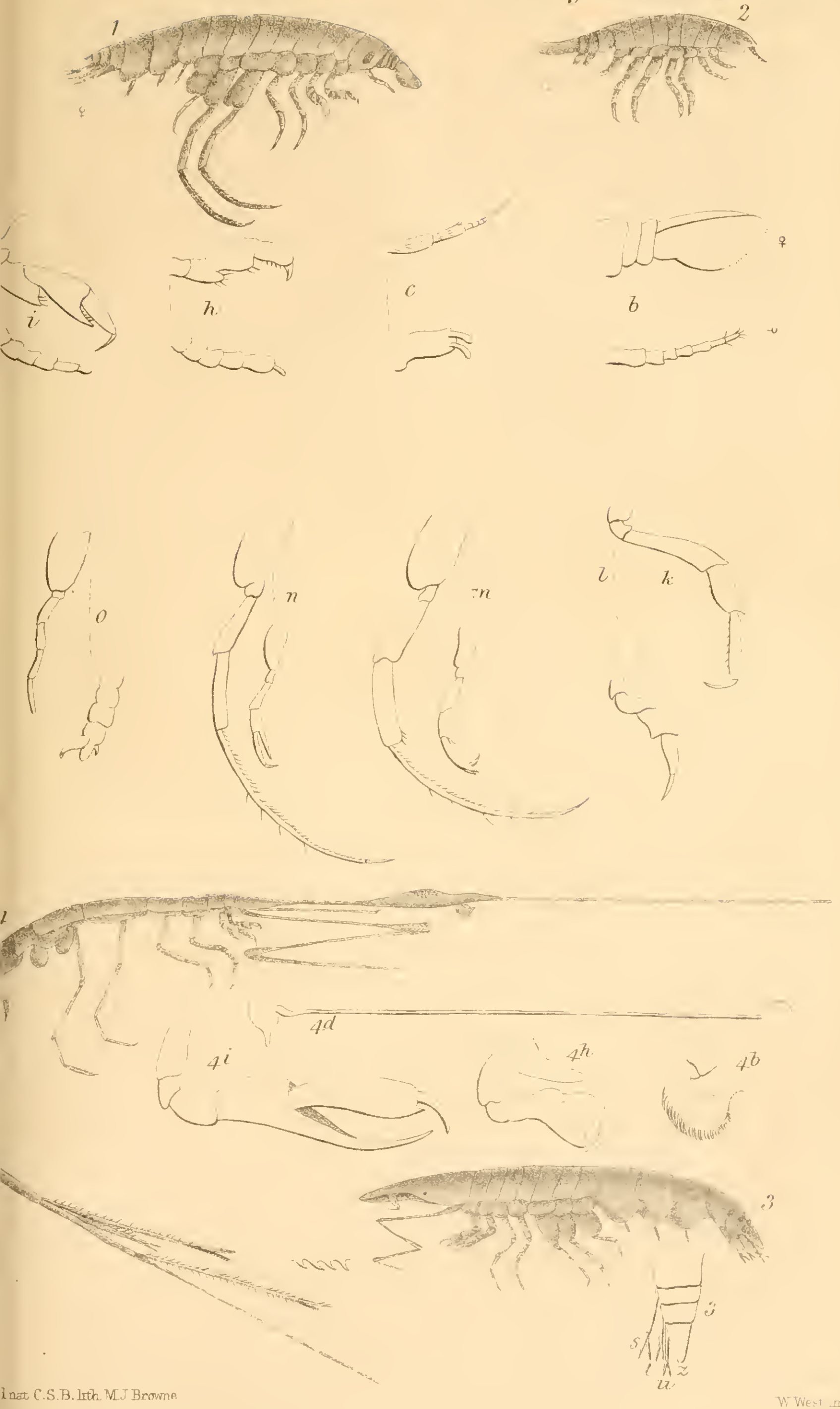

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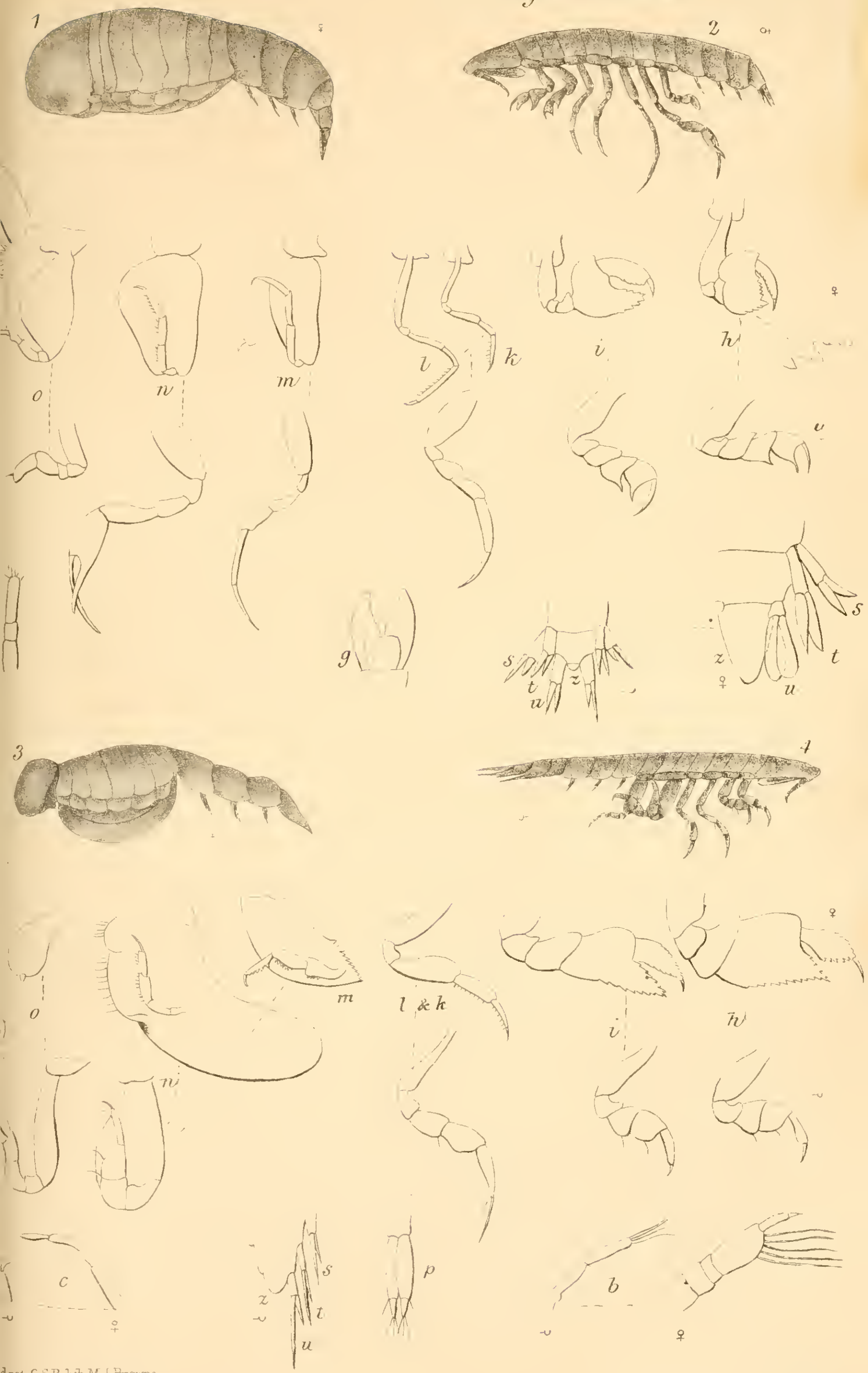

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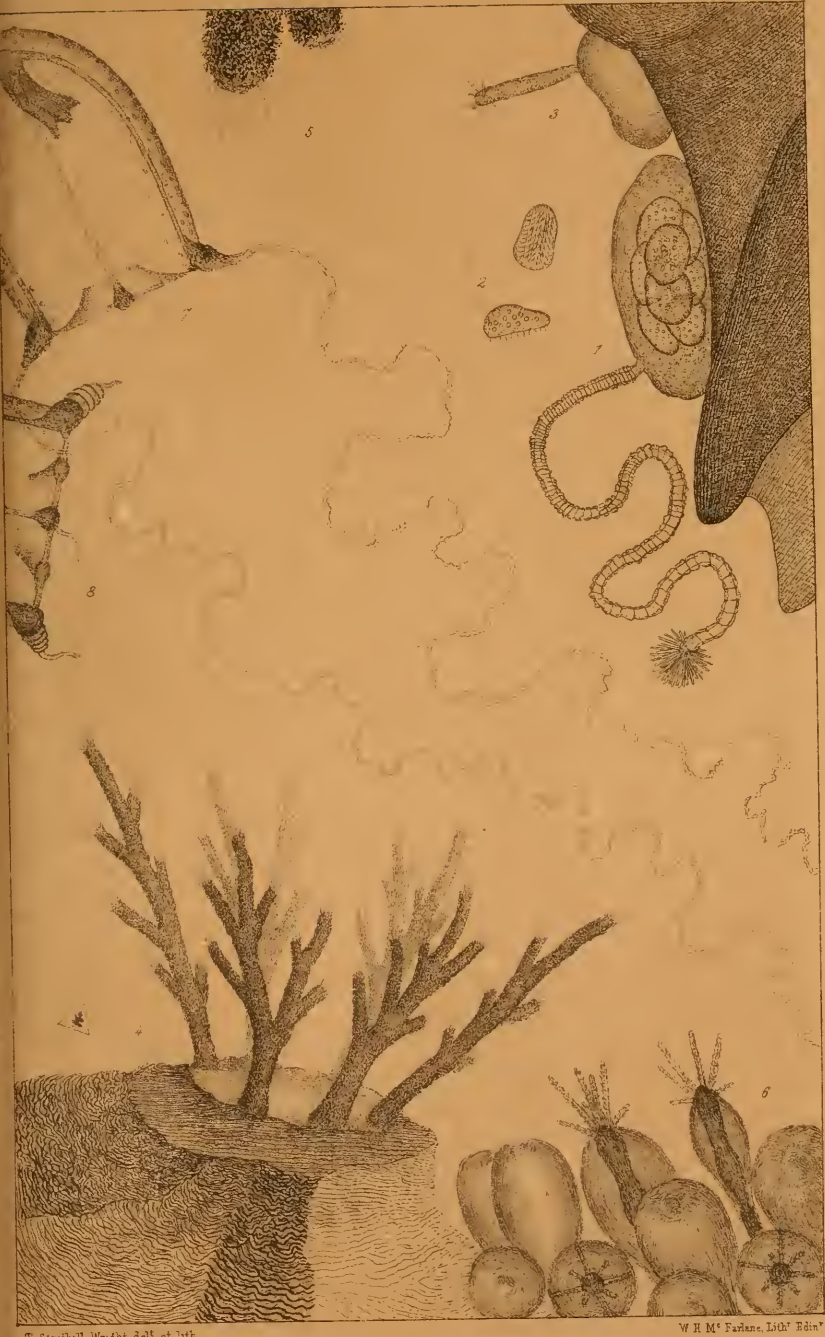

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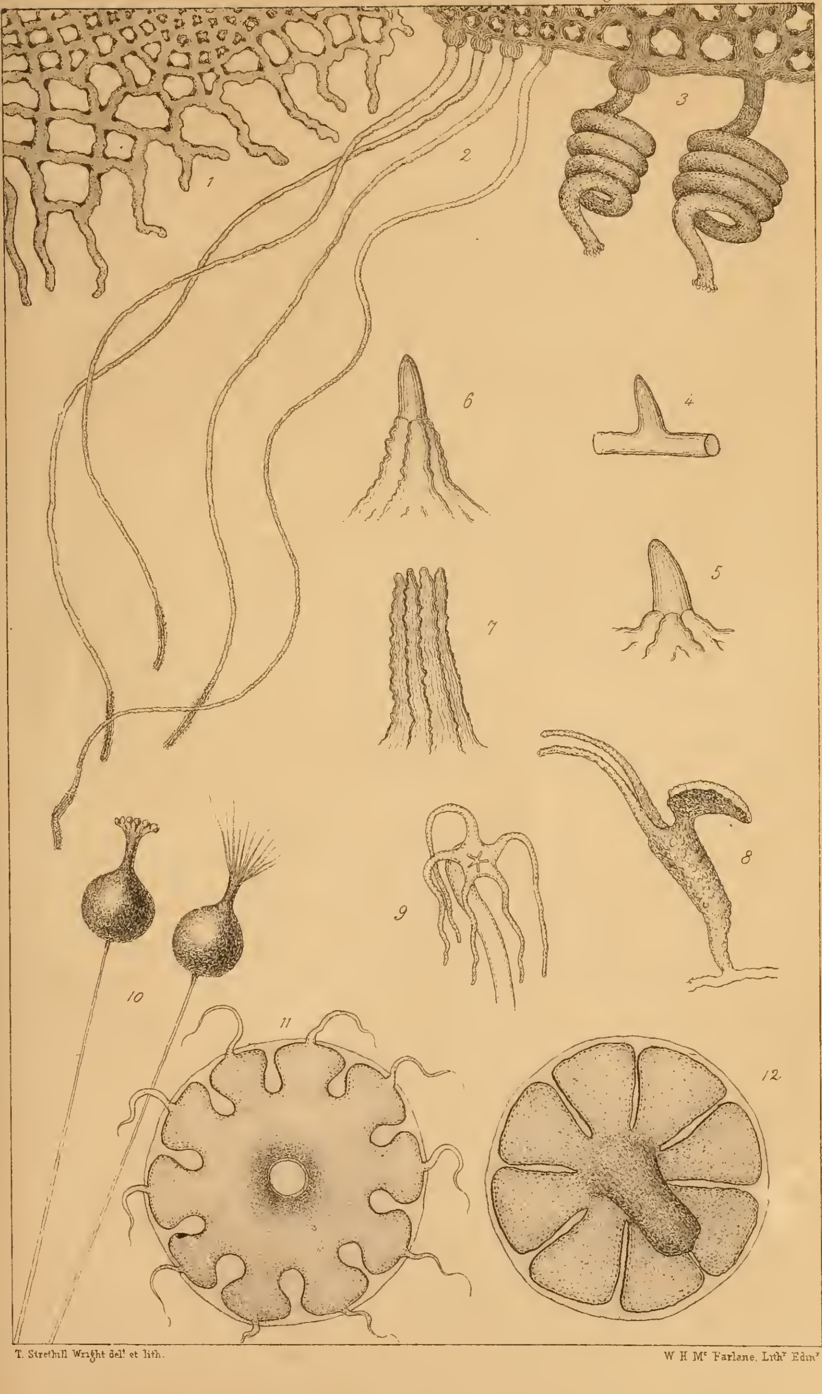
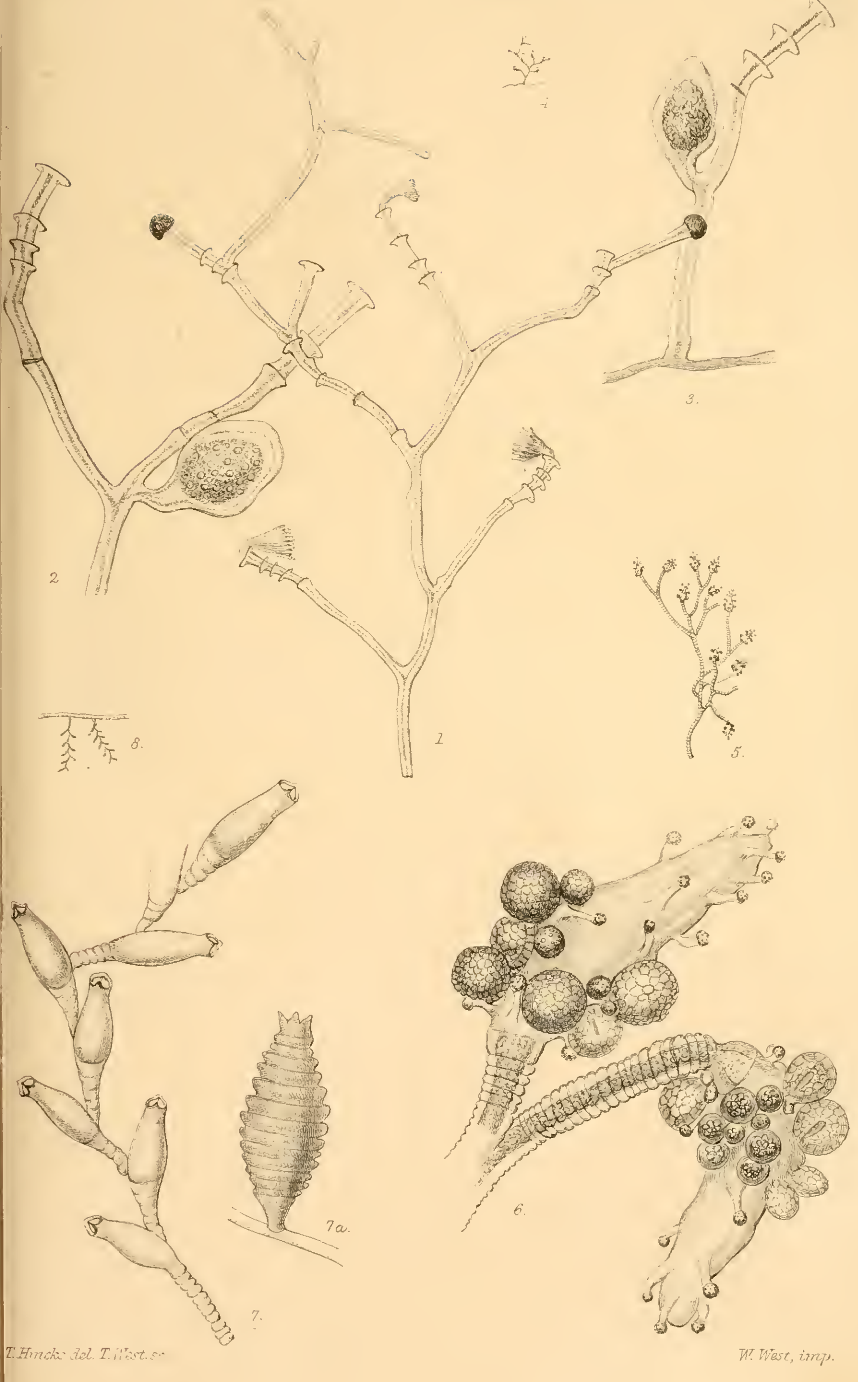


T. Strethill Wright del. et lith.

W H Mc Farlane, Lithr Edinr



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W. West, imp.

T.H. & Tuffen West. del. T.W. sc.

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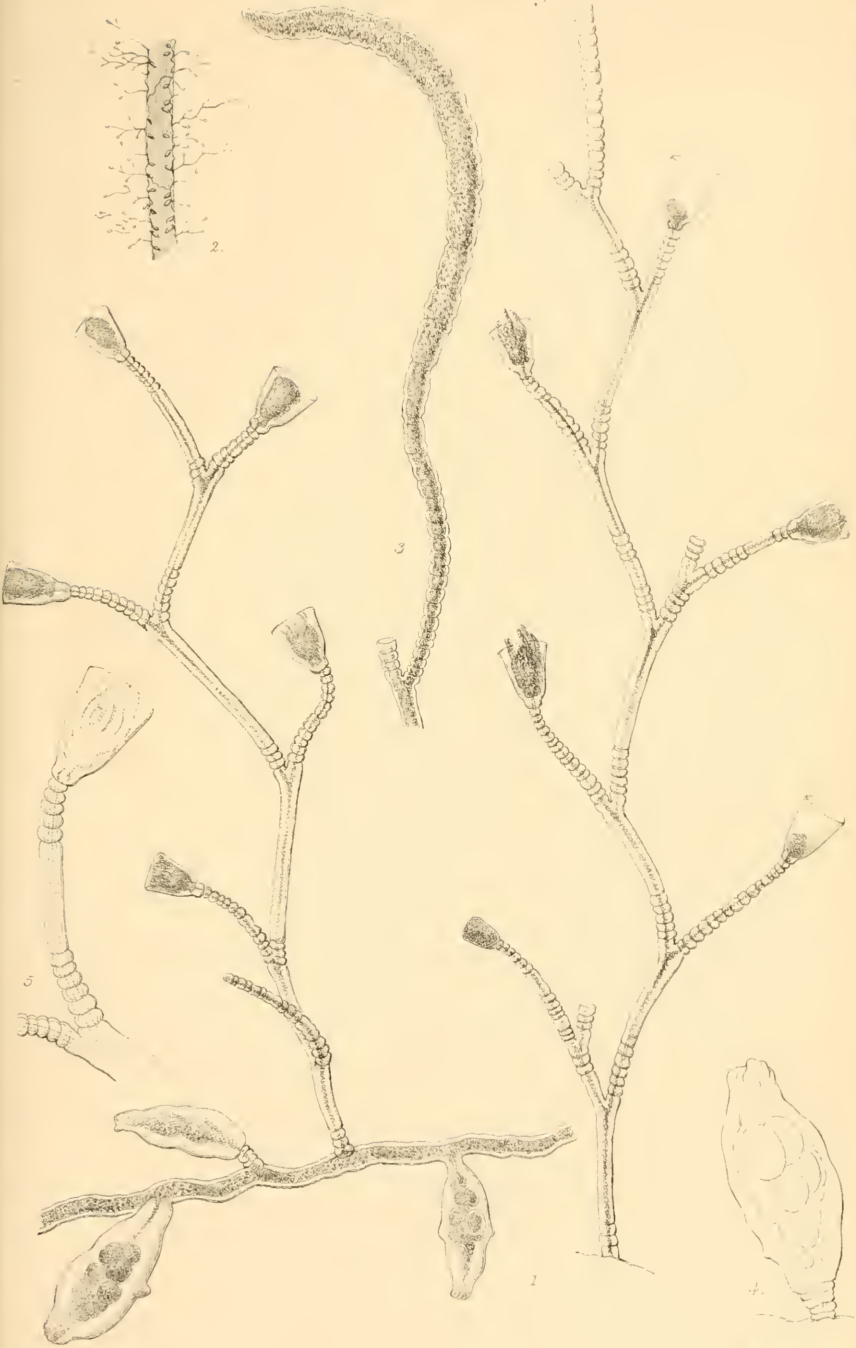
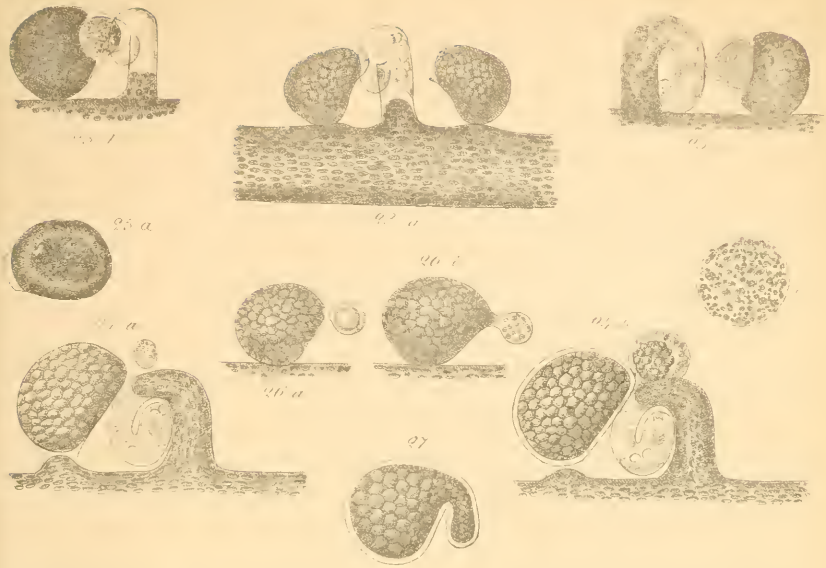
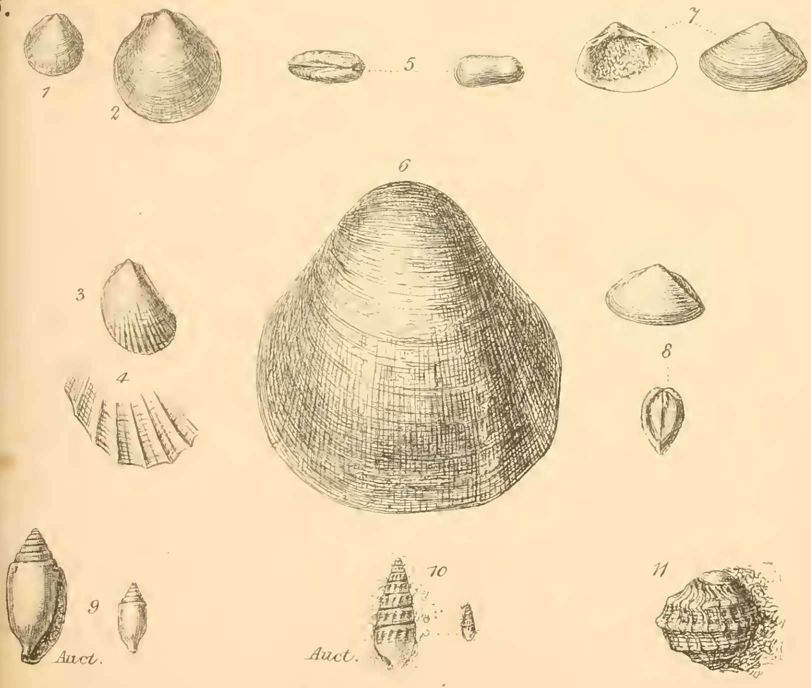


Tuffen West del. & sc.

A.



B.



J. De C. Sowerby. del. et sc.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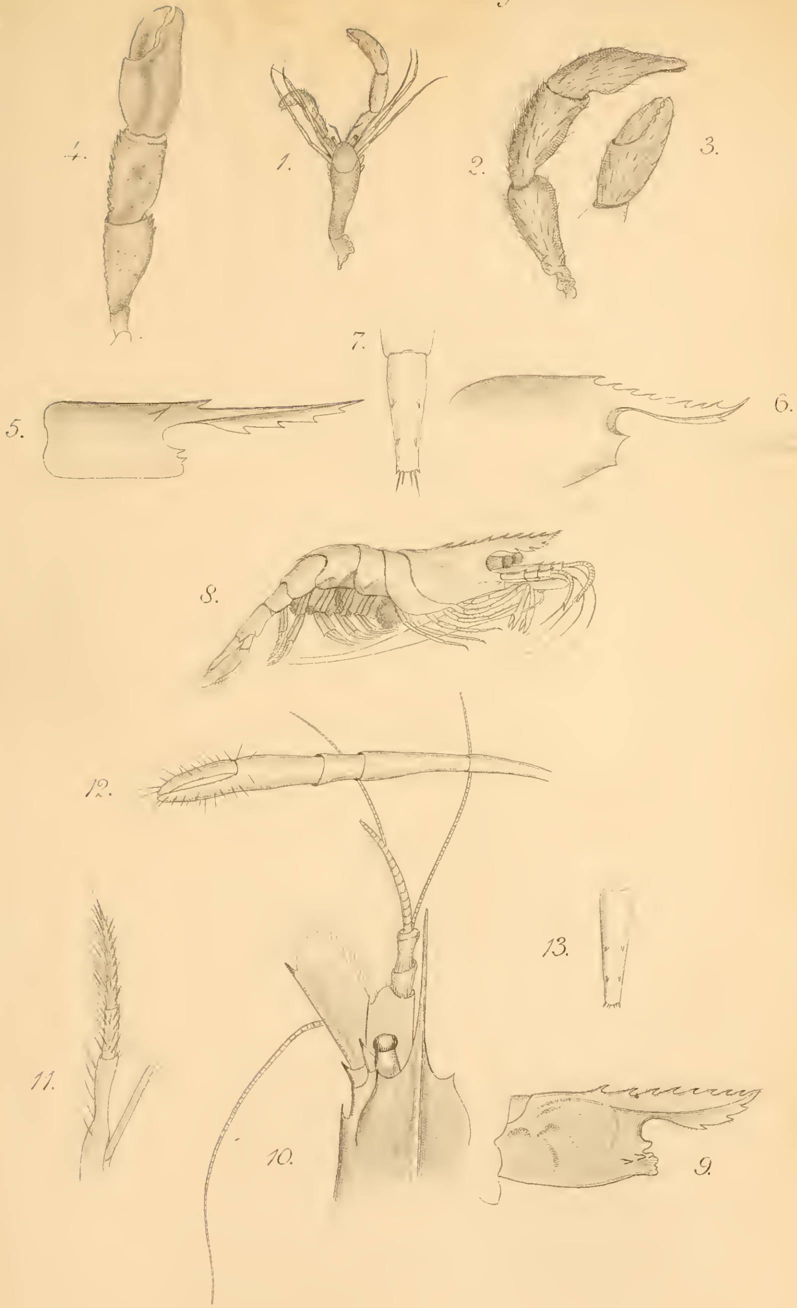
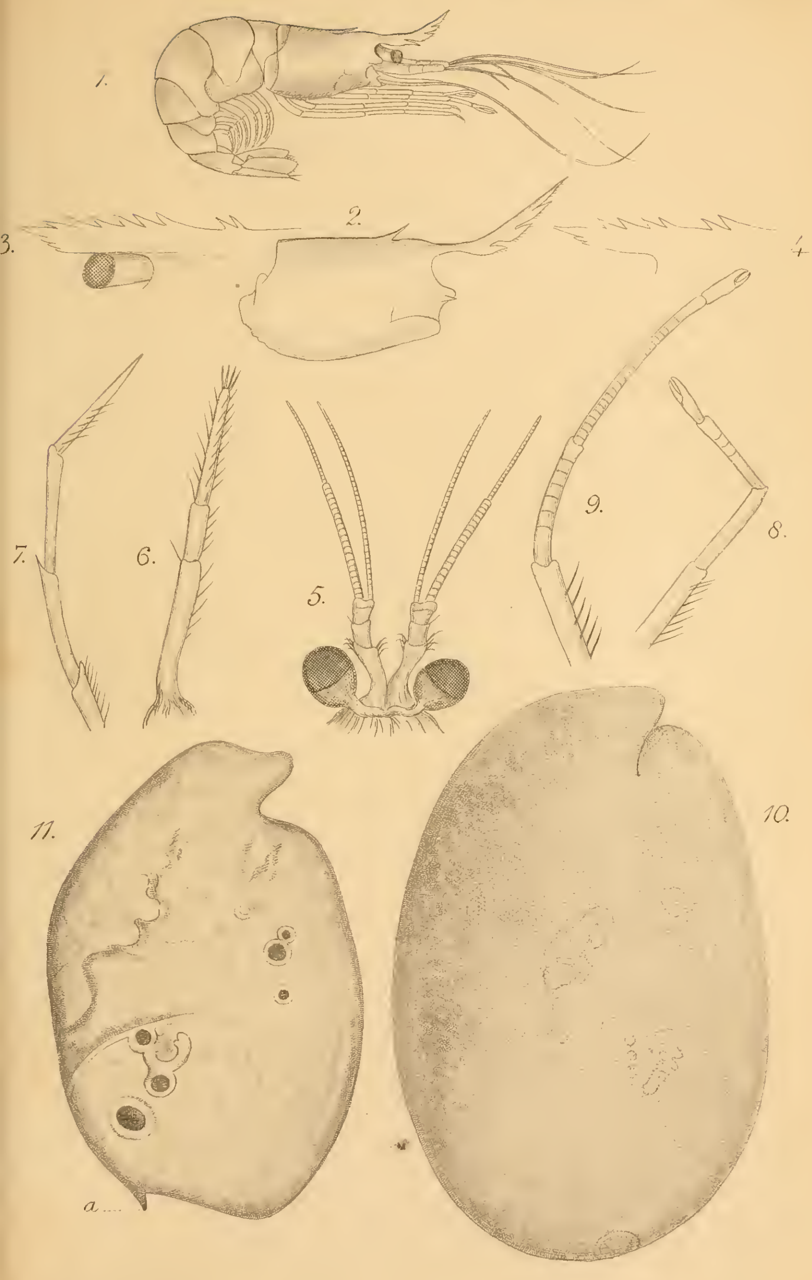
14

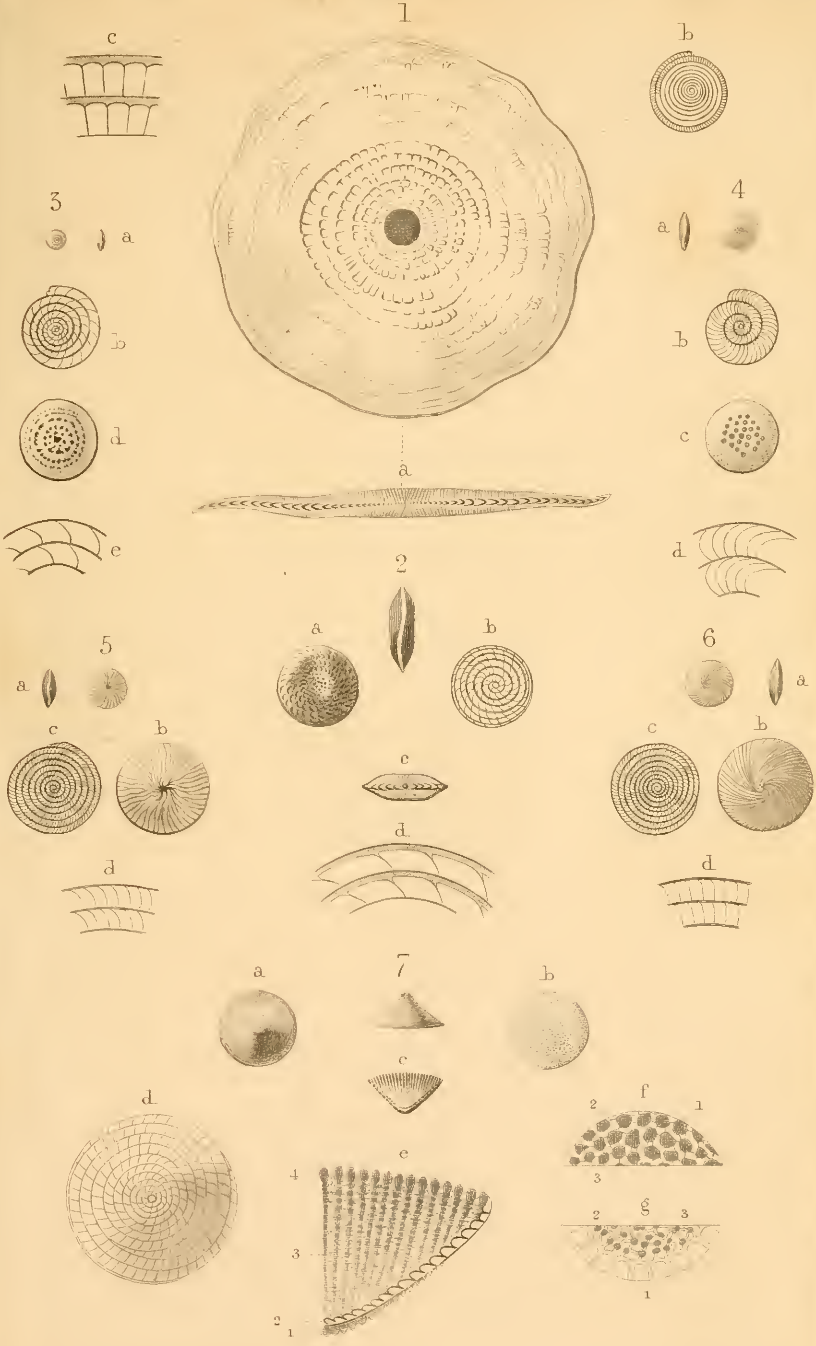
Willis delt. et lith.



George Hodge del.

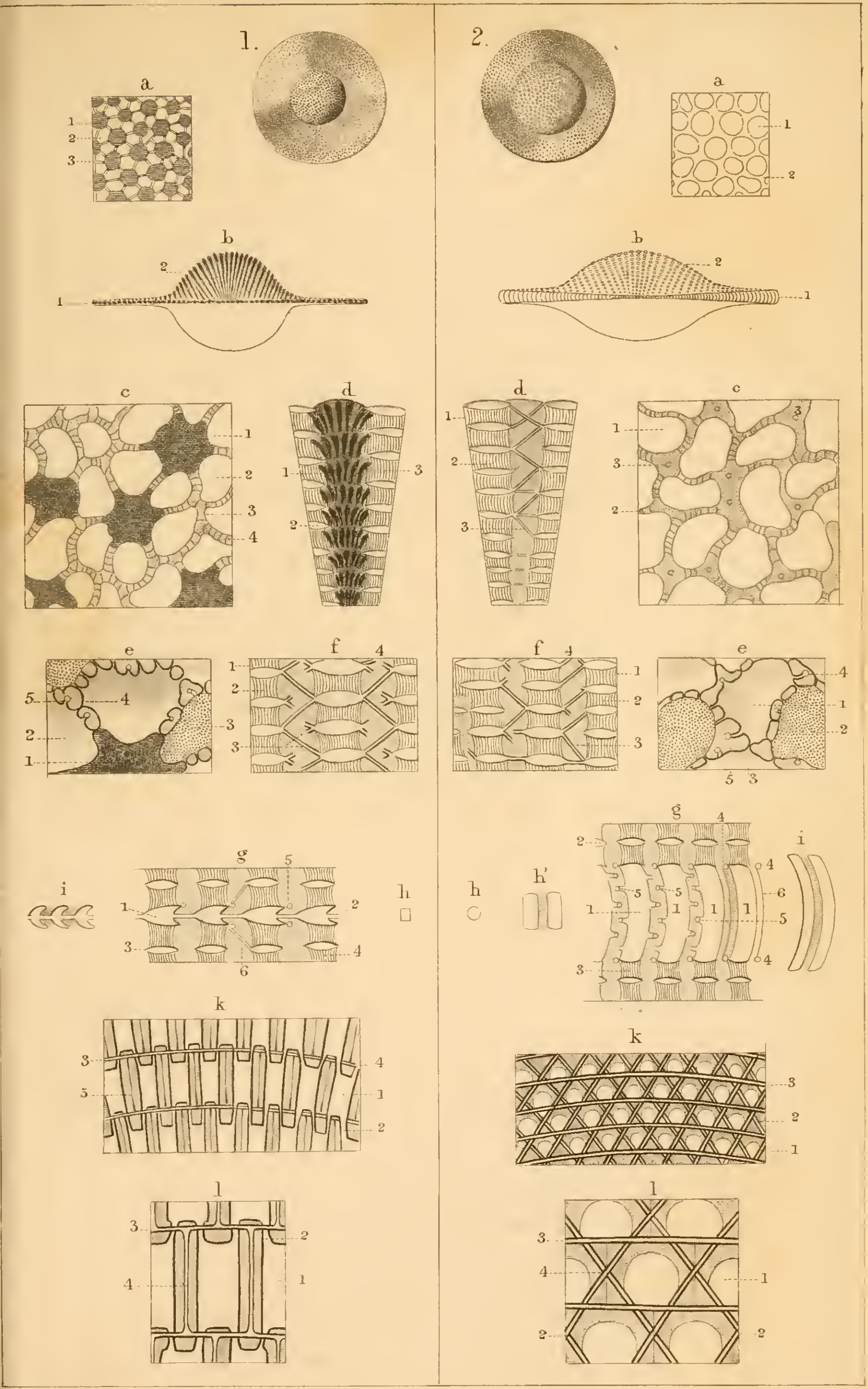


George Hodge & A. M. N. del.



H. I. C. del.

J. Basire sc.



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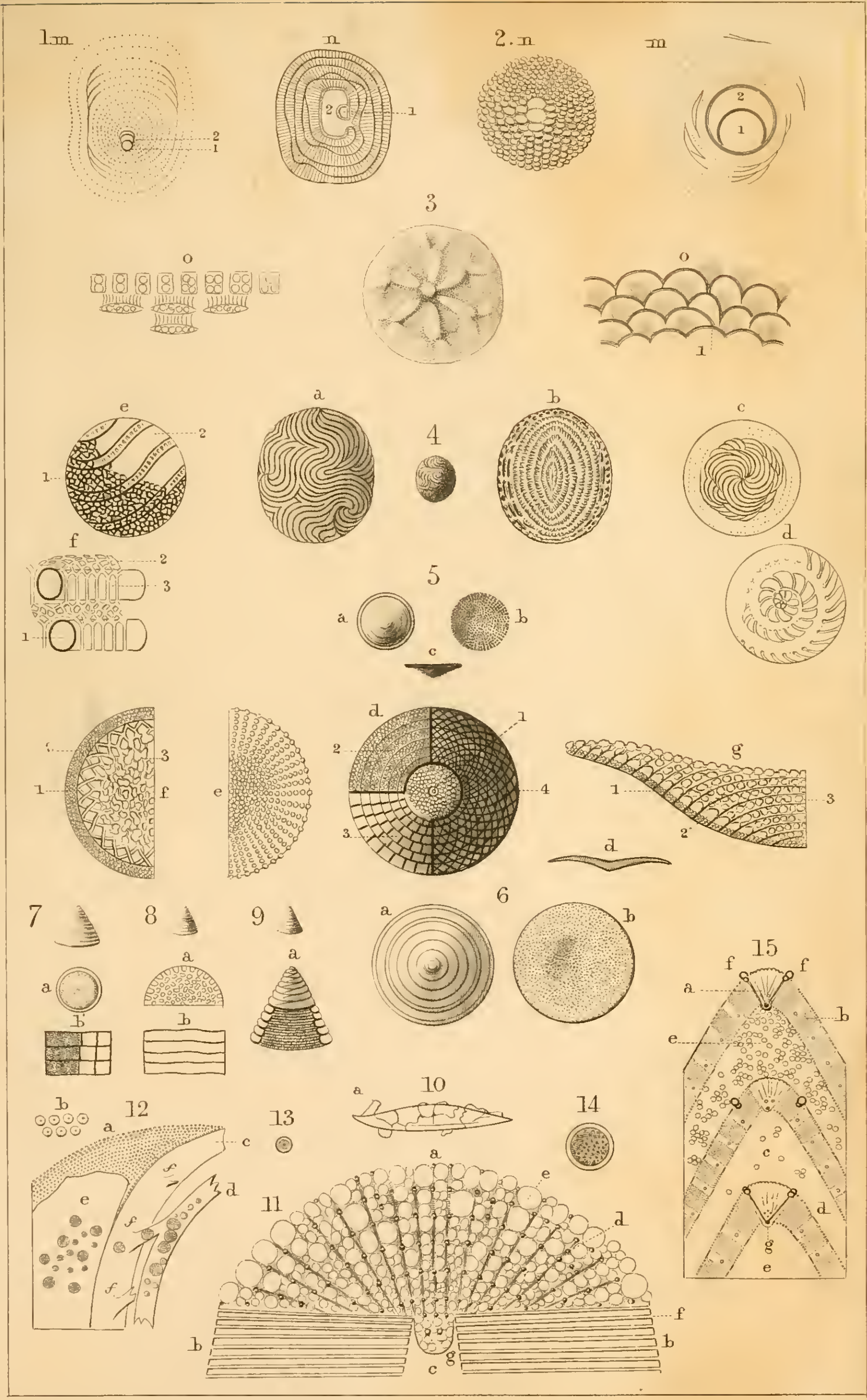

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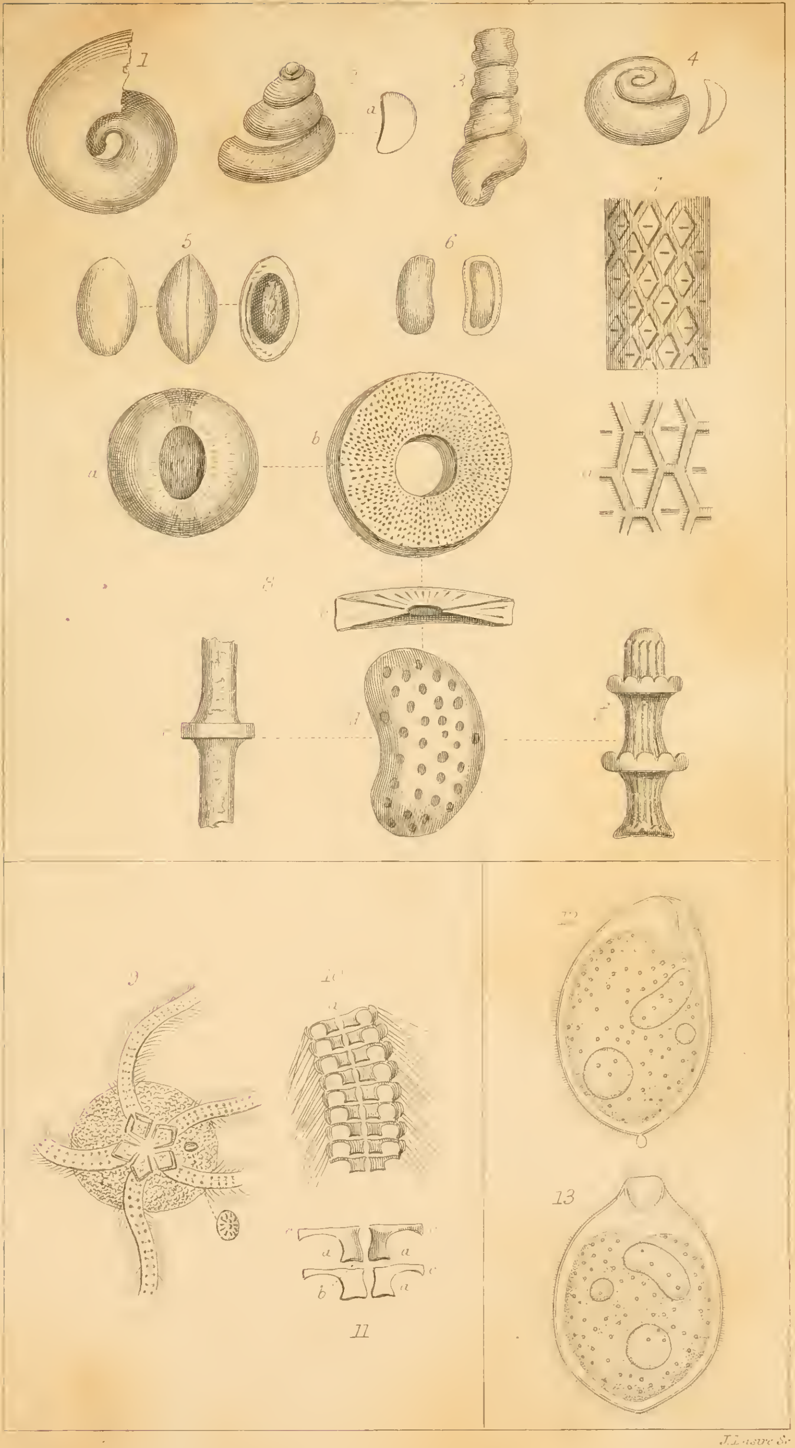

J. Basire Sc.