

THE ANNALS

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INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

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

CONDUCTED BY

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



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THE ANNALS
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MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

“ per litora spargite muscum,
Naiades, et circum vitreos considite fontes ;
Pollice virgineo teneros hic 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 Giannettasi Ecl. 1.

No. 109. JANUARY 1867.

I.—*On the Organs of Circulation of the Roman Snail (Helix pomatia).* By CHARLES ROBERTSON, Demonstrator and Curator of the Anatomical Collection, Oxford.

[Plate I.]

THE very imperfect account given in most of the standard works on comparative anatomy of the organs of circulation of the Gasteropoda has induced me, from time to time, to try various experiments and injections for the purpose of determining the course of the blood and the existence of a capillary system between the arteries and veins*.

The majority of recent writers agree in their accounts of the vascular system, and describe the artery and its branches as far as the head, where it is said to terminate in a sinus which surrounds the nerve-collar, and this, again, communicates with other sinuses in other parts of the body. These spaces left between the artery and vein have been named lacunæ, or intervisceral spaces; and the circulation is therefore said not to be closed throughout its course, and the capillary system is generally wanting.

Milne-Edwards, in his elaborate and instructive paper on the organs of circulation of the Mollusca, describes the arterial and

* Owen's Lectures on Comparative Anatomy (1855), p. 559; Carpenter's Comparative Anatomy (1854), p. 252; Siebold, Anatomy of the Invertebrata, translated by W. L. Burnett (1854).

venous systems of the Snail, and the lacunæ which form the means of communication between them; but the exact course which the blood takes on its way back to the pulmonary chamber is not very definitely pointed out, or any description given of the capillary system*.

In the present paper I propose giving the result of a numerous series of observations and injections of the Roman Snail (*Helix pomatia*); but, before proceeding to give a detailed description of the vascular system, I will describe the method adopted for killing the animals, and the substances used for injecting them. When the animals are killed with chloroform, spirits of wine, or warm water, the foot of the animal is generally so much contracted and rigid, that it is quite impossible to get the injection to run far without much of it extravasating amongst the viscera. After many trials with the above and various other substances, I at last found the following method of killing them answer remarkably well:—Place the animal in a jar of cold water, and exclude all air by placing a glass cover over the top, and allow it to remain undisturbed till it is drowned, when the foot will be found as fully distended and as soft and flexible as when the animal is living. It generally takes forty-eight hours to kill them in this way. Of injections, I have found that size mixed with various colouring matters has answered better than cold coloured fluids. The size, when injected very gently into the vessels, clings to them, and gives a certain amount of support to their delicate walls. I have found the finest gelatine and carmine run exceedingly well, and it has made some very beautiful preparations. Cold injections have this disadvantage, that, on account of the soft and flexible nature of the parts, it is necessary to keep the animal in water during injection, and also when it is dissected. With fluid injections, the least pressure with the hand, or in lifting the animal from one dish to another, may cause the fluid to escape from the vessels, or shift its position; and thus false results are obtained. When size is used, and the animal is not shifted during injection or, better, till the injection has set, you have an exact mould of the vessels, which does not shift its position during dissection.

Milne-Edwards, in his experiments on the snail†, used chromate of lead and size, and the injection-pipe was passed into a hole made by an instrument in the base of the tentacle. Injections made in this way fill first the lacunæ or spaces between the viscera, and finally reach the pulmonary chamber. I have tried many injections in this way, and also by thrusting the injection-pipe into the substance of the foot; but I have always considered it a very unsatisfactory method of proceeding; and although it

* Ann. des Sciences Nat. sér. 3. tome iii. p. 295. † *Ibid.* p. 294.

is quite possible to inject parts of the animal in this way, it is done on the supposition that lacunæ exist in the body, and that the injection will find its way from them into the vessels. I have therefore tried injections from the aorta, the venous sinus, and pulmonary vein, as well as the foot.

Before I proceed to give a detailed account of the vascular system, I will give in detail the results obtained from injections both from the tentacle and the aorta, selected from a large number of experiments.

Animal killed in a jar of cold water; the the foot and tentacle extended, but not much swollen with the water. Injected from the tentacle with warm size and carmine. After cooling, the foot and skin were uniformly red, and no appearance of extravasation on their surfaces. On opening the body, the injection was found to have returned to the heart by the pulmonary vein, injecting the anterior part of the pulmonary chamber, but neither the kidney nor that part of the pulmonary chamber situated between it and the rectum. None of the injection had found its way into the aorta or its branches. The surface of the crop and the salivary glands were well injected. A large mass of injection moulded between the viscera fell out easily when touched with the end of a scalpel. The venous sinus which runs along the side of the rectum filled well, and also the capillaries on the surface of the oviduct and vas deferens.

Animal killed in the same way as the last. The parts presented much the same appearance. Injected from the ventricle with size and carmine. On opening the body after cooling, the injection was found to have gone right round the body and returned to the pulmonary chamber, richly injecting the space of the pulmonary sac between the rectum and kidney (Pl. I. fig. 2 *d*). A small quantity of injection was found in the pulmonary vein (fig. 2 *b*). In this case, and in some other snails injected in the same way, I observed on the surface of the multifid vesicles and in other parts of the body small masses of carmine moulded between the cæca. When detached and placed in warm water, the whole dissolves, without leaving any trace of enveloping membrane: I consider these masses of carmine are merely masses of extravasation from the delicate walls of the capillaries. The capillaries of the digestive tract and generative organ most beautifully injected. The surface of the skin and foot uniformly red. Only a small quantity of extravasation found round the collar, and none observed in other parts of the body.

I might give numerous other examples, selected from my notes; but the results are generally the same, and the two examples I have selected give fairly the results of both methods of investigating such delicate structures. Of course it is difficult

to make a perfect injection of such delicate animals without some extravasation. If these two examples are placed side by side, and a comparison made of the vascular system, it is quite obvious that in the first example the injection had only filled the venous system, and left the arterial quite empty. Injection performed in this way fills first large spaces in the body, then the venous capillaries of the viscera, and lastly the pulmonary capillaries, before it reaches the heart; and a good deal of pressure is required to get it thus far. In the second experiment the injection was thrown into the natural starting-point of the circulatory current; and, for the present, I attach great importance to the fact of the whole vascular system being well filled, and only a small quantity of extravasation being found, round the nerve-collar,—most likely the result of a little too much pressure on the syringe.

The heart of the snail consists of a single auricle and ventricle enclosed in a pericardium (Pl. I. fig. 2 *a*), which is situated at the posterior and left extremity of the pulmonary chamber, about the middle of the lower border of the kidney (fig. 2 *e*). The delicate auricle receives the blood by a large pulmonary vein (fig. 2 *b*) from the surface of the pulmonary sac and kidney, and propels it into the ventricle, which is situated behind it and on the same plane. The aorta (fig. 1 *j*), after leaving the ventricle, perforates the peritoneal covering of the viscera, and passes into the abdominal cavity between a loop of intestine and the anterior margin of the liver, with the receptaculum seminis closely adhering to its right surface. It soon gives off two trunks (fig. 1 *k*) for the posterior part of the crop, the liver, and the whole of the viscera placed in the spire of the shell. The first of these trunks is the largest, and gives twigs to that part of the digestive tract contained in the spire of the shell. The second of these branches is much smaller, and is lost on the posterior portion of the crop and the albuminiparous gland and that part of the intestine which runs along the side of the pulmonary chamber. The aorta, after giving off these branches, bends forwards, having the crop on its inferior surface and the conjoined generative ducts above it. The next trunk which proceeds from it is a stout branch, and is given off when the aorta in its forward course reaches the posterior and right extremity of the salivary gland. This trunk again breaks up into three branches, which all spring from the same point. The first branch (fig. 1 *l*) passes to the right and supplies the sides of the body, and then passes down and is lost in the upper portion of the foot. The second branch runs to the left (fig. 1 *n*), and is lost on the surface of the crop and salivary glands. The third branch (fig. 1 *m*) passes straight down between the retractor muscles of the head,

and supplies the posterior portion of the foot with blood. The aorta, after giving off these trunks, runs straight forward to the inferior œsophageal ganglion (fig. 1 *p*) without giving off any large branches, having the crop on its superior surface, the retractor muscle of the head below, with the visceral nerve closely adhering to its left side. After perforating the inferior œsophageal ganglion, it splits into two branches, the first and smaller of which proceeds into the buccal mass. A small branch comes up on each side of the infra-œsophageal mass, adhering closely to the nerve-collar, supplies the tentacles (fig. 1 *o*), parts about the head, the whip and sheath of the penis, and anterior sides of the body. The second and larger bends sharply back round the inferior surface of the ganglion, and runs along the surface of the foot between the bundles of retractor muscles (fig. 1 *g*), and gives off branches throughout its course to all those parts not supplied by the posterior pedal*. The aorta therefore does not, as Milne-Edwards and others maintain, when it reaches the head, terminate in a large sinus which surrounds the collar, but can with ease be traced into the substance of the foot, where it ends in a capillary system.

Two large veins collect the venous blood from the capillaries of the body, foot, &c., and unite to form a large sinus, which runs along the side of the rectum; and from it the blood passes to the pulmonary capillaries. The most superficial of these veins commences at the posterior part of that portion of the liver which is contained in the spire of the shell, runs along the thickened rim of the mantle, receives in its course numerous large twigs which come up from the surface of the liver, and forms a junction with the second vein at the posterior extremity of the pulmonary chamber. The second vein collects the blood from the foot, the mantle, the skin covering the head, the anterior and lower surface of the liver, and forms a considerable sinus, which runs along the posterior border of the kidney and finally joins the first superior vein, to form a sinus at the point where the rectum leaves the visceral covering. A third and much smaller trunk runs along the wall of the intestine, receiving the blood from its rich plexus of capillaries, and, getting larger as it proceeds towards the rectum, enters the venous sinus close by the last two veins. The large sinus formed by the junction of these three veins runs along the outer border of the rectum (fig. 2 *c*), covered over by the mantle which is common to both, and when it reaches the pulmonary orifice it closes over its inferior surface and runs across in the thickened border of the mantle, giving off twigs to the whole of the pulmonary chamber.

* For Cuvier's brief account of the vascular system of *Helix*, see 'Mémoires des Mollusques,' Paris, 1817; or Ann. du Muséum, 1806, p. 159.

Injections show that the whole of the venous blood is returned to the sinus by the three veins I have described before it is distributed to the pulmonary capillaries; none of it returns along the anterior border of the mantle and so into the capillaries. If a transverse section is made of the intestine, venous sinus, and duct of the kidney, about the middle of their course (fig. 2 c), they will be found arranged in the following manner. The intestine has the venous sinus on its outer border, and the duct of the kidney on its inner; the duct of the kidney is much stouter than the sinus, but both have about the same calibre.

There is not much difficulty in making a successful injection of the venous system from the sinus, by the side of the rectum, the injection spreading very readily from the veins into the capillaries, and, if not too much pressure is used, without extravasating amongst the viscera*.

As I have before observed, the capillaries may be injected from the aorta, or by thrusting a pipe into the tentacle, or from the venous sinus. Injection performed in either of these ways fills a rich plexus of vessels on the whole of the digestive tract, the generative organs, mantle, and foot, before presenting any trace of lacunæ amongst any of these organs. I have repeatedly injected from the aorta, and have found the capillaries richly injected, as well as the venous system, without any trace of lacunæ or intervisceral spaces being observed between the arteries and veins. I have therefore come to the conclusion that the vascular system is closed in *Helix pomatia*, and that the arteries and veins are connected by a capillary system, and the blood is not shed into lacunæ in any part of the body. If the injection of these delicate animals is not very carefully performed, and the body quite soft and flexible before the injection is thrown in, it will very readily form large masses amongst the viscera. If one of these masses from a warm injection is carefully picked out, and placed in warm water, the whole of the injection readily dissolves, and does not leave any trace of enveloping membrane, which, I think, shows conclusively that if lacunæ do exist in the body, they are not dilatations of the venous system, but must be spaces excavated in the body without any independent walls. I have repeatedly examined the whole of the abdominal cavity, for the purpose of making out any communication between it and the venous system, without finding any. If the veins have any direct communication with the cavity of the body, and a size

* The vessels of *Helix algira* are figured by Carus and Ottone, part 6. tab. 2. fig. 5, from Erdl's 'Dissert. inauguralis de *Helicis algiræ* vasis sanguiferis, 1840,' which I have not seen. Siebold considers that they are arteries which are figured (Anatomy of the Invertebrata, p. 248); but I am quite confident that they are veins which are figured, and that Erdl is right.

injection is thrown in and allowed to cool, some trace of these communications ought to be found.

If my experiments are correct, the course of the blood after leaving the heart will be as follows:—From the artery it passes into a plexus of capillaries, which are richly spread over the whole of the body, and from them it is collected into veins with distinct walls, which return the whole of it to a large sinus by the side of the rectum (Pl. I. fig. 2 c). From this sinus the blood passes, first, into the capillaries of the pulmonary sac, which is situated between the rectum and kidney (fig. 2 d), and, lastly, runs forward and round into the whole of the anterior portion of the sac, the whole of the venous blood being thus aërated before returning to the heart. The arterial blood which is collected from the posterior narrow slip of pulmonary sac passes through the kidney (fig. 2 e) before it reaches the pulmonary vein. The kidney, therefore, is supplied with blood which has been previously aërated in the pulmonary capillaries; but the whole of the venous blood does not pass through it*.

I think it extremely probable that, with improved injection-fluids and injecting-apparatus, and by paying attention to the state of the animal before the injection is begun, a closed system of vessels will be found in other Gasteropoda. Messrs. Hancock and Embleton, after describing the arterial and venous systems of the *Eolis*, and the mode of communication between these systems, go on to remark †, “We cannot undertake to say whether they end by closed extremities, or whether they have open mouths which communicate with lacunæ or sinuses in the intervisceral spaces, or with those in the skin. The lacunæ in the viscera we have not been able to make out by dissection, and have not made use of injections on account of the great difficulty of injecting such small animals.” Also, in their account of the vascular system of the Nudibranchiate Mollusca ‡, “The parietal or hepatic system is probably provided with a complete system of capillaries.”

EXPLANATION OF PLATE I.

The arterial system of *Helix pomatia*, from a photograph by Messrs. Wheeler & Day, Oxford.

Fig. 1. The foot has been placed downwards, and the dissection made

* Milne-Edwards says that the whole of the venous blood is not obliged to traverse the pulmonary chamber before reaching the heart, part of it being carried by a system of canals and vessels to the kidney (Leçons sur la Physiologie et l'Anatomie Comparée, vol. iii. p. 148). Prof. Lawson says that a capillary system does not exist in *Limax maximus* (Quart. Journ. Microscopical Science, January 1863).

† Anatomy of *Eolis*, Ann. Nat. Hist. (1848), vol. i. p. 100.

‡ Alder and Hancock's 'Nudibranchiate Mollusca,' vii. p. 15.

from above; the pulmonary chamber has been turned to the left and the generative organs to the right. *a*, foot; *b*, pulmonary vessels; *c*, spire; *d*, rectum; *e*, kidney; *f*, albuminiparous gland; *g*, anterior pedal artery; *h*, multifid vesicles; *i*, penis; *j*, aorta just where it perforates the peritoneal covering of the viscera (the pericardium has not been laid open, so the heart is not seen); *k*, branch to stomach and contents of spire; *l*, branch to the side of the body; *m*, branch to posterior portion of the foot; *n*, branch to salivary glands and crop; *o*, branch to tentacles, penis, and parts about the head; *p*, point where the aorta perforates the infra-oesophageal mass and bends back to enter the foot (part of the ganglion has been cut away); *q*, branch to generative ducts.

Fig. 2. The pulmonary chamber, heart, kidney, and venous sinus of the same: *a*, heart; *b*, pulmonary vein; *c*, venous sinus; *d*, narrow portion of pulmonary chamber between the rectum and kidney; *e*, kidney, which has been laid open; its duct runs along the inner surface of the rectum, and terminates close by the pulmonary orifice; *f*, rectum.

II.—On Pauropus, a New Type of Centipede. By Sir JOHN LUBBOCK, Bart., V.P. Linn. Soc., Pres. Ent. Soc., V.P. Ethn. Soc., F.R.S., &c.*

THE subject of the following communication is a small, white, bustling, intelligent, little creature, about $\frac{1}{25}$ of an inch in length, and may be characterized as follows:—

Body composed of ten segments, including the head, convex, with scattered hairs. Nine pairs of legs. Antennæ 5-jointed, bifid at the extremity, and bearing three, long, jointed appendages.

The author has met with this little Centipede in some numbers, among Thysanura, &c., in his kitchen-garden. He was at first disposed to regard it as a larva; but having, during the last three months, had several hundred specimens under examination without finding any in a more advanced condition, and having found spermatozoa in several, he thought there could be no doubt that it is a mature form.

The body is rather narrower in front. The head consists of two segments; the third segment bears one pair of legs; the fourth, fifth, sixth, and seventh two pairs each. Strictly speaking, however, each of these segments is double. The posterior legs are the longest. Each segment, from the third to the seventh, has on the side a pair of strong bristles. There are also several transverse rows of short club-shaped hairs. The eyes are large and oval. The antennæ are very remarkable, and quite unlike those of any other Myriapods. They are 5-jointed and bifid at the extremity. The first four segments are short. The two branches constituting the fifth are longer and

* Abstract of a paper read before the Linnean Society, Dec. 6, 1866.

unequal. One bears a single, the other two, long, many-jointed appendages. The mouth consists of two pairs of minute organs; the anterior ones toothed, the posterior pointed. Between the second pair of legs are two processes, which probably form part of the generative organs.

The author has been able to trace the development. The smallest specimens met with have three pairs of legs, and the number increases at each moult; but it is remarkable that whereas two pairs are acquired in the first, so that the number rises from three pairs to five, at the subsequent moults a single additional pair only is obtained.

A second species of the genus was found with the first. It is, however, much rarer, and differs in the form of the antennæ.

Sir John then proceeded to make some remarks on the systematic position of the Myriapoda, which he regarded as forming a class, and he expressed the opinion that the genus now described approached the other Articulata more nearly than any Myriapod hitherto known. Nor did he think that *Pauropus* could be placed in either of the two great groups of Myriapoda, which may be characterized as follows:—

CHILOPODA. Antennæ with not *fewer* than fourteen segments. One pair modified into powerful footjaws. Generative organs opening at the posterior end of the body. Legs in single pairs.

DIPLOPODA. Antennæ with not *more* than seven segments. No footjaws. Generative organs opening at the anterior part of the body. Legs, after the first six, arranged in double pairs.

Pauropus, at first sight, looks most like a Chilopod. Its activity, the compactness of its body, the dorsal plate, and elongated hind legs give it much the appearance of a very minute *Lithobius*. A closer examination, however, does not favour this view. The antennæ have only five segments; the powerful footjaws are absent; and the generative organs appear to open anteriorly.

Nor can *Pauropus* be classed among the Diplopods. It is true that the eight posterior legs correspond to four dorsal plates; nevertheless it is evident that in reality each pair belongs to a separate segment, as may clearly be seen if we look at the animal from beneath. In one sense, this is true also of the Diplopods; but they invariably have the legs attached by double pairs, while those of *Pauropus* are equidistant. Moreover in all Diplopods the first three pairs of legs are distinguished from the rest by possessing each a distinct segment, whereas in *Pauropus* this is the case with the first pair only. In Di-

plopods, again, the legs are equal, and terminate in a simple claw, which is not the case in *Pauropus*. The mouth-parts, though very different from those of the Chilopods, are perhaps even less like those of the Diplopods. The eyes and antennæ are also very different.

Thus, then, *Pauropus* differs greatly from either of the two great orders of Centipedes. It forms a connecting link not only between the Myriapods and other Articulata, but also between the Chilopoda and Diplopoda.

III.—On the Sap-currents (*Rotation and Circulation in the Cells of Plants*), with reference to the question of Contractility. By Professor REICHERT*.

THE results of my investigations may be summed up in the following paragraphs:—

1. In all vegetable cells with rotating, circulating, or rotato-circulating currents, two parts are to be distinguished in the contents of the cellulose capsule—namely, the central “cell-juice” or “cell-fluid” situated in the axis, and the “mantle-layer” (*Mantelschicht*) diffused between this and the cellulose capsule.

2. The “cell-fluid” is colourless, or coloured as in *Tradescantia virginica*, not very tenaciously fluid, and without albumen, but not well known as regards its other chemical properties; with respect to the circulation, it is the motionless, resting part of the cell-contents.

3. To the “mantle-layer” belong the following constituents:—the “mantle-fluid” as I have called it, the tenaciously fluid substance named “protoplasm” by Hugo Mohl; chlorophyll corpuscles, and other very small solid corpuscles, the chemical nature of which cannot be ascertained positively; the cell-nucleus; microscopic crystals; and the primordial utricle when this is present, which would form the boundary of the “mantle-layer” towards the cellulose capsule.

4. In the Characeæ the “mantle-fluid” cannot be overlooked; it was, however, erroneously assimilated to the tenacious fluid substance of circulating sap-currents, the so-called protoplasm-currents, and rightly distinguished only by Nägeli. In the cells with circulating sap-currents, it was first detected by E. Brücke in the stinging-hairs of *Urtica urens*; and it was observed in all the cells with rotating or circulating sap-currents examined by me. It is diffused between the cell-juice and the cellulose capsule, or the primordial utricle when this is present, is fluid, rich

* Translated by W. S. Dallas, from the Monatsbericht der Akad. der Wiss. zu Berlin, 3rd May, 1866, pp 318-323.

in water, exhibits only a small amount of albumen, and does not mix with the cell-juice. Its saline contents and the presence of other organic substances dissolved in it cannot be accurately ascertained; but it may be taken as a matter of course that it is in chemical reciprocal action with the other constituents of the mantle-layer.

5. The other constituents of the mantle-layer are bathed by the mantle-fluid or suspended in it. Amongst the constant ones, leaving out of consideration the questionable primordial utricle, are the viscid substance and the chlorophyl and other small corpuscles. The "viscid substance" is strongly albuminous, more or less tenacious as regards its state of cohesion, and presents itself in different and variable arrangement and form before and during the flow of the sap. Neither the nucleus nor the microscopic crystals are always to be found. Among the crystals were observed irregularly stellate ones of unknown chemical constitution (*Hydrocharis morsus ranae*), and, in the stinging-hairs, oxalate of lime.

6. In the currents of the vegetable cell only the constituents of the "mantle-layer," not including the primordial utricle, take part. But whatever be the causes or forces by which these phenomena are produced in the constituents of the "mantle-layer," their action is demonstrably exerted especially, and exclusively, on the "mantle-fluid," which has hitherto remained quite unnoticed; this is thereby set in a rotatory streaming motion. The movements of the other constituents of the mantle-layer (the viscid substance, nucleus, chlorophyl and other small corpuscles, and microscopic crystals) are induced by the mechanical action of the rotating mantle-fluid upon them, with the cooperation of adhesion and, in the case of the viscid substance, of cohesion. The molecular movements of very small chlorophyl and other corpuscles visible under favourable circumstances remain excepted therefrom.

7. The rotatory movement of the mantle-fluid, as also its direction, is recognized especially from those constituents of the mantle-layer which float freely in it and are set in motion by it, namely the freely moving chlorophyl and other solid corpuscles, and this both in the cells with rotation and in those with a so-called circulation. In the *Charæ* and in *Hydrocharis morsus ranae* the viscid substance is also set in motion in separated fragments, in the *Charæ* in a globular form, and the current is then called "rotation."

8. The rapidity of movement of the freely floating and rotating substances under otherwise similar circumstances is secondarily dependent upon their mass, as also upon the influences of adhesion, which make themselves felt at the limit of

the cell-juice, and still more strikingly at the cellulose capsule and during the mutual contact of the floating constituents. In consequence of the operation of adhesion, it may also happen that the constituents passively carried on become momentarily or more permanently quiescent, or even acquire retrograde movements.

9. The mechanical action of the rotating mantle-fluid reveals itself also by the change of appearance and form of the viscid substance ("protoplasm"), both in its freely swimming state (*Hydrocharis*) and also especially during its adherence to the cellulose capsule, whether transitory or permanent, in the neighbourhood of the nucleus or in some other favourable spot (*Hydrocharis*, *Urtica urens*, *Tradescantia*, &c.). These changes of appearance resemble in external aspect the motory forms of contractile tissues; they are, however, caused by the quite unavoidable action of the rotating mantle-fluid upon the viscid substance, are often demonstrably combined with a permanent displacement of the mass, and cannot be regarded as the effect of molecular movements of the particles in the substance itself.

10. It is a matter of course, and will also be established by direct observations, that the viscid substance diffused upon and adhering to the cellulose capsule in the vicinity of the nucleus or in any other spot, when in a favourably tenacious state of cohesion, will be drawn out by the mechanical action of the rotating mantle-fluid into long filaments or cords, either simple or branched, and either terminating in free extremities or uniting again in circular or elliptical forms, and converted by the co-operation of adhesion into a more or less complicated net diffused between the cellulose capsule and the cell-juice. This is the arrangement and configuration of the viscid substance in the cells of plants with a so-called circulating or circulo-rotating current; and this is the foundation of the so-called "protoplasmic currents" so often spoken of. When the viscid substance is thus arranged, the free-swimming granules very easily get into the domain of its fibres and cords, and may even disappear entirely from the open region of the mantle-fluid, and in the struggle between the influences of the rotating mantle-fluid and of adhesion perform such vacillating and leaping movements as to remind one of the so-called "granular movement" of contractile substances. Lastly, in this arrangement the viscid substance may be set in motion in the region of its fibres and cords, as is proved by the progression on the fibres of swellings with imbedded granules or crystals; but the tenacity of the substance may be so considerable, and the power of the rotating fluid so small, that such a movement either does not take place at all, or not through the whole extent of the net (E. Brücke).

11. The structure of the ramified and net-like configuration of the viscid substance depends chiefly upon the degree of force of the rotating mantle-fluid, the form of the cellulose capsule, the point of attachment of the viscid mass on the cellulose capsule and its relative position to the axis of rotation of the mantle-fluid, and, lastly, upon its state of cohesion.

12. There is no essential difference between the rotating, circulating, and rotato-circulating currents of the cells; in all, the rotating mantle-fluid is to be placed in the foreground; in it alone we can recognize the direct influence of the unknown causes of the currents, and this everywhere acts in the same way.

13. The other constituents of the "mantle-layer" exposed to the mechanical influence of the rotating mantle-fluid cause the current of the vegetable cell to vary in outward appearance; they will also, of course, present varying obstacles to it according to circumstances. Among the phenomena of this nature I may indicate that in the cavities formed between the resting masses of the viscid substance the rotating mantle-fluid may come to perfect rest, and that then molecular movements of free granules are detected in such cavities,—further, that in *Hydrocharis morsus ranae* the rotating mantle-fluid is divided into two regular rotating currents, running down separated from each other by a distinct piece traversing the cavity of the cellulose capsule,—and, lastly, that by means of such impediments at the rounded poles of the cellulose capsule reflux movements of the currents of the most various kinds may be produced.

14. Motory phenomena from which the existence of a contractile activity in the viscid substance or in the other constituents of the cell-contents might be deduced, are entirely wanting in the plant-cells with currents investigated by me.

15. With regard to the movements of currents in the cells of plants, the first thing to be done is to discover the causes by which the rotating movements of the "mantle-fluid" are produced. But no physical or chemical processes by which this rotating movement might be brought about have hitherto been detected in the cells of plants.

IV.—*Conclusive Proofs of the Animality of the Ciliate Sponges, and of their Affinities with the Infusoria flagellata.* By H. JAMES-CLARK, A.B., B.S.*

BEFORE I proceed to the main point in question in this article, I wish to say a word in regard to the group of animals, viz. the PROTOZOA, of which I am fully convinced the *Spongiae ciliatae* are a part.

* From 'Silliman's American Journal, Nov. 1866.

From the time when Ehrenberg published his great work the 'Infusionsthierchen,' to the period of the issue of the 'Études sur les Infusoires' of Claparède and Lachmann, there has been a steadily growing belief that a large part of that mass of animalcules which Ehrenberg denominated *Infusoria* forms a distinct grand division, quite as decided in character as any of the four great groups which are now generally accepted. Still it is a little curious that, although Cuvier had long ago pointed out the *plan* or type upon which his four *embranchements* were constructed, later investigators have not attempted to elucidate the *typical idea* which lies at the basis of the Protozoan organization. Claparède and Lachmann have approximated nearest to such an attempt, in their division of a part of the group into dexiotropic and læotropic sections; but nothing is said even by them of a plan which runs through the whole grand division. Surely they had seen enough of material, at least of the higher divisions of the group, to sustain them in pronouncing upon the typical relation of the Infusorial organization; but it may be that the apparent paucity of characters among the lower members of this grand division misled them into an apprehension that there was no definite taxonomical relationship of the organs. That they recognized the latter as members of the same group with the former, no one will deny; but it must be conceded that the affiliation was observed to be only one arising from similarity of organization and habit, and not from any community of *plan* in the disposition of the organs.

It is now over two years since I demonstrated (in a course of lectures, delivered in February and March, 1864, at the Lowell Institute in Boston) that the arrangement of the organization of the Protozoa is based upon a spiral or, rather, a helix: more recently those lectures have been published*, and the *type* of the organization of the Protozoa, as well as that of each of the other four grand divisions of animals, made as clear by illustrations as the limits of the volume seemed to allow. In order, therefore, that I may not appear to claim for the Sponges merely a new position in the universe of obscurities, I shall take the liberty of drawing the reader's particular attention to the arguments which I have adduced, in the volume above mentioned, to prove the unity of plan in the organization of the Protozoa and its dissimilarity from any other which dominates among the four remaining grand divisions.

This much being premised, I proceed now to give a sketch of the peculiarities of some of the genera of Infusoria flagellata with which I think the Sponges are most intimately associated.

* H. James-Clark, 'Mind in Nature.' D. Appleton & Co., New York, 1865.

Several of these genera are new to science, and, moreover, of the most remarkable forms. I regret that words alone cannot, at this time, render their peculiarities as evident as I hope the illustrations will in my forthcoming paper in the 'Memoirs of the Boston Society of Natural History.'

I must ask the reader, in the first place, to go back with me almost to the Ultima Thule of animal simplicity, and revise the organization of the hitherto too lowly estimated *Monas*, in order to lay the foundation for the group which embraces in its limits so gigantic a family as the *Spongiæ ciliatæ*. I do not think any one will be prepared to fully appreciate such a remarkable definiteness and system in the arrangement of the organization of *Monas* as I have discovered among the various forms which constitute that genus.

Hitherto a *Monas* has been looked upon as a mere shapeless molecule, with a vibrating *cilium* of some sort or other, attached to its surface at an indefinite point. As I understand the relation of parts now, the *motory cilium* or *flagellum* is perhaps the most remarkable feature of the whole animal, not only in a physiological aspect, but also in its topographical relationship. Let me illustrate this by a description of the body and appendages of *Monas termo*, Ehr.

The body of that species has the form of a wide, compressed heart, with two distinct summits. The broad flattened sides lie opposite to each other, and parallel with the plane which passes through the two summits, and which forms the prolongation of the greater transverse diameter of the body. Between these summits is an aperture which constitutes the mouth. One of the summits is prolonged into a broad, conical, beak-like body, and assists the mouth in the prehension of food. It is therefore a true *lip*. The *flagellum*, however, is the real prehensory organ, although it, at the same time, performs the office of a propelling agent when the body is detached from its pedicel and moves about in a free state. This organ has the form of a scarcely tapering bristle, which is attached close to the edge of the mouth, on that side of it which is opposite to the lip, and rises with a decided well-defined curve whose plane is coincident with the plane which runs through the two summits, and forms, as I have just mentioned, the plane of the greater transverse diameter of the body. This remarkable feature is scarcely to be recognized during the free state of the animal; but when the latter is moored by its posterior end to its pedicel, the phenomenon in question is very marked and conspicuous. For most of the time the *flagellum* sustains itself in this rigid arcuate position, and is always curved away from the lip; but its terminal end keeps up an

almost incessant spasmodic incurvation toward the mouth, to all appearance for the purpose of throwing or jerking particles of food in that direction. When an acceptable morsel is met with, both the lip and the flagellum combine to press it into the open jaws of the animal; and when that is accomplished, the two organs immediately return to their former positions.

Scarcely less noticeable is the so-called *contractile vesicle*—the analogue of the heart of the higher animals. In a view of the body so placed that the lip is next the eye, and the flagellum consequently curving away from the observer, we have the two broad sides on the right and left, and the plane of the greater transverse diameter coincident with the line of vision. The body then seems, at first sight, to have a symmetrical aspect, such as is not observable from any other point of view; and such it might be made to appear if I should belittle the importance of one single organ, by simply mentioning its existence and omitting to lay down its exact topographical relationship. I refer to the *contractile vesicle*. During the systole of this organ it is so inconspicuous that it would easily escape even the most careful observation; but during the transition to the expanded state, and at the full diastole, its prominence, from the point of view just mentioned, is so great as to rival the flagellum in attraction. It may then be seen as a comparatively large, rounded, transparent, vesicular body, which stands out in strong profile, just in front of the middle, and close to the surface of the left side of the body. At full diastole it even forces the overlying region outwardly into a quite prominent papilla. In reference to the other organs and parts of the body, it stands, therefore, altogether in an asymmetrical relation; and from whatever point of view it, or any of the organs, may be observed, the organization as a whole evidently rests upon an oblique basis. The *bilaterality* of the type is sufficiently clear; but the topographical relationship of the organs is incompatible with *bisymmetry*, for right and left are twisted upon each other.

So much for *Monas*. As for the objection which has been raised against the estimate that has been put upon the monad-like Infusoria, because they have not been proved to be adult forms, it seems to me that the *onus* of proof lies on the other side, viz. to show that they are not adult. I think, moreover, that I am fully warranted in assuming that a *Monas* which possesses such an organization as I have described, and is attached to a stem, is an adult; and more especially so since, among many hundreds which I have observed from time to time, I have never seen any trace of a transition to a higher form. That such simple organizations can exist without rising to a more compli-

cated state during a whole lifetime, I am furthermore sustained in believing by the discovery of some new generic forms, which, although scarcely, if at all, more highly organized than *Monas*, have in addition such characters as would seem to stand in the way of a transition to a more elevated grade of existence. For instance, the presence of a *calyx* about the body of an infusorian, into which it can retreat, is an indication of a fixity of condition which corresponds to the adult state. Thus I found one of the new genera which I have just alluded to.

Bicosæca, as it is called, may be described in general terms as a stemless *Monas* which is attached to the bottom of a calyx by a highly muscular retractile cord. All the organs have the same remarkable definiteness of relationship and peculiarity of form that *Monas* possesses; and in addition there is the muscular cord which with oft-repeated jerks retracts the body to the very bottom of the calycine envelope. There are two singularly diverse species of this genus—one marine, and the other lacustrine.

The most interesting infusorian of this group of new forms is the one which I have called *Codosiga*. This links the Sponges to the flagellate Infusoria. Its greatest peculiarity consists in the possession of a highly flexible, extensible and retractile, membranous collar or hollow cylinder, which projects from the anterior end of the body. The cylinder is slightly flaring; and if we include the asymmetrical body, the whole might be compared to a very deep one-sided bell, with its narrower end half filled up. The single, sigmoid-arcuate, rigid flagellum arises from the depths of the bell, exactly at the middle of the truncate front, as it were forming a prolongation of the longitudinal axis of the body. There is no lip; and the flagellum, which rises close to the mouth, has a strong resemblance to that of *Monas*, both in proportion, form, and habits, and performs the office of a prehensile organ when the body is fixed, or acts as a propeller during natation. The *contractile vesicles* are two, or even three, in number, and lie in the posterior third of the body. The only species of this genus which I know of is gregarious in habit; but usually not more than four or five bodies are to be found attached, like *Anthophysa*, by their narrower posterior ends, to the branchlets of a single forking stem. The peculiarity in regard to the direction of the curvature of the flagella in a backward direction toward the stem, is as highly marked in *Codosiga* as in *Anthophysa* (described by me in the Number of the 'Annals' for December, 1866); and there is also the same fixed relationship of the longitudinal and the greater and less transverse diameters of the several individuals of the colony.

There is still another new genus which I should like to mention. *Ann. & Mag. N. Hist. Ser. 3. Vol. xix.*

tion here, because it forms a collateral link with *Codosiga* in the affiliation of the Sponges with the *Monadina*. This genus I have called *Salpingæca*. It is, as it were, a single individual of *Codosiga*, which does not possess a stem, but is seated in a *calyx*, from which it protrudes, or into which it retracts, at will. There are three well marked species, of which one is marine.

I now come to the principal object of this communication. The sponge which formed the main basis of these investigations is the well-known marine species, *Leucosolenia* (*Grantia*) *botryoides*, Bowerbank. It is preeminently a branching form, and, on account of the slenderness and transparency of its tapering, hollow ramules, is a most desirable object for study. A branchlet, and, in fact, the whole colony, may be stated to be essentially a double tube. The outer tube consists of a glairy, gelatiniform stratum in which the spicules are imbedded in a certain order, and is pierced by numerous ostioles, which are continued through the interior tube to its hollow centre. The inner layer or tube is entirely made up of the individual members of the colony, the bodies of which are packed together closely, side by side, like pavement-stones, with their posterior ends slightly imbedded in the glairy substance of the outer tube, and their anterior ends projecting freely into the general cavity. To describe the shape and organization of one of these individuals would be to repeat, almost word for word, what I have already said of the monad of *Codosiga*; in short, *Leucosolenia* bears some such sort of relationship to *Codosiga* as *Salpingæca* does, the latter being, as it were, a stemless *Codosiga* seated in a calyx, whilst *Leucosolenia* is comparable to a stratum of the monads of *Codosiga* imbedded in a spiculiferous envelope. It is clear therefore that the organic difference between *Leucosolenia* and *Codosiga* is scarcely enough to locate them in two different families; in fact, I am inclined to regard them as only generically distinct, and hardly, if at all, more widely separated in this respect than are *Salpingæca* and *Codosiga*.

What are the diversities of other genera of the SPONGIÆ CILIATÆ I cannot more than conjecture; but seeing that one of the genera is so closely related to the monociliate FLAGELLATA, it can hardly be possible that the others are very far removed; and I shall feel warranted, therefore, in assuming, upon the premises, that the whole group of SPONGIÆ CILIATÆ is as intimately allied with the monociliate INFUSORIA FLAGELLATA as it is possible for it to be without actually constituting with the latter a uniform family.

V.—*On the Menispermaceæ.*
By JOHN MIERS, F.R.S., F.L.S., &c.

[Continued from vol. xviii. p. 22.]

34. COCCULUS.

Much confusion has existed in regard to this genus. The earliest mention of the name was made by Bauhin and Plukenet, who used it to denote the *Cocculus officinarum* of commerce. The plant supposed to yield this famous drug was first botanically named *Menispermum Cocculus* by Linnæus; but *Cocculus*, as a genus, was not established till 1818, when DeCandolle first employed it to comprehend a very heterogeneous series of plants, most of which had previously been included in *Menispermum*. The *Menispermum Cocculus*, Linn., ought therefore to have been the type of De Candolle's genus; but such was the want of knowledge and the uncertainty then prevailing in regard to the subject, that no one really knew to what plant the true *Cocculus* of commerce belonged. It had been referred by botanists to three several species:—(1) *Cocculus lacunosus*, DC., which I considered identical with his *Cocculus suberosus*; (2) *Cocculus Plukenetii*, DC. (now a *Pachygone*), a species identified by De Candolle with the *Menispermum Cocculus*, Willd. (non Linn.); and (3) *Cocculus suberosus*, DC. (now an *Anamirta*). It is to the last that the drug in question really belongs; it is identical with the *Menispermum Cocculus*, Linn., but not of Willdenow. When I published my notes on *Menispermaceæ* in 1851, I was conscious that, according to strict rule, the *Cocculus suberosus* ought to have been taken as the type of the genus *Cocculus*; but in that case *Anamirta*, established by Colebrook in 1819, must have been suppressed, and a new genus formed from the plants I had retained in *Cocculus*. In the midst of the confusion that had so long prevailed, I considered it far better not to disturb *Anamirta*, but to choose another of the oldest species remaining in De Candolle's genus for the type of *Cocculus* as now restricted: accordingly *Cocculus Carolinus*, DC. was selected for this purpose. Having cleared away from De Candolle's heterogeneous group the numerous species possessing a structure at variance with this type, *Cocculus* was thus for the first time reduced to precise limits in its floral as well as in its carpological organization.

It was endeavoured, however, by botanists of the highest reputation, to set aside this precision with regard to *Cocculus*. The authors of the 'Flora Indica,' led away by their too ardent desire for abrogating genera and species, disregarded the limits I had assigned to this genus, and refused to acknowledge *Nepthoica*, *Holopeira*, and *Diplochisia*, on the plea that a difference

in the form of the petals (though constant and very peculiar in each group) is of little importance in a generic point of view : heedless, too, of the carpological features which distinguish these genera, they fused together, after their peculiar method, all the genera of my *Platygoneæ*, reducing them to a few species of *Cocculus*, corresponding in number with my genera. It is much to be regretted that the authors of the new 'Genera Plantarum' should have adopted these extreme views in that useful work, and have been thus led to form many erroneous conclusions concerning *Menispermaceæ*. It is scarcely possible that this hasty disavowal of valid genera and species can meet with general assent or can be maintained when the different points of structure are carefully compared. If the method of ignoring marked differential features in the floral as well as in the carpological structure be adopted in one tribe, as attempted here, it ought equally to be applied to the other tribes of the family : in such case its many genera, deprived of their precise limits, would collapse, and the whole distribution would again become involved in endless confusion. In order to avoid this, and to preserve one uniform consistency, it appears to me desirable to maintain *Cocculus* as a distinct genus of the *Platygoneæ*, within the limits I have ascribed to it ; otherwise the genus *Cocculus* must disappear, as the *Nepthoica* of Loureiro would take its place by right of a priority of many years, or perhaps *Epibaterium* of Forster, which is of still older date.

In regard to the plea before mentioned, that the form of the corolla, even where it assumes uniformly a very peculiar shape, is a character too trivial to be entertained, I might cite hundreds of instances where that feature forms a leading mark of generic distinction ; indeed it has been employed successfully in several families by the above-mentioned botanists ; and there can be no especial reason for discarding it in the *Menispermaceæ*, particularly in the instances of *Nepthoica* and *Holopeira* as distinguished from *Cocculus*. The carpological structure of *Diploclisia* is unquestionably distinct from that of the last-mentioned genus ; its putamen and condyle are constructed upon quite a different plan, and its cotyledons and radicle offer very different proportions ; while the mode of its inflorescence and the general aspect of the plants afford the most striking marks of distinction.

The difference in the form of the corolla is so manifest in all these four genera, that, in examining the male plants, it is impossible to mistake one genus for another ; but this is not the case as regards *Pachygone*, which has a floral structure hardly different from *Cocculus* : in both cases the form of the petals and the trimerous arrangement of parts are alike, the only difference being that in the former the outer series of bracteiform

sepals is generally wanting. It is chiefly in the female plant, and the structure of the putamen and seed, that the two genera become utterly irreconcilable.

The fruit of *Cocculus* is well distinguished: the putamen is osseous, reniformly globular, slightly compressed, with a peculiar grooved surface, and has a large excentric condyle, round which the lunate or nearly cyclical cell extends; the condyle is vertically divided by a complete septum, parallel to the two faces, into two hollow chambers, each having an external crescent-shaped aperture; the seed is cyclical, flattened on its inner side, and consists of simple albumen enclosing a nearly annular embryo, with a narrow terete radicle half the length of two fleshy subfoliaceous incumbent cotyledons, which are twice its breadth.

In Prof. Martius's 'Flora Brasiliana,' Dr. Eichler enumerates two species, neither of which belongs to the genus. The first is *Cocculus filipendula*, Mart., of which a drawing is given (*l. c.* fasc. xxxviii. tab. 42. fig. 4); this shows clearly that I was quite correct in considering it to be a species of *Odontocarya* (*Contr. Bot.* iii. 65). The second is *Cocculus enneandrus*, Eichl., established upon a Peruvian plant from the collection of Ruiz and Pavon, of which the ♂ flower only is figured (*l. c.* tab. 42. fig. 5); this is considered by Dr. Eichler to be a variety of *Cocculus Carolinus* that has strayed into Peru, and which, under another soil and climate, has produced monstrous flowers. There appears no reason for this improbable supposition, as that species has never been seen beyond the limits of the United States. If it be a monstrous flower, it is far more likely to be an abnormal condition of some plant which we know to be growing in Peru or its vicinity. The inference appears to me certain, that the plant cannot belong to *Cocculus*, from which it differs in having an inner whorl of three stamens which stand alone, without petals, in addition to the ordinary number of six perfect stamens embraced by as many petals; the anthers as they are described are very different from those of *Cocculus*, as are also the petals, whose involuted lobes are lateral, not basal as in that genus. Dr. Eichler gives no drawing of the plant; but, from its description, it appears very likely to belong to the South-American genus *Odontocarya*; indeed, in the form of its cordate, nearly 3-lobed leaves, which are also membranaceous, it scarcely differs from the diagnosis I have given of *Odontocarya hederæfolia* (*Contrib. Bot.* iii. 64), a plant from Panama, which has a range as far eastward as northern Brazil, and is therefore not unlikely to extend to the much shorter distance southward of Upper Peru, where it is only supposed that Ruiz's plant was obtained; for no locality is given with the specimen. It is therefore reason-

able to conclude that it is either an abnormal species of *Odontocarya* or that it belongs to a new genus. The former idea is more probable if we consider the inner whorl to be formed by three sterile ovaries, such as I found to exist occasionally in the ♂ flowers of the Indian genus *Hæmatocarpus*, and in those of *Tiliacora*, where they look somewhat like emasculated stamens: this supposition is strongly supported by Dr. Eichler's drawing, where the fifth figure in the bottom row upon the plate mentioned is either a deformed ovary or a monstrous stamen.

Cocculus is a cosmopolitan genus, some of its species belonging to the New World; *Nephroica* is widely distributed through Asia and its numerous islands; *Holopeira* is Indian and African; *Diploclisia* is found in Ceylon, the Indian peninsula, and along the Malayan coast.

Cocculus, DC.—*Flores* dioici. *Masc. Sepala* 9, ordine ternario alternatim disposita, interiora majora, exteriora minora et bracteiformia, obovata, margine sæpius eroso-denticulata, æstivatione imbricata. *Petala* 6, sepalis opposita, biserialia, æqualia, sepalis interioribus minora, oblonga, infra medium angustiora, imo 2-auriculata, lobis filamenta amplectentibus. *Stamina* 6, subæqualia, unguibus petalorum affixa; *filamenta* petalis paulo longiora, teretia, apice incrassata; *antheræ* dorso introrsum adnatæ, rotundato-4-lobæ, 2-loculares, loculis collateralibus connectivo angustissimo interstinctis, utrinque rima diagonali bivalvatim hiantibus. *Ovaria* rudimentaria 3, centralia, punctiformia.—*Fœm. Sepala et petala* masc. *Stamina* sterilia 6, petalis involuta, breviora, emasculata vel abortiva. *Ovaria* 3 vel 6, ovata, gibba. *Stylus* brevissimus, excentricus. *Stigma* subito horizontaliter deflexum, subteres, superne canaliculatum. *Drupæ* 3, transversim ovatæ, carnosæ, stigmate persistente hilo proximo notatæ; *putamen* osseum, reniformi-globosum, subcompressum, sulcis radiatis vel tortuosis exsculptum carinaque peripherica lævi signatum, uniloculare, loculo subcyclico circa condylum gytrato; *condylus* excentralis, internus, cochlearis, septo integro verticali in locellos 2 vacuos divisus, utrinque meatu parvo externo triangulari perforatus. *Semen* loculo conforme, extus convexum, intus planum; *integumentum* membranaceum, facie ventrali medio *chalazæ* ad condyli septum affixum; *embryo* intra *albumen* simplex carnosum, fere annularis, *cotyledonibus* foliaceis, carnosulis, lineari-oblongis, incumbentibus, *radicula* tereti supera ad stylum spectante duplo longioribus et multo latioribus.

Frutices scandentes, intra (rarius extra) tropicos totius orbis crescentes; folia alterna, petiolata, ovata, oblonga vel sublinearia;

paniculæ racemosæ vel spicatæ, axillares, rarissime terminales, solitaria vel interdum plures, sæpius brevissimæ, ♂ multifloræ, ♀ paucifloræ, bracteis minimis donatæ; flores minusculi, pedicellati, sæpius glabri.

The species referred to this genus are the following, which will be fully described in the third volume of 'Contributions to Botany:—

1. *Cocculus Carolinus*, DC. Syst. i. 524, Prodr. i. 98; A. Gray, Gen. Un. St. i. 72, tab. 28;—*Menispermum Carolinum*, Linn. Sp. 1468; Lam. Dict. iv. 97; Willd. Sp. Pl. iv. 825; Mich. Fl. Bor. ii. 242;—*Wendlandia populifolia*, Willd. ii. 275; Poir. Dict. viii. 796;—*Androphylax scandens*, Wendl. Obs. ii. 38.—In Americæ comitatibus meridionalibus: v. s. in herb. variis e Carolina, Florida, Louisiana et Texas.
Var. *hederæfolius*;—*Menispermum hederæfolium*, Dill. Elth. 223, t. 178. f. 219;—*Menispermum Virginicum*, Linn. Sp. 1468; Willd. Sp. Pl. iv. 824; Lam. Dict. iv. 95.—In Florida, Louisiana, et Texas.
2. — *sagittifolius*, nob.—In Texas: v. s. in herb. Hook., San Felipe (Drummond).
3. — *oblongifolius*, DC. Syst. i. 529, Prodr. i. 99; Hænk. Reliq. ii. 79.—In Mexico: v. s. in herb. Hook. ♂ et ♀, Acapulco; Sonora alta, ♂ (Coulter, 656), ♀ (Coulter, 657); Matamoras (Berlandier, 2300); Tehuacan, Pueblas (Galleanotti, 1536): in herb. Boissier, Mexico (Pavon).
4. — *Leæba*, DC. Syst. i. 529, Prodr. i. 99; A. Rich. Fl. Seneg. i. 13; Hook. Nig. Fl. 97; Hook. & Th. Fl. Ind. i. 192;—*Leæba*, Forsk. Fl. Egypt. 172;—*Cocculus Cebatha*, DC. Syst. i. 527, Prodr. i. 99;—*Cebatha edulis*, Forsk. Fl. Egypt. 171;—*Cocculus Epibaterium*, DC. Syst. i. 530, Prodr. i. 100;—*Epibaterium pendulum*, Forst. Gen. 108, tab. 54;—*Menispermum Leæba*, Del. Fl. Egypt. Ill. 30, tab. 51. f. 2 & 3;—*Menispermum ellipticum*, Poir. Dict. Suppl. iii. 657;—*Cocculus ellipticus*, DC. Syst. i. 526, Prodr. i. 100;—*Menispermum edule*, Vahl. Symb. i. 80; Lam. Dict. iv. 99; Willd. Sp. Pl. iv. 828.—In Senegalia, Egypto, Abyssinia, et India orientali: v. s. in herb. Mus. Brit. ♀, Senegal (Perottet); Egypt (Wilkinson et Forskal, sub *C. edule*); St. Iago Cap. Verd. (Forster sub *Epibaterium pendulum*): in herb. Hook., Senegambia (Heudelot), Afr. centr. (Vogel, 39), Abyssinia, Fazokel (Kotschy, 456), Egypt (Sieber), Arabia (Schimper, 354), Ethiopia (Bromfield), ins. Cap. Verd. (Forbes-Brunnen), Scinde (Vicary), Punjab (Dr. Thomson).
5. — *glaber*, W. & A. Prodr. i. 13;—*Cocculus lævis*, Wall.

- Cat. 4975;—*Cocculus Leæba*, Hook. & Th. (in parte) *Fl. Ind.* i. 192.—In India orientali: *v. s. in herb. Soc. Linn.* (Wall. Cat. 4975); *in herb. Hook.*, Coimbatore (Gardner), prope Coimbatore (Wight, 43).
6. *Cocculus recisus*, nob.—In India orientali: *v. s. in herb. Mus. Brit.*, *in herb. Hook.* ♂ et ♀, Punjab (Falconer, 85), *ibidem* (Dr. Thomson); ♀, Moultan (Edgworth, 1146); ♂, Afghanistan (Griffiths, 1295).

35. NEPHROICA.

This genus, established by Loureiro, was disregarded by botanists for nearly sixty years, until I first pointed out its peculiar structure and the differences which separate it from *Cocculus*, with which genus it had been associated. De Candolle placed its typical species in a particular section, on account of its monœcious flowers, Loureiro having erroneously stated that male and female flowers are found on the same plant; but his original specimen in the British Museum does not present this character, nor have I found it in any other of its species. I have elsewhere stated that the authors of the 'Flora Indica' have declined to admit this genus, fusing *Nephroica*, *Holopeira*, and *Diploclisia* into *Cocculus*, because they attach no importance to the shape of the petals, asserting that it is not even constant in each species; and thus, after their singular method, they conglomerated most of the species of *Nephroica* enumerated below into a single species of *Cocculus*. The principal reason they assign is not supported circumstantially; for I have carefully examined scores, nay, hundreds of flowers in the genus, and have found their shape and proportion constant in each species. In every case the petals are far more elongated than in *Cocculus*, and are divided from their apex to near their middle into two extremely attenuated caudate points, usually inflected above, while at their base they have two short auricular lobes, which are involuted round the base of the stamens. The filaments are gradually thickened at the apex into a clavate form, the anthers being globular, parallel, dorsally attached to the filament, with a very narrow connective between them; they are therefore introrse, and each lobe bursts by a horizontal suture. The female flower has sepals and petals like those of the male, and six effete stamens; they have three or six free ovaries each, with a stigma different from that of *Cocculus*. There is not much dissimilitude in the structure of the putamen and seed in these two genera.

In adopting Loureiro's generic name I have corrected a typographical error, by reforming it into *Nephroica*, a name evidently derived from *νεφρός* (*ren*), *εἶκω* (*similis sum*), which expresses the reniform shape of its putamen: we thus avoid the inconvenience

of forming three distinct syllables out of the three terminal vowels.

NEPHROICA, Lour.—*Flores* dioici. *Masc. Sepala* 9, in ordine ternario alternatim disposita, gradatim majora. *Petala* 6, sepalis interioribus multo breviora, lineari-oblonga, imo utrinque auriculata, lobis involutis filamenta amplectentibus, apice in lacinias 2 angustissimas acutas sæpius paulo inflexas profunde fissis. *Stamina* 6, libera, petalis opposita, his subæquilongia vel longiora; *filamenta* suberecta, apice sensim incrassata; *antheræ* subglobosæ, sub-4-lobæ, dorso affixæ, 2-loculares, loculis connectivo angustissimo sejunctis, utrinque rima horizontali 2-valvatim dehiscentibus. *Ovaria* sterilia 3, punctiformia, centralia.—*Fæm. Sepala* et *petala* ut in masc. *Stamina* sterilia 6, petalis opposita; *filamenta* filiformia, brevia, apice 2-punctata. *Ovaria* 6, rarissime pauciora, gibboso-oblonga, gynæcio 6-lobato imposita, 1-locularia, 1-ovulata, *ovulo* facie interiore medio affixo. *Stylus* brevis, excentralis. *Stigma* elongatum, teres, reflexum, superne canaliculatum. *Drupæ* 6, vel abortu pauciores, ovatæ, gibbæ, carnosæ, paulo supra basin stylo persistente notatæ; *putamen* reniformi-orbiculatum, subcompressum, 1-loculare, loculo fere annulari circa condylum gyrato, utrinque serie interiore lilarum alteraque concentrica exteriori irregulariter sulcato; *condylus* internus, cochleatus et bicameratus, extus utrinque profunde excavatus et foramine lunato marginato perforatus. *Semen* loculo conforme, dorso rotundatum, ventre subconcauum; *integumentum* tenue, latere ventrali linea incrassata (chalaza) ad condylum affixum; *embryo* in *albumine* simplici carnosulo subcyclicus, *cotyledonibus* crassiusculis, foliaceis, lanceolato-oblongis, incumbentibus, *radicula* tereti supera ad stylum basalem spectante 3-plo latioribus et 4-plo longioribus.

Frutices scandentes vel suberecti, per Asiam tropicam et insulas dispersi; folia petiolata, ovata vel lanceolata, e basi 3-5-nervia; paniculæ ♂ axillares, racemosæ, folio breviores, ramis 3-4-floris; racemi ♀ axillares, breves, pauciflori.

The following species will be fully described in the third volume of the 'Contributions to Botany':—

1. *Nephiroica sarmentosa*, Lour. Fl. Coch. ii. 692;—*Nephiroica pubinervis*, nob., Hook. Kew Journ. iii. 259;—*Cocculus Nephiroica*, DC. Syst. i. 531, Prodr. i. 100;—*Menispermum reniforme*, Spr. Syst. ii. 156.—In China et Java: v. s. in herb. Mus. Brit., Cochin-China (Loureiro); Java, ♂ et ♀ (Banks & Solander); in herb. Hook. ♂, Hongkong (Champion, 202).

2. *Nephroica hexagyna*, nob. ;—*Cocculus hexagynus*, *Coleb. Linn. Trans.* xiii. 63 ;—*Menispermum hexagynum*, *Roxb. Fl. Ind.* iii. 815.—In China et Japonia : *v. s. in herb. Mus. Brit.*, China (Staunton), Calcutta (Hort. Bot. cult., Wallich), ibidem (sub nom. *Menisp. parabolicum*, Roxburgh) ; *in herb. Hook.*, China (Millett), Hongkong (Champion), Amoy (Welford, 458).
3. — *ovalifolia*, nob. ;—*Cocculus ovalifolius*, *DC. Syst.* i. 526, *Prodr.* i. 99 ; Blume, *Bijd.* 25 ;—*Cocculus umbellatus*, *Steud. Nom.* 392 ;—*Menispermum ovalifolium*, *Vahl in Pers. Ench.* ii. 628 ; *Spr. Syst.* ii. 157, *Cur. post.* iv. 143.—In China et ins. Sandwich. : *v. s. in herb. Mus. Brit.*, *Hook.*, et *Lindl.*, Chusan ; *in herb. Hook.*, Corea, Chusan (Welford, 924) ; Woabu (Barclay, 1271).
4. — *caudata*, nob.—In Japonia : *v. s. in hb. Hook.*, Nagasaki (Oldham, 29).
5. — *Thunbergii*, nob. ;—*Cocculus Thunbergii*, *DC. Syst.* i. 524, *Prodr.* i. 98 ;—*Menispermum orbiculatum*, *Thunb. (non Linn.) Fl. Jap.* 194 ; *Lam. Dict.* iv. 97.—In Japonia : *v. s. in herb. Hook.*, Azama (Oldham, 30), Semada (Oldham, 231), Nagasaki (Oldham, 28 in parte).
6. — *dilatata*, nob. ;—*Cocculus Bantamensis* ?, *Bl. Bijd.* 26 ; *Walp. Rep.* i. 93.—In China et Java : *v. s. in herb. Hook.*, prov. Kianang (Staunton).
7. — *hastata*, nob. ;—*Menispermum hastatum*, *Lam. Dict.* iv. 98 ;—*Cocculus hastatus*, *DC. Syst.* i. 522, *Prodr.* i. 98 ;—*Cocculus dianthera*, *Hook. Arn. Beech. Voy.* 167 ;—In China : *v. s. in herb. Hook.*, China (Millett, Vachel).
8. — *mollis*, nob. ;—*Cocculus mollis*, *Wall., Hook. & Th. Fl. Ind.* i. 193.—In India orient. : *v. s. in herb. Soc. Linn.*, Nepalia (Wall. Cat. 4973) ; *in herb. Hook.*, Khasya (Hook. & Th.).
9. — *triloba*, nob. ;—*Menispermum trilobum*, *Thunb. Fl. Jap.* 194 ; *Lam. Dict.* iv. 95 ; *Willd. Sp.* ii. 825 ;—*Cocculus trilobus*, *DC. Syst.* i. 522, *Prodr.* i. 98.—In Japonia et China : *v. s. in herb. Hook.*, Nagasaki (Oldham, 28 in parte) ; hort. Kew. cult. ; ins. Formosa (Oldham, 8) ; *in herb. Mus. Brit.*, prov. Kianang (Staunton).
10. — *cuneifolia*, nob.—In ins. Formosa : *v. s. in herb. Hook.* (Welford, 526).
11. — *cynanchoides*, nob. ;—*Cocculus cynanchoides*, *Presl, Reliq. Hænk.* ii. 79.—In Asia orient. : *v. s. in herb. Lemann.*, Serampore ; *in herb. Lindl.*, Mauritius, hort. bot. cult. (Bouton) ; *in herb. Hook. et Mus. Brit.* ex *Mus. Paris.*, Bourbon cult. (Richard).
12. — *pycnantha*, nob.—In China : *v. s. in herb. Lindl.*, Macáo (Vachel, 242).

13. *Nephroica Ferrandiana*, nob. ;—*Ferrandia oleifolia*, *Gaud. Freyc. Voy.* 477, tab. 101 ;—*Cocculus Ferrandianus*, *Presl, Rep. Bot.* i. 154 ; *Walp. Rep.* i. 94 ;—*Cissampelos? acuminata*, *DC. Syst.* i. 538, *Prodr.* i. 102.—In ins. Sandwich. : *v. s. in herb. De Cand.*, Owhyhee (*Gaudichaud*) ; *in hb. Mus. Brit.*, Owhyhee (*Cook, Third Voy.*).

36. HOLOPEIRA.

In describing *Cocculus* and *Nephroica*, with which *Holopeira* has been amalgamated by the authors of the 'Flora Indica' and the 'Genera Plantarum,' I have stated many of the reasons for maintaining their separate integrity. *Holopeira* is distinguished from those genera by its broader oblong petals, which are cuneate at base, always obtusely and in a minor degree cleft, or only emarginate at the apex (not entire as in *Cocculus*, and not extremely acute and deeply incised as in *Nephroica*), and by its lateral lobes springing from the middle on each side (not basal, as in those genera) : the stigma is more or less elongated, suddenly reflected over the apex of the ovary, channelled above, with crenately inflected margins, and truncated at the extremity : in the one genus the sepals and petals are quite glabrous, in the other they are frequently clothed with very long sericeous hairs. But the chief distinction, one of manifest structural difference, lies in the very peculiar form of its putamen, which is pale, often thinly crustaceous, orbicular, somewhat flattened on the opposite faces, and there marked with numerous radiating, finely tuberculated striæ ; it has a broad and somewhat flattened periphery, with a remarkably acute projecting keel running round it between two grooves ; the condyle is altogether central and quite circular, consisting of two broad, open and deep chambers, with a finely toothed margin, and separated by a septum formed of two thin united laminæ having a central hole, sometimes very large ; the putamen is thus cleanly pierced through its centre by three distinct parallel holes (whence the generic name). This central transperforation is somewhat analogous to the structure of *Stephania* ; but there the condyle is thin and disciform, marked by a single foramen. The structure in *Holopeira* is so very peculiar, and so entirely different from that of *Cocculus* and *Nephroica*, that I cannot conceive why its generic validity should be disputed by botanists who, in many other extensive families, have recognized far more trivial discrepancies.

HOLOPEIRA, nob.—*Flores* dioici. *Masc. Sepala* 6, ternatim et alternatim disposita, spathulato-oblonga, sæpius villosissima, exteriora minora, rarius bracteis 1–2 consimilibus donata. *Petala* 6, biscriata, oblonga, imo cuneata, lateribus medio

utrinque auriculata, lobis introflexis, apice breviter bifida vel emarginata, lobis latis, obtusis. *Stamina* 6, petalis opposita et ad unguis affixa; *filamenta* imo dilatata et interdum villosa, superne teretia, tenuia, et glabra, petalis æquilonga vel paulo excedentia; *antheræ* rotundiuscule 4-lobæ, sine connectivo 2-loculares, apice fere peltatim affixæ, subintrorsum flexæ, rima laterali utrinque 2-valvatim dehiscentes. *Ovaria* rudimentaria 3, punctiformia.—*Fœm.* *Sepala* et *petala* ut in masc. *Stamina* sterilia 6, circa gynæcium hirsutum affixa. *Ovaria* 3, gibba, gynæcio parvo insita, glabra, unilocularia, *ovulo* unico pariete interno appenso. *Stylus* nullus. *Stigma* excentricum, lineare, obtusum, horizontaliter deflexum, rugosum, sulco marginibus crenulatis superne signatum. *Drupæ* 3, vel abortu 1, subglobosæ, carnosulæ, circa basin stigmatate persistente notatæ: *putamen* reniformi-orbiculatum, trochiforme, paulo compressum, periphæria carina acuta sulcisque 2 notatum, faciebus radiatim tuberculato-liratis; *condylus* excentralis, utrinque meatu sæpissime amplo margine denticulato profunde vacuus et septo intermedio centro pertusus, hinc foraminibus 3 parallelim distinctis fere centralibus perforatum; 1-loculare, loculo quasi annulari circa condylum gyrato, in valvulas 2 facile solutum. *Semen* loculo conforme, fere annulare, extus convexum, intus subconcauum; *integumentum* tenue, ad latus internum laxum *chalaza* notatum, hinc intra laminas septi insinuatim et condylo affixum: *embryo* in *albumine* simplici carnosio sepultus, cyclicus, *cotyledonibus* crassiuscule foliaceis, lineariblongis, incumbentibus, *radicula* tereti supera ad stylum spectante 4-plo longioribus.

Frutices scandentes *Asiæ* et *Africæ intertropicæ*; folia petiolata, ovata, sæpius dense pubescentia, 3-5-nervia; paniculæ ♂ axillares, ramosæ, folio breviores, rarius longiores; racemi ♀ axillares, pauciflori.

The species, to be described in the third volume of 'Contributions to Botany,' are the following:—

1. *Holopeira villosa*, nob. Ann. Nat. Hist. 2 ser. vii. 42:—Cocculus villosus, DC. Syst. i. 525, Prodr. i. 98; Hook. & Th. Fl. Ind. i. 193;—Cocculus aristolochiæ, DC. Syst. i. 520, Prodr. i. 97; Pluk. Alm. t. 13. fig. 2;—Menispermum villosum, Lam. Dict. iv. 97; Roxb. Fl. Ind. iii. 812;—Menispermum hirsutum, Linn. Sp. 1469 (non Roxb.);—Menispermum myosotoides, Linn. Sp. 1469.—In India orientali: v. s. in herb. Soc. Linn., Wall. Cat. 4957 A, G; in herb. variis e multis locis.
2. — *læviuscula*, nob.;—Menispermum hirsutum, Roxb. (non Linn.) Fl. Ind. iii. 814;—Cocculus sepium, Coleb. Linn.

Trans. xiii. 58, tab. 6. fig. 2.—In India orientali: *v. s. in herb. Soc. Linn.*, Wall. Cat. 4957 B, C, D, E, F; *in herb. variis a multis locis.*

3. *Holopeira auriculata*, nob.—In India orientali: *v. s. in herb. Lemann.* (ex hort. bot. Calc. cult.).
4. — *torrida*, nob.—In Africa tropicali: *v. s. in herb. Hook.*, Africa occidentali (Cunon); Shire, Zambesi (Kirk).
5. — *lonchophylla*, nob.;—*Cocculus Ferrandianus*, *Seem.* (non *Gaud.*) *Fl. Fiji.*—In insulis Sandwich: *v. s. in herb. Hook.* Hue-hue (Hildebrand), Oahu (Seemann, 2281).
6. —, *fecunda*, nob.;—*Cocculus hexagynus*, *Ham.* (non *Roxb.*)—Forsan ex India orientali: *v. s. in hort. Kew. cult.*
7. — *laurifolia*, nob.;—*Menispermum laurifolium*, *Roxb. Fl. Ind.* iii. 815;—*Cocculus laurifolius*, *DC. Syst.* i. 530, *Prodr.* i. 100; *Deless. Icon.* i. t. 97; *Coleb. Linn. Trans.* xiii. 65; *Hook. & Th. Fl. Ind.* i. 191.—In India orientali: *v. s. in herb. Soc. Linn.*, Wall. Cat. 4965 A, B, C.
8. — *australis*, nob.;—*Menispermum Australe*, *Zucc. MS.*—In Japonia et Java: *v. s. in herb. Lindl.*, Japonia (Siebold, anno 1840), in hort. Monach. cult. sub nom. *Zuccarinio imposito (Menispermum Australe)*; *in herb. DeCand.*, Java, ♂ (Zollinger, 1640), ♀ (Zollinger, 3184); *in herb. Hook.*, Japonia (De Vriese), Java (Lobb), *ibid.* (Horsfield, 245).
9. — *fusiformis*, nob.—In Java: *v. s. in herb. Mus. Brit.* (Horsfield).

[To be continued.]

VI.—*On the Perforate Structure of the Shell of Spirifer cuspidatus.* By WM. B. CARPENTER, M.D., F.R.S.

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

GENTLEMEN,

I read with much surprise in your Number for August last (p. 144) the statement, quoted from 'Silliman's American Journal' for May, to the effect that Mr. Meek had ascertained the shell of *Spirifer cuspidatus*, not only in American specimens referred to this species, but in an Irish specimen received by him from Mr. Davidson, to be "clearly punctate, contrary to the decision of Dr. Carpenter."

My determination of the imperforate character of the shell of that species was made, some twenty-five years ago, upon specimens obtained from St. Vincent's Rocks, near Bristol (where I was then residing), and authenticated by Mr. S. Stutchbury. In my Report to the British Association (1844, § 44),

I pointed out that the *Sp. cuspidatus* of the Mountain Limestone differs from *Sp. Walcotii* and other Liassic Spirifers in not being perforated,—the absence of the superficial punctations seen upon the latter not being due (as Prof. Morris had supposed) to the metamorphic condition of the shell, “since, although the structure of the shell is often obscured by this action, I possess sections in which it is extremely well preserved, and in which there is an evident *absence of the perforations.*”

The distinction which I thus drew between the two groups of *Spirifers* characterized respectively by the perforation and non-perforation of their shells, led Mr. Davidson to a more careful examination of the internal structure which they respectively present; and the differences which he then discovered were such as to lead him to separate these two groups generically, the designation *Spirifera* being retained for the original *Sp. striata, cuspidata*, and other imperforate species, whilst the perforated species were remitted to the genus *Spiriferina*.

The question as to the real character of *Sp. cuspidata* having thus come to be of no small importance, I have gladly responded to the suggestion of Mr. Davidson that I should re-investigate it; and I have commenced with a careful examination of my original Bristol sections. These, I again confidently affirm, show not the slightest trace of perforations, though the structure of the shell is well preserved.

I have obtained from the School of Mines, through Mr. Etheridge, and from the Museum of Irish Industry and that of the Geological Survey of Ireland, through Mr. W. H. Baily, chips of specimens from six different localities, all which specimens are vouched for by those gentlemen as genuine *Sp. cuspidata*. In not one of the sections I have made of these shells is there the smallest trace of perforations, though the structure of the shell is well preserved in every instance.

Further, at the suggestion of Mr. Davidson, I have examined chips from the shells of the following Carboniferous species, all of them more or less nearly allied to *Sp. cuspidata*: viz., *Sp. laminosa* and *Sp. distans*, procured for me by Mr. Etheridge from the Museum of the School of Mines; and *Sp. subconica*, kindly transmitted by Mr. Carrington from Derbyshire. These, like *Sp. cuspidata*, show no trace whatever of perforations.

I cannot but believe, therefore, that my original determination of the imperforate character of the shell of *Spirifera cuspidata* remains unshaken by Mr. Meek's contradiction; and I can only suppose either that Mr. Meek (like Prof. King*) has mistaken the accidental black points which often present themselves on

* See his 'Permian Fossils of England,' pp. 124, 125, and p. 110, note.

the surfaces of these shells for the punctations indicative of true perforations, or that (as he himself suggests) his punctated shell, though resembling *Sp. cuspidata* in external characters, really belongs to a different genus. I trust that I shall be able, ere long, to clear up this part of the question, Mr. Davidson having written to request that Mr. Meek will send me chips of his punctated *Spirifera*, and that Prof. Winchell will send me chips of a shell belonging to his genus *Syringothyris*. When I shall have examined these, I shall report to you the results without delay.

I remain, Gentlemen,
Your obedient Servant,
WILLIAM B. CARPENTER.

P.S.—Mr. Davidson permits me to add the following extract from a note which he has written to me after perusing the above:—"I have always placed the most implicit reliance on your admirable observations on the shell-structure of the Brachiopoda, and therefore, as far as I am personally concerned, would not have required the additional confirmation given by your recent researches; but I am not sorry that you should have again investigated the matter, as it can but strengthen the value of your discoveries,—and the more so, as I have always found this shell-structure to be combined with internal modifications, so that *a perforated species could not be generically the same as an imperforate one*. This has now been observed in so many instances, that the supposed exceptions brought forward by Messrs. Meek and King are, no doubt, the result of incorrect observation. To make this clear to the public was therefore a matter of some importance, and I am very glad you have done so."

University of London, Burlington House.
Dec. 10, 1866.

VII.—On the Correlation of the Lower Lias at Barrow-on-Soar, in Leicestershire, with the same Strata in Warwickshire, Worcestershire, and Gloucestershire; and on the occurrence of the remains of Insects at Barrow and in Yorkshire. By the Rev. P. B. BRODIE, M.A., F.G.S.*

As my friend Professor Jukes has already described the Lower Lias at Barrow and the neighbourhood in Potter's Charnwood Forest, it will merely be necessary thus briefly to refer to his account; but I shall draw attention to one section not given by

* Communicated by the Author, having been read at the Meeting of the British Association in Nottingham, August 1866.

him, taken from an upper quarry of Mr. Lee's, in order to identify the beds, where we have, in descending order,

		ft.	in.
	1. Drift-sand and red clay, with rolled boulders of Lias .	8	0
	2. Blue shale	3	0
Insect-beds.	{ 3. Hard blue limestone (rummels), with young <i>Lima gigantea</i> , <i>L. duplicata</i> , and numerous characteristic Ammonites of the <i>Lima</i> series, which is here much reduced in bulk	0	9
		4. Thick blue shale	4	0
	5. Blue limestone	0	6
	6. Black shale	1	2
	7. Limestone	0	6
	8. Black shale	1	0
	9. Blue, nodular, and crystalline limestone (top hurls)— a very peculiar band, resembling a stratum adjacent to the "firestone" of Warwickshire, as at Wilmcote and Grafton in that county	0	6
	10. Shale. Bottom of quarry.		
Total		19	5

As Mr. Jukes correctly observes, the strata vary considerably, even in adjacent quarries; certain beds thin out, and others come in: thus, in Mr. Ellis's large pit on the other side of Barrow, there are at least 30 feet of shale above the "rummels" (No. 3 in the section), and there are more courses of limestone, especially those which appear to represent the "Insect-limestones." The "rummels" (No. 3) is evidently the equivalent of the "*Lima*-beds" elsewhere, though only 9 inches thick; and these are immediately succeeded by the "Insect-limestones" and included shales, which are not generally so largely developed here as they are in Warwickshire and Worcestershire as to number and thickness, although on the whole the series which may be considered to belong to this zone is quite as thick as it is in Warwickshire. Deducting 8 feet for the superincumbent drift, the total thickness of the Lias exposed in the above section is only 11 feet 5 inches. In another of Mr. Lee's quarries a section given by Mr. Jukes makes the Lias 28 feet 6 inches, and one at Horton 20 feet, the *Lima*-beds being 6 feet at the former. It is impossible to say to what extent the *Ostrea*- and other beds prevail here, or whether the Rhætic series is present beneath, as indicated by a boring below the "firestones" at Wilmcote in Warwickshire. But possibly there may be a considerable thinning-out of this lower portion of the Lias and the underlying Rhætics in this direction, although they have been lately detected by Mr. Burton near Gainsborough, in Lincolnshire, and described by him in a paper read at the late meeting of the

British Association. From an account I have received of some Lias sections in Nottinghamshire, it may be inferred that the same series also occurs there in its proper position. Most of the pits at Barrow do not exceed 30 feet in depth; but some have been opened to a depth of 42 feet, the lowest stratum being a bed of blue marly clay.

The limestones are used in Leicestershire for the same economical purposes as the Warwickshire paving-stones, and are equally well adapted for this object; but they were not employed on the spot, when I visited Barrow some years ago, for making hydraulic lime, as they are in the extensive quarries belonging to my friends Messrs. Greaves & Kershaw at Wilmcote, near Stratford-on-Avon, though I have little doubt they might be profitably employed for this purpose.

In places there are several small faults; and in one pit the lower strata are thrown up so as to form a complete saddle, of limited extent, at right angles to Mount Sorrel, not far off, showing, on a small scale, what the effect of such a dislocation would be on a large one. At Wilmcote, in Warwickshire, there are also indications of numerous faults in all directions round the district—more than has generally been supposed. Thus the “firestone,” which is the lowest and hardest stratum worked, crops out at various points and dips at a considerable angle, on the higher ground, and the several bands of Insect-limestone and shale lie in a basin formed by the outcrop of the lower bed. The “*Lima*-beds,” containing the usual characteristic fossils, occur in places in their normal position, more or less denuded. The Insect-beds are more numerous, at least eight courses divided by thick shale, in Warwickshire than in Leicestershire, Worcestershire, Gloucestershire, or Somersetshire; and the other Liassic and Rhætic beds being present below them gives a completeness to the Warwickshire sections not met with elsewhere. Except in No. 3 of the above section, shells are scarce; below this I observed only a few of *Ammonites planorbis* and *Aptychus*, and a species of *Inoceramus* common in the shale at Brockridge Common, near Tewkesbury, in Gloucestershire, and there associated with numerous and beautiful specimens of the same Ammonite. The fine Saurians and fish for which this district (Barrow) has long been famous occur more or less in all the shales and limestones, though some courses are richer than others, more so apparently with respect to the latter than the same zone in Warwickshire. But neither at Barrow nor in other places are the Saurians or fish confined to this division of the Lias, but, as at Lyme (as Mr. Day has shown in an able and interesting paper read at the meeting of the British Association in Birmingham in 1865), have a wide vertical range. The genus

Dapedius seems to be the most abundant; and among several fine fish in Mr. Lee's collection, since sold, I noticed one nearly 2 feet long, belonging to a different genus, and in a remarkably fine state of preservation. The following species of fish have been recorded from Barrow and elsewhere:—

Pholidophorus Stricklandi.	Tetragonolepis monilifer.
—— Hastingsæ.	—— striolatus.
—— sp. ?	Lepidotus serrulatus.
Dapedius orbis.	

Pholidophorus Stricklandi occurs also in Warwickshire, and *Dapedius orbis* and *Tetragonolepis monilifer* in Warwickshire, Worcestershire, and Gloucestershire. The *Plesiosaurus*, as usual, is much less frequent than the *Ichthyosaurus*; but fine and entire specimens of both have been obtained. Among the Crustacea, *Eryon Barrovensis* and *Glyphæa liassica* are common to all these districts; but the former is much larger at Bidford and Wilmcote, in Warwickshire. This Crustacean has a wide horizontal range; for I have noticed it in this lower division of the Lias, associated with insects, in Leicestershire, Warwickshire, Worcestershire, and Somersetshire; and it has also been found in Dorsetshire. My friend Mrs. Hutton (late Miss Holland) has a fine specimen from the Upper Lias of Dumbleton; but I have not observed it in the intervening beds.

At the time of my visit to Barrow, I could not find or hear of any remains of insects, although I suspected that a careful search would detect them; and not long since, my lamented friend Mr. Wyatt Edgell obtained a portion of a gigantic wing of one of the Libellulidæ (now in my collection) and a large elytron of *Buprestis* (?). No doubt other genera will be discovered there and in Nottinghamshire, as they have already been by my friend the Rev. W. Norwood in the "Insect-limestones" in Yorkshire, which therefore have a very extensive horizontal range and are characterized by the same remains of insects throughout; indeed these remains really distinguish them far better than the Saurians, which, as stated, have a much wider vertical range. I suspect, too, that the Ammonite-zones of some geologists will ultimately have to be either modified or abandoned; for some of the species have a much less limited area of existence than has been hitherto supposed.

Note.—Mr. Burton informs me that he has not yet observed any trace of the Insect-beds above the Rhætics near Gainsborough.

VIII.—On the Fecundation of the Floridææ.

By E. BORNET and G. THURET*.

THE fecundation of the spores of the Algæ by the antherozoids is a well-known fact, upon which we have now very precise observations. But there still remained a gap to be filled up in the history of the Floridææ—one of the highest groups of Algæ, and the most remarkable of all, on account of the number and variety of genera composing it and the peculiarities of their organization.

Most of the Floridææ, as is well known, present two sorts of fructification, upon distinct individuals,—one consisting of spores which divide into fours, *tetrasporic fructification*; the other, formed by agglomerations of undivided spores, has received the name of *capsular* or *cystocarpous fructification*. We also find, and generally upon different individuals, cellular productions of various forms, composed of small colourless cells, each enclosing a hyaline corpuscle. These organs are designated the antheridia of the Floridææ. The corpuscles which they contain are regarded as analogous to the antherozoids of the other Cryptogamia; but from these they differ considerably, inasmuch as they consist only of a simple globular or oblong vesicle, which is always immobile and destitute of cilia. Their relation to the fructification of the Floridææ has hitherto remained entirely unknown.

They are, nevertheless, certainly fecundating corpuscles; their action is manifested from the first development of the cystocarp when the latter is still composed only of a small number of cells surmounted by a caducous unicellular hair. Nägeli was the first to indicate this transitory structure of the cystocarp in the Ceramieæ, Spyridieæ, and Wrangelieæ; but, being preoccupied by other views, he never suspected its physiological importance. According to him the capsular fructification is asexual, the tetraspores alone representing the female organ. We hope to show that this is by no means the case, and that the peculiar structure presented by the cystocarp at its origin is destined to facilitate contact with the corpuscles issuing from the antheridia, from which result fecundation and the ulterior formation of the spores.

Let us take, for example, one of the inferior tribes of the Floridææ—that of the Nemalieæ, in which the development of the cystocarp is most easily observed on account of its simplicity. If we study the origin of this organ in *Helminthora divaricata*, J. Ag., we shall find that it commences by a small cell springing from the side and at the base of one of the dichotomous filaments of which the frond consists; this cell elongates,

* Comptes Rendus, Sept. 10, 1866, pp. 444–447.

is divided successively by transverse septa, and becomes a very short branchlet composed of four superposed cells. Subsequently the superior cell alone continues its development, and becomes filled with a refringent protoplasm; soon a small protuberance makes its appearance at the apex, and gradually elongates into a long hyaline hair, which is often slightly dilated at its extremity. At last this hair exceeds the filaments of the frond. It is the essential organ of impregnation; hence, on account of its importance, we give it the name of *trichogyne*. When the corpuscles issuing from the antheridia come into contact with the upper part of this hair, they adhere to it, and several of them are often found fixed at its apex. Then the cell which forms the base of the trichogyne begins to swell and to become divided by septa, and is soon transformed into a small cellular mass which will constitute the young cystocarp. During this time the trichogyne seems to wither; its membrane becomes destroyed, and disappears by degrees, until no traces of it are to be found, even before the cystocarp has arrived at its complete development.

In the higher tribes of the Floridææ the organization of the cystocarp is more complicated, and the fecundation is not so direct as that just described. Thus in the Callithamniæ it is not in the basal cells of the trichogyne, but in two lateral cells that those glomerules of spores known as *favellæ* are formed after fecundation. In the Rhodomeleæ, Chondriææ, and Dasyææ the structure of the little cellular urn, or *ceramide*, which will afterwards enclose the spores, is already well advanced, and its form perfectly recognizable, when one of the superior cells begins to be elongated into a trichogyne. When the cellular tissue is closer, as in *Ceramium*, *Plocamium coccineum*, Lyngb., &c., the connexion of the trichogyne with the development of the cystocarp becomes difficult to follow, on account of the opacity of the frond. Lastly, the very existence of this delicate hair has appeared to us impossible to verify in the plants with thick fronds, such as the Gigartineæ, Gracilarieæ, &c. It is, however, to be presumed that its presence is a general fact among the Floridææ, since we find it in all those the structure of which adapts them to researches of this kind. And whenever we meet with this organ the essential point is ascertained, that its appearance always precedes that of the spores.

The moment when the corpuscles of the antheridia adhere to the apex of the trichogyne deserves particular attention; for a phenomenon then occurs which leaves no doubt as to the importance of this contact and the reality of the fecundation. We have, in fact, in a great many cases been able to see with perfect certainty that at this period a true copulation takes place, and that a direct communication is established between the two

organs. Thus, in *Ceramium decurrens*, Harv., we have most distinctly seen the corpuscles soldered to the tube of the trichogyne. Various species of *Polysiphonia* have likewise presented us with frequent and perfectly decisive examples of this. In these plants the corpuscles are often seen implanted upon the trichogyne by a small process, which is very short, but perfectly visible; and when the functions of the trichogyne are accomplished, we still, for some time, find it bearing the empty corpuscles suspended from its apex. We may instance especially *Chondria tenuissima*, Ag., as one of the Algæ in which the copulation of the two organs may be ascertained the more distinctly because both of them are of a size which is not usual in the Floridææ. The antheridial corpuscles are, moreover, remarkable for their elongate form. The trichogyne is inflated into a club at its apex; and as it is twice as large as that of the *Polysiphoniæ*, it is easy to study its structure. The membrane of which the walls are formed, which is very visible on the sides of the tube, is so attenuated at the apex that it eludes the eye, and the refringent protoplasm with which the trichogyne is filled appears to be destitute of an envelope at this point. When one of the corpuscles comes into contact with this part, it unites therewith by a portion of its surface, and very soon no line of demarcation between the two organs can be distinguished; the finely granular matter which they contain mingles; frequently the apex of the trichogyne swells and becomes deformed, in consequence of the partial fusion which takes place between them; its contents become detached from the walls of the tube, and contract, and then we no longer see anything in the trichogyne but a row of a few irregular granules to the apex of which the remains of one or several corpuscles are still attached.

The number of corpuscles emitted by the antheridia is very considerable, and they are often found scattered among the hairs with which nearly all the Floridææ are provided. This abundance explains how fecundation may be accomplished in these plants, notwithstanding the obstacles which seem to be opposed to it by the diœciousness of most of them, the immobility of the fecundating corpuscles, and the fugacity of the trichogyne. We may add, moreover, that on examining the cystocarps borne by a specimen in a good state of fructification, we may observe a certain number of them the development of which has not passed the period at which they were furnished with a trichogyne: these have become simple organs of vegetation; but their origin is recognized from their form and the position which they occupy on the frond. It seems natural to attribute the frequency of these abortions to the circumstance that the contact of the corpuscles with the trichogyne has not been effected at the proper time.

From the preceding observations it follows that the phenomena

of fecundation in the Floridæ differ widely from those hitherto known to occur in the Algæ. The structure of the organs, their mode of action, the period at which their functions are performed, and the effects which they produce present important differences related to those which distinguish the Floridæ from the other Hydrophytes. We no longer find in this case a direct action of the antherozoids upon the reproductive bodies: the operation is less simple, and in some respects presents some resemblance to that occurring in the higher plants; for we see in the same way a fecundation produced by immobile corpuscles upon an external organ, and having as its result the determination of a complete development of the apparatus of fructification.

IX.—*On the Ballast-Flora of the Coasts of Durham and Northumberland.* By JOHN HOGG, M.A., F.R.S., F.L.S. &c.*

IN this short paper I beg to offer to botanists a few remarks on the plants which have been introduced with ballast by ships on the coasts of Durham and Northumberland.

This interesting subject has already received some attention from our practical and field-working botanists, namely the late Mr. Winch, the late Mr. Storey, the Rev. A. M. Norman, and Mr. M. A. Lawson, who have all published, in the 'Transactions of the Natural-History Society of Newcastle-on-Tyne,' and in those of the Naturalists' Field-Club, some lists of the *rare plants* which they found growing on the ballast-hills in their own vicinity. I have been able, from an acquaintance of some years with the ballast-districts of the county of Durham, to add several *rarer* species to those lists which were formed by the botanists whom I have already mentioned.

The extent of the two counties to which I have now limited myself comprises the sea-coasts and chiefly the banks of the rivers Tees, Wear, and Tyne: of the latter are the great ballast-deposits at Port Clarence and those at West Hartlepool, at East Hartlepool, and the embankment of the railway to the north of the latter town, the mounds of ballast at Seaham, at Sunderland, and near Wearmouth, as well as those at South and North Shields, and others along the Tyne nearer to Newcastle.

In the following lists of species I shall only divide them into *two* heads or divisions, viz., the first, those plants which are *exotics* or foreign to our island, and, the second, those more scarce indigenous and naturalized plants of Great Britain which were rarely seen, if not entirely unknown, in the before-named portions of England.

* Communicated by the Author, having been read before the Section Biology at the British Association Meeting, held at Nottingham, August 28, 1866.

I. Plants which are *exotics*, or foreign to our island.

1st. Mr. Winch has given the annexed catalogue of forty-seven "Exotic Plants gathered on the Ballast-hills by the shores of the rivers Tyne and Wear:—"—

Blitum virgatum.	Lavatera trimestris.
Phalaris paradoxa.	Pisum Ochrus.
Bromus Madritensis.	Ornithopus compressus.
Convolvulus tricolor.	Echium Italicum.
Hyoseyamus albus.	Scorpiurus vermiculatus.
— aureus.	Vicia Benghalensis.
Solanum Lycopersicum.	— cordifolia.
Tordylium Syriacum.	Trifolium Indicum.
Cuminum Cyminum.	— Messanense.
Apium Petroselinum.	— elegans.
Reseda odorata.	Medicago prostrata.
— fruticulosa.	— coronata.
— alba.	— rigidula.
Euphorbia tithymaloides.	Scolymus maculatus.
— spinosa.	Chrysanthemum Italicum.
Mesembryanthemum crystallinum.	Anthemis tomentosa.
— falcatum.	— mixta.
— glomeratum.	— Valentina.
Argemone Mexicana.	Centaurea Galactites.
Nigella arvensis.	Calendula officinalis.
— Damascena.	Cannabis sativa.
Ranunculus muricatus.	Atriplex hortensis.
Lepidium sativum.	Salix acutifolia.
Alyssum incauum.	

2nd. Mr. Norman's foreign plants which are not included in Mr. Winch's catalogue are* :—

Fumaria micrantha.	Polygonum rurivagum (<i>Jordan</i>).
Sinapis Schkuhriana (<i>Reich.</i>).	East Hartlepool.
Melilotus leucantha.	— microspermum (<i>Jordan</i>).
Petroselinum sativum (<i>Hoffm.</i>).	Stockton and Seaham.
	— arenastrum (<i>Jor.</i>). Seaham.

3rd. Mr. Lawson's foreign plants which are not given in either Mr. Winch's or Mr. Norman's lists are only from the ballast of the two Hartlepoons :—

Cheiranthus incanus.	Centaurea orientalis.
Hesperis matronalis.	Sclerochloa dura.
Coronilla varia.	Zea Mays.
Galega officinalis.	Eschscholtzia Californica.
Gypsophila paniculata.	Gazania splendens.

4th. The foreign plants which I have noticed are :—

Scolymus maculatus.	North of Old Hartlepool.
Iberis umbellata.	Port Clarence.

* I think it unnecessary to repeat in these lists many other species that generally occur in *all* the ballast-mounds, or those exotic plants which have been already given.

Astragalus. (A beautiful species, on the sides of the railway south of Seaton, where it has grown for many years, and perfects its seeds. It probably came from Spain or Portugal.)

Blitum virgatum. West Hartlepool.

Trifolium Michelianum (*Savi*). West Hartlepool.

Galega officinalis. From Spain.

Coronilla varia. Southern Europe.

Calendula officinalis. Port Clarence.

Lepidium Draba. West Hartlepool.

Centaurea orientalis. West Hartlepool.

II. *Rare plants, native or naturalized, which were imported with ballast.*

1st. Species enumerated by Mr. Winch :—

<i>Erigeron Canadense</i> .	<i>Oenothera biennis</i> .
<i>Eryngium campestre</i> .	<i>Centaurea Jacea</i> .
<i>Datura Stramonium</i> .	<i>Linum usitatissimum</i> .
<i>Anchusa officinalis</i> .	<i>Borago officinalis</i> .
<i>Sinapis muralis</i> .	<i>Papaver somniferum</i> .
<i>Senecio viscosus</i> .	<i>Chærophyllum sativum</i> .
<i>Panicum viride</i> .	<i>Digitaria sanguinalis</i> .
— <i>verticillatum</i> .	<i>Polypogon Monspeliensis</i> .
<i>Solanum nigrum</i> .	<i>Anethum Fœniculum</i> .
<i>Centaurea Calcitrapa</i> .	<i>Teucrium Chamædrys</i> .
<i>Geranium rotundifolium</i> .	<i>Bromus diandrus</i> .
— <i>Pyrenaicum</i> .	<i>Glaucium luteum</i> .
<i>Cynosurus echinatus</i> .	<i>Coriandrum sativum</i> .
<i>Phalaris Canariensis</i> .	<i>Anagallis cærulea</i> .
<i>Clematis Vitalba</i> .	<i>Ranunculus hirsutus</i> .
<i>Anthemis maritima</i> .	<i>Hydrocharis Morsus-ranæ</i> .

2nd. Additions found by Mr. Storey :—

<i>Medicago maculata</i> .	<i>Pastinaca sativa</i> .
<i>Glyceria rigida</i> .	<i>Dipsacus sylvestris</i> .
<i>Beta maritima</i> .	

3rd. Included in Mr. Norman's list are—

<i>Papaver hybridum</i> .	<i>Glyceria loliacea</i> .
— <i>dubium</i> .	<i>Lepidium ruderales</i> .
<i>Coronopus didymus</i> .	<i>Sisymbrium Sophia</i> .
— <i>Ruellii</i> .	<i>Sinapis tenuifolia</i> .
<i>Thlaspi arvense</i> .	<i>Raphanus Raphanistrum</i> .
<i>Nasturtium sylvestre</i> .	<i>Saponaria officinalis</i> .
— <i>terrestre</i> .	<i>Medicago sativa</i> .
— <i>amphibium</i> .	— <i>minima</i> .
<i>Reseda lutea</i> .	<i>Onobrychis sativa</i> .
<i>Arenaria Lloydii</i> .	<i>Cichorium Intybus</i> .
<i>Trifolium arvense</i> .	<i>Artemisia campestris</i> .
— <i>scabrum</i> .	<i>Echium vulgare</i> .
<i>Oenanthe crocata</i> .	<i>Chenopodium rubrum</i> .
<i>Carduus tenuiflorus</i> .	— <i>glaucum</i> .
<i>Senecio sylvaticus</i> .	<i>Mercurialis annua</i> .
<i>Myosotis versicolor</i> .	<i>Agrostis Spica-venti</i> .
<i>Atriplex arenaria</i> .	<i>Lepturus filiformis</i> .
— <i>Babingtonii</i> .	

4th. Species discovered by Mr. M. A. Lawson :—

Delphinium Consolida.	Salvia Verbenaca.
Erysimum cheiranthoides.	Euphorbia amygdaloides.
Brassica oleracea.	Eryngium maritimum.
Lepidium campestre.	Veronica Buxbaumii.
Silene maritima.	Thymus Acinos.
— Otites.	Parietaria diffusa.
Spartium scoparium.	Epilobium angustifolium.
Sisymbrium Irio.	Erigeron acre.
— Monense.	Anthemis tinctoria.
Camelina sativa.	Symphytum officinale.
Raphanus maritimus.	— —, <i>var. patens.</i>
Erodium moschatum.	Antirrhinum spurium.
Linum angustifolium.	— minus.
Medicago falcata.	— Linaria.
Lathyrus sylvestris.	Sambucus Ebulus.
Chrysanthemum segetum.	Centaurea solstitialis.
Verbascum Thapsus.	Polygonum Fagopyrum.
— Blattaria.	Poa maritima.
— nigrum.	

5th. The last list contains the chief indigenous or naturalized plants which I have found on the ballast in different places, during several years. Some of the species were seldom seen, and others never occurred, in the districts already indicated, before the deposits of the shingle or ballast were formed.

Artemisia campestris.	Galium cinereum.
— cærulescens.	Borago officinalis.
Carduus eriophorus.	Phalaris Canariensis.
— acanthoides.	Camelina sativa.
Cichorium Intybus.	Tragopogon major.
Eryngium campestre.	Marrubium vulgare.
Trifolium ochroleucum.	Pyrethrum inodorum, <i>var. flore pleno.</i>
— arvense.	Scleranthus annuus.
Alyssum maritimum.	Medicago sativa.
Onopordum Acanthium.	Trifolium scabrum.
Papaver somniferum.	Melilotus leucantha.
Senecio sylvaticus.	Solanum nigrum.
Glyceria rigida.	Nasturtium sylvestre.
Chenopodium viride.	Glaucium luteum.
Galium Mollugo.	Raphanus Raphanistrum.
Vicia lævigata.	Senecio viscosus.
— Bobartii.	Centaurea Calcitrapa.
Hedysarum Onobrychis.	Sinapis tenuifolia.
Antirrhinum minus.	— muralis.
Astragalus glycyphyllus.	Antirrhinum Linaria.
Mercurialis annua.	— Elatine.
Lepidium campestre.	Lepidium ruderales.
Reseda lutea.	Melilotus officinalis.
Anthyllis vulneraria.	— arvensis.
Echium vulgare.	Trifolium repens, <i>var. foliaceum.</i>
Pastinaca sativa.	Cochlearia Armoracia.
Convolvulus arvensis.	Reseda lutea.
Beta maritima.	Erigeron Canadense.
Picris echioides.	Brassica oleracea.
Ononis arvensis, <i>var. flore albo.</i>	Delphinium Consolida.

The plant which I have identified with *Trifolium Michelianum* (Savi), and which I found this summer at West Hartlepool, is very handsome, and in some respects resembles *T. elegans* of the same author, which Mr. Winch had observed many years ago on the Tyne ballast. My species differs, however, from *T. elegans* (Savi) by its stem being hollow, and by its *broad ovate* stipules. It is a large and strong plant, a native of Italy, and has most likely been brought with ballast from Leghorn; also *Galega officinalis*, an elegant plant with blue flowers, originally from Spain. A very pretty *variety* of *Ononis arvensis*, with a *snow-white* flower, I observed in the same place: it has a smaller standard-petal, and rounder than that of the common *pink Ononis*, without the small terminal point, slightly hairy and less keeled on the back. Also a curious *variety* of the common white clover, *Trifolium repens*, from the same ballast-heap, deserves notice: it may be termed var. *foliaceum*. From the specimens it will be seen that the segments of the calyx terminate in leaves with strong ribs and teeth, thus causing very much the appearance of *curled parsley*. This sort of clover is known to run into *varieties*. Withering mentions one as having "small heads of leaves growing out of the flowers" (vol. iii. p. 633, 4th edit.), and Dr. Johnston, in his 'Flora of Berwick,' vol. i. p. 162, describes another variety, which he observed on Holy Island. "The flowers," he says, "are supported on rather long stalks; the calyx has six leaf-like cut segments, while the style is dilated into a large ovate leaf, toothed on the margins." And Mr. Norman mentions another "form of the *Dutch clover*, in which the place of petals is supplied by little leaves;" this he noticed at Seaham. Mine, however, seems to differ from the other three abnormal forms chiefly in having the sepals fully transformed into leaves; and I take it to be the var. *phyllanthum* of Seringe, which is found at Geneva and Berne.

The ballast of the localities named being very commonly chalk with flints, we find many plants which grow naturally in that and other calcareous formations. But several orders of plants are without one representative: for example, there are no Orchideæ, not even the *Ophrys muscifera*, *O. apifera*, *O. aranifera*, *Herminium Monorchis*, *Orchis militaris*, *O. fusca*, and others which rejoice in a chalky soil. Nor are there any Saxifragæ, or Seduns, except *S. acre*.

No *roses** have I met with, or *Rubi*, or Ranunculaceæ. Of the Umbelliferæ I have found several more exotic species; but they are difficult to determine, as well as more of the Cruciferæ

* Mr. Winch only records one rose in his lists, which is *Rosa alba*. He found it "on the banks of the Tyne, below Bill Quay." As it is "a native of Germany and South Europe," it seems to me more probably to have been an outcast from some neighbouring garden.

and Compositæ: this is caused in a great degree by many of those plants being poor specimens, not in flower, and often dwarf and puny in their growth; besides, very many are foreign species.

It may be asked, do many of these ballast-plants continue to flourish in a naturalized condition for a long period? and have they spread in the vicinity or superseded the more common plants of the district?

To these questions I may reply that the more tender kinds flourish for two or three seasons, but are soon killed by the frost of a severe winter or the cutting east winds in spring. Several sorts have been carried to some distance from the coast by ballast taken for the repairs of the railways. *Antirrhinum Linaria*, the *Meliloti*, the two species of *Sinapis* now named *Diplotaxis*, *Spartium scoparium*, *Anthyllis vulneraria*, *Senecio viscosus*, some other Compositæ, and Leguminosæ may be met with in spots where, some years ago, and before so many railways were finished, they did not occur at all. But I do not think that the ordinary plants of the district have as yet undergone any material decrease or any considerable change.

Mr. M. A. Lawson, a zealous and good botanist, who resides during a part of the year very near to the two Hartlepoons, and has had more frequent opportunities of examining the ballast species there than I have had, thus describes the appearance of *annuals* in the ballast when first deposited, and the succession of *perennials* after a brief period:—

“For a long time I have observed that after the ballast is first thrown out, it is covered almost solely with *annuals*; but in two or three years these *annuals* have either entirely disappeared, or else, from their scarceness, have become a very inconspicuous part of the flora, and a vast variety of *perennials* have sprung up in their place, which in their turn overrun the whole ground, and then gradually dwindle away to a most minute fraction of their former abundance, so that, even if there were no spot from which they had entirely disappeared, it might be reasonably supposed that they would in a few years, at the furthest, become extinct” (p. 304, Trans. T. N. F. Club, vol. v. part 4, 1863).

Between North Shields and Berwick-on-Tweed I believe there are no large ballast-heaps, since along the coast of Northumberland only two quays or shipping-places of any size exist, namely near Blyth and at Alnmouth, where, in fact, only coasting-vessels or ships of light tonnage resort. And I know little about what ballast-hills may have of late years been formed near the Tweed at Berwick, as I have not been there recently; but most assuredly there must be some such mounds, because the railway traffic and the increase of shipping in that port must have introduced much coal-refuse, shingle, or ballast.

X.—*Further Observations on Venus's Flower-basket* (*Euplectella speciosa*). By Dr. J. E. GRAY, F.R.S., V.P.Z.S. &c.

ON the same day that the account of this beautiful Sponge appeared in the former Number of the 'Annals,' Henry Chevalier, Esq., commander of the ship 'Simeon,' most kindly presented to the British Museum a couple of these sponges, one of them containing the crab that is said to form them. He observes that the name given to them is *Rigederos*. The coral is "worked by two insects at the bottom of the sea, at a great depth (40 fathoms). The first were discovered by fishermen near Cebu or Zebu, one of the Philippine Islands, about twelve months ago."

Accompanying these two specimens is another very young one, in a very early stage of development.

It is evident from the latter specimen that the sponges commence by developing a number of elongated free spicules placed in a ring. These free spicules form the fringe round the base of the fully developed sponge, and are more developed in some specimens than in others; and, no doubt, in some specimens many of them are removed.

Within this ring of free spicules a number of longitudinal bundles of spicules are formed, making an inner ring, and these are crossed by the horizontal bundles of spicules, which connect the longitudinal bundles together, like hoops on a cask, forming the network with square meshes that constitutes the framework of the complete sponge.

The number of slender filiform spicules in the longitudinal erect and in the horizontal hoop-like bundles are few at first; but their number is gradually increased in each bundle as the skeleton requires greater strength for its support.

Eventually the whole outer surface of the sponge is strengthened with elevated, transverse and oblique, often anastomosing ridges of shorter spicules; and the mouth of the tube is covered over with a network of short fibres, and its edge furnished with a fringe.

It would appear, from one of the specimens in the Museum collection, that the network over the cavity of the tube is commenced as soon as the tube has reached its proper length, and that it, and the ridges on the outer surface, and the fringe are each then deposited.

In a note just received from M. Trimoulet, fils, of Bordeaux, offering other specimens, he observes it has been described as a sponge; but "d'après les renseignements que j'ai et que je publierai prochainement, j'ai tout lieu de penser que c'est le nid d'un crustacé de la section des Isopodes nageurs." So the Spanish fishermen's theory has found one scientific supporter at least.

XI.—On *Argulus dactylopteri*, a new Marine Argulid from the West Indies. By T. THORELL*.

As a supplement to my paper on the Crustacean family of the *Argulidae*†, I submit the following description of a new species of that family, which has been kindly communicated to me by Professor S. Lovén, together with the information that it was found in the gill-cavity of a *Dactylopterus volitans* (Linn.) from the West Indies.

The number of Argulids which live exclusively in the sea has hitherto been limited, as far as we know for certain, to two species, viz. *Argulus purpureus* (Risso) and *Argulus giganteus*, Lucas, both from the Mediterranean, of which, moreover, only the first-named species is known with any completeness. Consequently the discovery of a new marine Argulid is in itself an occurrence of some interest—so much the more so, however, since the West-Indian species, in such points as are most essential systematically (*i. e.* the structure of the mouth and legs), approaches the European *A. purpureus*, and forms with it (and perhaps also *A. giganteus*) a natural group (*Agenor*, Risso), reminding us, however, in the weaker development of the head-shield, of the common Argulid-type exemplified by the freshwater forms *A. foliaceus* (Linn.) and *A. coregoni*, Thor. As is the case in *A. purpureus*, the swimming-feet lack the “tassel” (*flagellum*); the mandibles are placed near the opening of the mouth, and the “lip” is open beneath. The intermediate joint or “patella,” found on the second pair of maxillipeds in *A. purpureus*, is wanting in *A. dactylopteri* as in *A. foliaceus* and other species. This species is especially remarkable for the great difference which exists between the sexes: in the other known Argulids such difference is principally displayed in the form of the posterior portion of the body or *tail*, and in a very slight degree affects the head-shield; in *A. dactylopteri* this part also is of an entirely different form in the two sexes.

The specimens which I have examined were twelve in number, and seem to have been about half the number actually found on the fish. Thus more than twenty of these parasites lived in the gill-cavity of this fish. Those examined are of very different sizes, from 4 to 8 millimetres long; only three of them

* Communicated Dec. 14, 1864. See ‘*Cefvers. Kongl. Vetensk.-Akad. Förhandl.*’ Translated by Arthur W. E. O’Shaughnessy.

† Thorell, ‘*Om tvenne Europeiska Argulider; jemte anmarkningar om Argulidernas morfologi och systematiska ställning, samt en öfversigt af de för närvarande kända arterna af denna familj*’ (translated, from the ‘*Cefvers. af K. Vet.-Akad. Förhandl. 1864,*’ pp. 7–72, in Nos. 105, 106, & 108 of this Journal).

are males, of which one, although only 5 millims. long, would seem to be almost full-grown; of the females, even the least ($4\frac{3}{4}$ millims. in length) contain some large and fully developed eggs.

Argulus (Agenor) dactylopteri, n. sp.

Scutum cephalicum antice utrinque sinuatum, postice late incisum, in ♀ inverse subovatum, latitudine paullo longius, pedes ultimi paris non tegens, in ♂ paullo minus, utrinque ante medium auriculato-productum; cauda parum profunde incisa, in ♀ subtriangula, paullo latior quam longior, angulis rotundatis, longit. circa $\frac{1}{3}$ reliqui corporis, laciniis apice rotundato-acuminatis, in ♂ oblongo-ovata, longit. circa $\frac{1}{3}$ totius corporis, laciniis acutioribus; stimulus mediocris, siphon subcylindratus; cotyledones parvi, diametro $\frac{1}{10}$ – $\frac{1}{9}$ longit. corporis æquantur; pecten elongato-productus, plaga magna scabra dentibusque tribus fortibus conicis, acuminatis; pedes flagello carent.—Long. ♀ 7–8, lat. 5 millim.; long. ♂ circa 5, lat. circa 3 millim.

Hab. in Mari Indiæ occidentalis, in cavitate branchiali *Dactylopteri volitantis*, (Linn.) inventus.

Descr. FEMINÆ. Scutum cephalicum supra modice convexum, inverse subovatum, latitudine paullo longius, in lateribus leviter rotundatum, amplum, usque ad basin pedum quarti paris pertinens, antice abrupte sinuato-angustatum, parte cephalica prominenti, antice rotundato-triangula, in dorso costis duabus chitinosus ut in reliquis distincta; postice late et sat profunde (ad $\frac{1}{3}$ longitudinis) incisum, laciniis intus subsinuatis, apice rotundatis, forma incisuræ subtriangula; supra læve, subtus versus margines antice dentibus minutissimis scabrum. *Truncus* latitudine circa $\frac{1}{3}$ scuti, segmentis latioribus quam longioribus, ultimo prioribus latiori, utrinque supra insertionem pedum quarti paris rotundato-dilatato, postice late et non profunde emarginato, basin caudæ tegenti. *Cauda* mediocris, $\frac{1}{3}$ longitudinis scuti æquans, $\frac{1}{4}$ totius corporis longit. vero paullo brevior, subtriangula, angulis rotundatis, latitudine paullo latior (in junioribus angustior), segmento ultimo trunci haud parum latior, antice bis sinuata, in lateribus leviter rotundata, postice parum profunde vix ultra $\frac{1}{3}$ longitudinis incisa, laciniis apice rotundato-acuminatis. *Appendices* minutissimæ: ex binis articulis constare videntur, primo brevi, subcylindrato, altero longiori, subovato, piloso.

Receptacula seminis a basi caudæ remota, ovata (longit. circa 0·9, lat. circa 0·55 millim.); a capsula seminis, quam includunt, canalis (filum?) longus, tenuissimus, convolutus, alium ejusmodi canalem excipiens, ad papillam prope basin caudæ sitam ductus est. *Ovarium* oblongum, per totum truncum extensum; ova perlucet sat magna (circa 1 millim. longa, $\frac{3}{4}$ millim. lata), 35 vel pauciora in exemplis, quæ vidimus.

Oculi oblongo-rotundati, obliqui, sat magni, diametro maxima circa $0.35 (= \frac{1}{20})$ longit. corporis fere). *Macula ocellaris* parva, cum oculis triangulum fere æquilaterum formans.

Antennæ primi paris fere ad marginem capitis pertinent; art. 1^a brevis est, transversus, aculeo forti postice armatus; art. 2^a oblongus, priori 3-4-plo longior, versus apicem angustatus et in unco fortem, incurvum productus, versus basin tuberculo forti, acuto, foras directo in margine antico, et unco forti in margine postico armatus; *appendix* ex articulis duobus constat: art. 1^a tenuis, angustus, æqualis, fere ad apicem antennæ pertinens; art. 2^a priori paullo angustior, plus duplo vero brevior, triplo longior quam latior, apice rotundato.

Antennæ secundi paris longitudine priorum, angustiores vero et inter se longius distantes, ad basin (art. 1^a et 2^a) crassæ, extus angustæ, subattenuatæ, articulis quinque. Art. 1^a diametro paullo longior, subcylindratus, basi postice unco armatus; art. 2^a eadem fere diametro, sed brevior est; art. 3^a longit. fere priorum 2 conjunctis, multo vero angustior, versus apicem subangustatus, diametro circa 4-plo longior; art. 4^a illo paullo angustior, et dimidio brevior; art. 5^a priori duplo fere brevior, paulloque angustior, diametro paullo longior. Pone basin antennarum adsunt *unci auxiliares* duo fortes, cum uncis art. 1^a antennarum primi paris trapezium paullo latius quam longius formantes.

Stimulus mediocris est, vagina ad basin antennarum primi paris saltum pertinenti, verticula ad basin nulla.

Sipho sat parvus, versus apicem subangustatus, ipso apice oblique truncato et in dorso subincrassato; diametro circa triplo longior; subtus versus basin granulis vel dentibus minutissimis sparsus; porrectus inter basin maxillipedum secundi paris pertinet. Apex cucullo sive *labio* rotundato-subtriangulo, subtus aperto ut in *A. purpureo*, efficitur, cujus margo in medio emarginatus est et membranula tenuissima ibi auctus (?): intus pegmate ejusmodi, atque in *A. foliaceo* et *coregoni* descripsimus, fulcitur, instrumenta masticationis gerenti. *Maxillæ* parvæ, debiles, oblongæ, apice extus rotundatæ, intus rectæ, non dentatæ, callo chitinoso, transverso conjunctæ. *Mandibulæ* transverse positæ, certo situ in ipsa apertura oris apparentes, paullo profundius tamen quam in *A. purpureo* pertinentes: oblongæ sunt, basi latæ, tum angustatæ et paullo curvatæ, in ipso apice et versus apicem in margine concavo dentibus minutis acutis, densis, versus apicem in margine vero convexo dentibus tribus raris, ultimo forti, armatæ. Ante maxillas et mandibulas in fundo aperturæ oris dentes vel *apices* duo fortes sese ostendunt.

Cotyledones (maxillipedes primi paris) parvi; diameter maxima $\frac{1}{9} - \frac{1}{10}$ longit. totius corporis æquat et paullo major est quam spatium quo inter se et a margine scuti distant. Radios marginis circa 45 numeravi.

Maxillipedes secundi paris ex articulis 5 constant: art. 1^a crassus, diametro paullo longior, *pectine* quasi in manubrium elongatum, angustum, oblique intus et antrorsum directum producto, in margine postico dentibus tribus fortibus conicis acuminatis armato, quorum extimus reliquis fortior est, ante dentes vero plaga magna obliqua,

scabra prædito. Art. 2^s priori paullo brevior et angustior, versus apicem subangustatus, latitudine maxima vix longior, nulla "patella" auctus; art. 3^s eo duplo brevior est, multoque angustior, latitudine paullo longior; art. 4^s etiam paullo brevior et angustior; art. 5^s prioris longitudine et versus apicem paullo angustatus, subconicus, apice in digitum minutum producto et aculeo parvo armato. Inter et pone maxillipedes secundi paris adsunt *unci* quatuor sat fortes, trapezium formantes.

Pedes omnes flagello carent; extensi ad marginem scuti pertinent. Stipes ped. par. 1^a-3^a ex tribus, paris 4^a ex duobus articulis constat; rami versus apicem angustati sunt et in latere posteriore et in apice setis fortibus, plumatis vestiti. Ramus inferior pedum paris 3^a-4^a ex articulis 2 constat, reliqui rami simplices sunt. Ramus superior inferiori paullo longior est, præsertim in pedibus anterioribus. Stipes pedum *primi* paris, a latere inferiore visus, reliquorum paullo longior est, art. 1^o brevissimo, transverso, art. 2^o dimidio fere longiore quam latiore, art. 3^o priore dimidio brevior, versus apicem angustato; ramus superior longior et crassior multo, quam ramus inferior. *Pedes secundi* paris prioribus paullo breviores; *pedes tertii* paris longitudine fere priorum, ramis subæqualibus: ramus inferior ex art. 2 constat, quorum 1^s latitudine circa duplo longior est, subcylindratus, 2^s eo fere duplo longior. *Pedes quarti* paris stipitem ex 2 tantum articulis constantem habent, art. 1^o transverso, in latere posteriore intus retro producto et rotundato et tum in processum magnum, subtriangulum, foras directum producto; art. 2^o illo fere duplo longiore, latitudine fere ut in pedibus anterioribus, ad apicem rotundato-angustato; ramus inferior stipite et ramo superiore brevior est, articulo 1^o versus apicem subangustato, duplo longiore quam latiore, art. 2^o eo paullo longiore.

MAS femina minor est (longit. circa 5 millim.) eique valde dissimilis, forma præsertim scuti et caudæ. *Scutum cephalicum*, quod minus est (longit. = circa $\frac{2}{3}$ longitudinis corporis), postice *pedes tertii* paris vix tegens, utrinque paullo ante medium in lobum productum est fere semicircularem, subtruncatum, antrorsum et foras directum, sinu profundo a parte cephalica separatum, et hoc modo ibi fere latius quam longius evadit; postice eodem modo atque in ♀ incisum est, laciniis modo magis parallelis, margine interiore vix sinuato. Pars cephalica major magisque prominens et truncata quam in ♀. *Truncus* multo angustior quam in ♀, latitudine fere 3-plo longior, segmentis transversis, gradatim paullo brevioribus, ultimo simplici, non dilatato. *Cauda* longitudine $\frac{3}{10}$ totius corporis longit. æquans, ovata, subacuminata, latitudine paullo plusquam dimidio longior, antice et in lateribus rotundata, postice non ad $\frac{1}{3}$ longitudinis incisa, laciniis apice subacuminatis; in ♂ juniore etiam angustior, laciniis acutioribus.

Testes longi sunt et angusti (1 millim. longi, lat. max. circa 0.2 millim.), a basi caudæ fere ad fundum incisuræ pertinentes. *Vesicula seminis* rotundato-ovata, sat parva (0.4 millim. longa, 0.3 millim. lata), in trunci segmento 1^o (et parte segmenti 2ⁱ) locata est; duo *ductus deferentes*, primum crassi, tum attenuati, ab extremitate ejus anteriore oriuntur, spatio vix ullo sejuncti: mox retro flexi et prope

latera vesicæ euntes pone eam paullo magis approximati paralleli ad segm. ultimum currunt. *Vasa efferentia* duo, a testibus inter ductus deferentes ad vesicam seminis ducta, vidisse videor, *glandulas accessorias* vero nullas.

Antennæ primi paris paullo ultra marginem scuti pertinent. *Pedes* quoque extensi ultra marginem scuti porriguntur. *Pedes* primi et secundi paris ut in ♀ fere sunt: tertii et quarti paris vero diversi, *instrumentis copulationis* instructi. *Stipes* pedum tertii paris art. 1^m transversum habet, postice in angulum obtusum productum; art. 2^s quoque transversus et parum longior est, postice eminentia (*capsula seminis*) magna, forma fere mammæ, ad apicem antice, supra, procursum forma fere digiti, antrorsum et foras directo præditus. Art. 3^s priori paullo longior est, ad basin illius fere crassitudine, versus apicem angustatus, diametro maxima parum longior. Rami ut in ♀ fere. In pedibus quarti paris art. 1^s stipitis transversus est, postice subdilatus, obliquus et bis rotundatus; art. 2^s crassus, oblongus, in apice et postice rotundatus, in latere anteriore *supra* procurribus duobus conniventibus, obtusis, anteriore crassiore, *infra* vero dente armatus. Rami subæquales, inferior, ut in pedibus tertii paris, verticula paullo intra medium in duos articulos divisus.

Color (exemplorum in spiritu vini asservatorum) albicans, subpellucidus. In feminis dorsum trunci distinguitur vittis duabus ad longitudinem ductis violaceis, e maculis parvis ejusdem coloris formatis, quæ vittæ ovarii sunt, per cutem dorsi perlucens.

[In a note appended to this paper, Prof. Thorell says, with regard to his species *A. coregoni*, that its range is not confined to Sweden. It is found in other parts of Europe, and has probably been confounded, by many of the older authors, with *A. foliaceus* (= *A. delphinus*, Müll.): this is the case, at least, with Hermann, who, in his 'Mémoire Aptérologique' (1804), p. 131, pl. 5. fig. 3, and pl. 6. fig. 11, describes and figures *A. coregoni* under the name of *A. delphinus*, although the synonyms (Müller's and Löfling's) which he cites refer to *A. foliaceus*.]

XII.—*Description of a new Genus of Diurnal Lepidoptera belonging to the Family Satyridæ.* By ARTHUR G. BUTLER, F.Z.S.

[Plate II.]

THE species which represents the present genus was described by Mr. Frederick Moore in his 'Catalogue of the Lepidopterous Insects in the Museum of the East India Company,' vol. i. p. 234. n. 503, as a species of *Mycalesis*?, for which he proposed the generic name of *Theope*.

Unfortunately this name had been previously used for a genus of Erycinidæ, which was characterized by Prof. Westwood at page 439 of 'The Genera of Diurnal Lepidoptera.'

This genus, although it has somewhat of the appearance of *Mycalesis* (fig. 3), is totally distinct from it, and is much more nearly allied to *Debis* (figs. 2, 2^a, 2^b); in fact the neuration is almost identical with that of the latter genus; but the great size of the typical species, its clubless antennæ, naked eyes, and erect palpi at once distinguish it. I therefore propose the name *Anadebis*.

In some respects this form seems to be nearly allied to *Amechania* of Hewitson, which should, I think, be placed between it and the genus *Orinoma* (figs. 4, 4^a) of Doubleday, and not, as in the 'Exotic Butterflies,' in the family Eurytelidæ.

ANADEBIS, gen. nov. Pl. II. figs. 1, 1^a, 1^b.

Magnitudine formaque *Tisiphones*, Hübner. Alæ anticæ magnæ, subtriangulares; costa arcuata; apice convexo; margine postico subdirecto; angulo anali convexo; margine interiore subdirecto.

Alæ posticæ late ovatæ; costa subdirecta; apice convexo; angulo anali subconvexo; margine postico sinuato: venis apud basim vix tumidis, velut in *Debe* positis.

Corpus thorace brevi, cirrato; capite cirrato; antennis tenuibus, apicibus vix clavatis, medium alarum anticarum attingentibus; palpis elongatis, erectis; oculis exstantibus nudis.

Fore wings large, subtriangular; costa strongly arched; apical angle rounded, outer margin nearly straight; anal angle rounded; inner margin nearly straight.

Hind wings broadly ovate; costa nearly straight; apical angle rounded; outer margin slightly scalloped; anal angle slightly rounded.

Nervures at base of wings scarcely swollen.

Fore wings. Costal nervure extending some distance beyond the cell; first and second subcostal nervures emitted just before the end of the cell; the first disco-cellular nervule very small and oblique, the second rather longer, the third very long and slightly waved; the first branch of the first discoidal nervure emitted, as in *Mycalesis* (fig. 3^a, 3^b), before the middle of the vein, the second branch reaching the apex, the third emitted at one-third of its length from the apex; the second and third discoidal nervures are emitted near the apex of the cell; the first median branch arises just beyond the middle of the median nervure, the second at about one-sixth of its length from the base; the third is slightly curved outwardly, and terminates the cell.

Hind wings. Precostal nervure curved, the tip directed inwards; costal nervure extending to beyond the middle of the costa; first branch of subcostal arising at some distance from the base, its extremity extending to the apex; the upper and lower disco-cellular nervules curved, oblique, of about equal

length; the first emitted at a short distance from the origin of the first subcostal branch, the second uniting with the median nervure at the origin of the second and third median nervules.

Body. Thorax short, hairy; head hairy; antennæ very slender, with scarcely perceptible club, about half the length of the front wings; fore legs small, especially in male.

Anadebis Himachala. Pl. II. fig. 1.

Theope (*Mycalesis*?) *Himachala*, F. Moore, Cat. Lep. Mus. E. I. C. i. p. 234 (1857).

Ethope Himachala, Moore, Proc. Zool. Soc. p. 770 (1865).

Neorina Sita, Felder, Wien. ent. Monatschr. iii. p. 403 (1859).

Hab. Darjeeling (Moore). Sylhet. B.M.

This genus must be placed next to *Neorina* of Westwood, from which it principally differs in the form of the antennæ and the disco-cellular nervures.

XIII.—*Observations on the Variation of Cyllo Leda of Linnæus, a Species of Satyride Lepidopteron; and on the different forms of that Insect in the National Collection.* By ARTHUR G. BUTLER, F.Z.S., Assistant, Zoological Department, British Museum.

AMONGST all the exotic Butterflies, I have met with no species that exceeds *Cyllo Leda* in variation of form, pattern, and coloration. The common *Diadema Lasinassa*, though subject to great diversity of marking and ornamentation, differs but little in the general outline of the wings; of *C. Leda*, on the contrary, we find specimens in which the entire character of the insect is changed in consequence of the falcation or non-falcation of the apices of the front wings.

This extraordinary variability has naturally had the effect of adding considerably to the synonymy of this species: amongst other forms, *C. Helena* of Westwood and *C. Banksia* of Fabricius must be included. The synonymy of *C. Leda* will therefore be as under:—

Papilio Leda, Linnæus, Syst. Nat. ii. p. 773. n. 150 (1766).

Oreas (*marmorata*) *Leda*, Hübner, Samml. exot. Schmett. Band i. pl. 91. f. 1-4 (1806-27).

Hipio Leda, Hübn. Verz. bek. Schmett. n. 538 (1816).

Satyrus Leda, Godart, Enc. Méth. ix. p. 478. n. 4 (1819).

Cyllo Leda, Westwood and Hewitson, Gen. Diurn. Lepid. p. 361. n. 1 (1851).

Papilio Solandra, Fabricius, Syst. Ent. p. 500 (1775).

Cyllo Solandra, Boisduval, Voy. dans l'Océanie (de 'l'Astrolabe'), Ent. pt. 1. p. 142 (1832-35).

Cyllo Helena, Westwood, Gen. Diurn. Lepid. p. 361. n. 2 (1851).

Papilio Banksia, Fabric. Syst. Ent. p. 499 (1775).

Cyllo Banksia, Westw. & Hewits. Gen. Diurn. Lepid. p. 361. n. 3 (1851).

Papilio Ismene, Cramer, Pap. Exot. i. pl. 26. f. A, B (1779).

— *Mycena*, Cram. Pap. Exot. iv. pl. 291. f. F (1782).

— *Phedima*, Cram. Pap. Exot. iv. pl. 292. f. B (1782).

— *Arcensia*, Cram. Pap. Exot. iv. pl. 292. f. C. (1782).

Var. *Cyllo Taitensis*, Felder, Verhandl. zool.-botan. Gesellsch. in Wien, xii. (1862).

India; Java; Oceania; Australia; Africa.

The forms of *C. Leda* in the British Museum Collection are as follows:—

1. *Oreas* (marmorata) *Leda*, *Hübner*, *Samml.* i. pl. 91. f. 1, 2; *Cramer*, *Pap.* iii. pl. 196. f. C, D. Java; North India.

1^a. *Alæ supra rufescentes*. Solandra, *Donovan*, and *Helena*, *Westwood*. Moreton Bay* (nec Tropical Africa).

2. *Alæ subtus fasciis transversis minus distinctis, ocellis majoribus*. North India.

2^a. *Ocellis anticarum supra macula permagna ochrea inclusis*. Ashanti; Sierra Leone.

2^b. *Alæ supra ferrugineæ*. Mauritius; Moreton Bay.

3. *Papilio Leda*, *Drury*, *Ill.* i. pl. 15. f. 5, 6. Ceylon.

3^b. *Alæ anticæ minus falcatae*. Moulmein.

4. *Alæ subtus ochraceæ, ocellis minus distinctis*. North India.

4^a. *Ocellis anticarum supra macula permagna ochrea inclusis*. Moreton Bay.

5. *Alæ subtus violascentes, ocellis multo minoribus, lineis transversis magnis distinctis*. Celebes.

5^a. *Alæ anticæ magis falcatae; ocellis anticarum supra macula permagna ochrea inclusis; ocellis posticarum majoribus*. Congo.

5^b. *Alæ supra rufescentes*. Cape of Good Hope.

6. *Alæ anticæ vix falcatae, ocellis supra indistinctis, anticarum subtus obsoletis, posticarum apud marginem analem distinctis*. Ceram.

7. *Alæ anticæ falcatae, supra ocellis distinctis, intus ferrugineo marginatis; posticæ ocellis subanalibus vix distinguendis; subtus ocellis ochraceis, anticarum vix distinguendis*. Java?

8. *Alæ anticæ supra ocellis fusco-albido cinctis; alæ subtus lituris vix distinguendis, ocellis ochraceis, quarto anticarum distinctiore*. Java?

9. *Alæ subtus coloribus Ismenes* (Cramer), sed sine maculis confusis nigris. North India.

10. *Alæ supra præcedenti similes; subtus coloribus Phedimæ* (Cramer). North India.

10^a. *Alæ anticæ supra rufescentes, ocellis macula permagna ochrea inclusis*. Cape of Good Hope.

11. *Alæ supra præcedenti similes, anticæ autem magis elongatis; subtus coloribus Arcensia* (Cramer), anticæ autem sine macula discali alba. North India.

12. *Alæ subtus rufescentes, anticæ macula discali alba; alæ omnes maculis striisque confusis fuscis*. North India.

13. *Alæ coloribus Mycenes* (Cramer), multo magis autem pallidioribus. Ashanti.

* This is the only specimen in the collection that agrees with *Hübner's* figure.

14. Alæ subtus olivaceo tinctæ maculis striisque indistinctis confusis fuscis; ocellis consuetis, anticarum fuscis albido pupillatis, posticarum ochreo-olivaceis albido pupillatis; posticæ macula nigra post cellam posita. North India.

15. Alæ subtus flavidæ, fasciis ocellisque vix distinguendis; ocellis albidis olivaceo-cinctis; posticæ macula nigra distincta post cellam posita. North India.

16. Alæ subtus flavidæ, anticæ lineis duabus distinctis; posticæ linea media angulata fusca, maculaque velut in præcedente nigra. North India.

17. Alæ subtus fasciis minus distinctis; posticæ macula altera apud basin nigra. North India.

18. Alæ subtus paulo rufescentibus; disci medio fusciscente; maculis pluribus nigris. North India.

18^a. Alæ supra ocellis anticarum late ochreo cinctis. Congo.

19. Papilio Ismene, Cramer, *Pap. Exot.* i. pl. 26. f. A, B (1779). North India.

19^a. Alis supra rufescentibus. —?

20. Alæ subtus fusco confusæ, ocellis indistinctis. North India.

20^a. Alis supra rufescentibus. Cape of Good Hope.

21. Alæ subtus violaceo tinctæ, anticæ subtus area basali nigro rotata. North India.

22. Papilio Leda ♀, Cramer, *Pap. Exot.* iv. pl. 292. f. A (1782). Oceania.

23. Alæ supra ocellis anticarum ochreo circumcinctis; subtus *P. Leda* ♀ (Cramer) simillimæ, fasciis autem olivaceis, ocellisque indistinctis. North India.

23^a. Alæ supra ferrugineæ. South Africa; Australia.

24. Alæ subtus violaceo tinctæ; aliter velut in præcedente. Australia.

25. Alæ subtus fasciis nigris cinereo variis; aliter velut in præcedente. Australia.

26. Alæ subtus fasciis viridescentibus, aliter velut in præcedente. Australia.

27. Alæ subtus purpurascens ochreo variæ; fasciis velut in præcedente, nigro-fuscis et rufescentibus. Moreton Bay.

28. Papilio Phedima, Cramer, *Pap. Exot.* iv. pl. 292. f. B. (1782). Australia.

28^a. Papilio Banksia*, Fabricius, *Syst. Ent.* p. 499 (1775). Moreton Bay.

In determining the above varieties I have found the small dark form (the true *P. Leda* of Linnæus) to be almost exclusively confined to India; but the variation from this form to that of *Banksia* (including *Helena* of Westwood) is so gradual that it is impossible to determine the exact limits of these two extremes. African specimens are usually of a reddish colour on the upper side; they differ from the generality of the Australian specimens in being somewhat smaller: the latter usually have the most strongly falcated fore wings.

* Also in the Banksian Collection.

Mr. Hewitson, in his list of Lepidoptera collected by Mr. Wallace (Proc. Linn. Soc. viii. pp. 143-149, 1863) has included several different forms as synonyms of *C. Leda*; but, as I have not seen types of these insects, I am unable to determine whether or not they are really distinct. I think *C. Suyndana* may very likely belong to this series, although the colouring of the upperside appears somewhat different.

XIV.—On the Contractile Substance and Intimate Structure of the Campanulariæ, Sertulariæ, and Hydridæ. By Professor REICHERT*.

1. IN the *Campanulariæ* and *Sertulariæ*, as also in other zoo-phytes, we may distinguish, with Allman, two parts:—the true polypes or polype-heads in the asexual or sexual stage of development; and the bearer of these polype-heads, the *cænosarc* of Allman, the *substance commune* of Van Beneden, and the *cænenchyma* of later authors. The bearer of the polype-heads is a young state of these animals, from which the so-called polypes or polype-heads are produced by gemmation; it may be more suitably named the “polype-stem” (*polypphyton*).

2. In the *Campanulariæ* and *Sertulariæ* examined by me, the polype-stem is always divided into a section serving for the attachment of the polypidom, which constitutes the roots, stolons or “rootstock,” and the simple or ramified “stalk,” which bears the polypes directly either at its extremities or attached to its walls.

3. On the polype-heads we find, as previously recognized distinguishable parts, the mouth-piece (*trompe buccale* of Van Beneden) and the stomach (*estomac* of Van Beneden; *post-buccal cavity*, Allman; *cavité post-buccale*, Milne-Edwards), with the tentacular apparatus. In the asexual polype-heads of the *Campanulariæ* and *Sertulariæ*, the “transition-piece” from the stomach to the stalk must also be particularly indicated. In the *Campanulariæ* and *Sertulariæ* this is situated in the bottom of the bell or cell of the polyparium. In general this division of the bell is separated from the other parts, sometimes externally, but more frequently on the inner surface, by an annular or semicircular projection; so that the “transition-piece” is placed in a more or less dissepimented cavity of the cell.

Lister has called the annular process in the *Campanulariæ* the diaphragm or the septum. Besides these, two other narrowed places are perceptible, situated between the three divi-

* Translated by W. S. Dallas, F.L.S., from the ‘Monatsbericht der Akademie der Wissenschaften zu Berlin,’ July 1866, pp. 504-509.

sions, of which that introduced between the mouth-piece and the stomach may be called the "œsophageal passage" (*Schlundenge*), and that between the stomach and transition-piece, in the orifice of the so-called diaphragm, the "portal passage" (*Pfortnerenge*). In many genera belonging to this group the stalk bears the secondary heads*, particularly characterized by their urticating organs, most frequently in the vicinity of the polype-heads, apparently as appendages of the latter.

4. In the *Hydridæ* the stomach passes, without any distinctly limited transition-piece, into the polype-stem or foot; the "portal passage" also is not marked externally, but may be recognized during the closure of the stomachal cavity from that of the foot. The *Hydridæ* are further distinguished from the *Campanulariæ* and *Sertulariæ* by the fact that the former are naked and possess no polyparium, and particularly by the structure of the tentacles.

5. The *Campanulariæ*, *Sertulariæ*, and *Hydridæ* are admitted on all hands to consist in all their parts, excepting the arms, of two chief constituents or layers, the ectoderm and endoderm of Allman. Between these two principal layers a third accessory constituent, named by me the "supporting lamella" or "supporting membrane," a sort of inner skeleton, is everywhere introduced. This has already been conjecturally established by Leydig and Kölliker (*basement membrane*). Allman has regarded the supporting lamella as a muscular fibrous layer.

6. In the developed state the ectoderm does not consist of cells; it is not an epithelium as is generally supposed, but is the essential and sole contractile substance of the polypes, comparable to that of the Polythalamia; it contains imbedded in it the urticating organs and sometimes also pigment-corpuseles, but otherwise not the least trace of nuclei or of any cell-constituent. The contractile substance itself is perfectly transparent and of perfectly uniform homogeneous texture, as in the Polythalamia. It acquires the aspect of a cellular structure only during certain states of contraction, especially the papillar condition.

7. During the transition of the cortical layer from the state of rest to that of so-called active contraction, there appear upon any part of its outer surface small knots, warts, papilliform projections, and ridges of variable number and size. The ridges are regularly transverse in direction, embracing the cavity more or less completely. Such annular ridges are formed, however, only on the very mobile parts of the body, but therefore all over the *Hydridæ*. In *Hydra* the head and foot may in this way acquire a very regularly ringed appearance. The papillæ of con-

* *Nematophores* of Busk.

traction also sometimes appear very regularly distributed, and thus cause the polyhedric epithelial marking, as the nuclei of which scattered and covered urticating organs have been indicated.

8. The papilliform processes may become elongated into actual root like feet, which, in most cases, are employed for the attachment of the body. In *Hydra* such root-like feet have been observed on the margin of the pedal disk; in the *Campanulariæ* and *Sertulariæ* they rather occur isolated on the stem, but more frequently and often in larger numbers on the "transition-piece." The root-like feet here adhere by means of a disciform dilatation to the polyparium, and have been more or less distinctly indicated as supposed stable bands in the figures of previous authors. In the *Hydridae* such root-like feet of filamentous form are developed in greater number also on the inner surface of the contractile layer, and attach themselves firmly to the supporting lamella. These are the muscular fibres of the *Hydridae* mentioned by Kölliker. Filiform pseudopodia with the so-called granular movement were not observed.

9. The second principal constituent of the body-wall, the endoderm, consists throughout of a simple layer of cells, which is for the most part spread out like an epithelium and provided with cilia. The form of the cells varies according to the state of contraction of the true contractile layer. In the extended state the cells are rather flattened, and in *Hydra* even frequently drawn out in the direction of the longitudinal axis; in proportion as abbreviation takes place their thickness increases, and the cellular layer finally acquires the aspect of a cylinder-epithelium. It is not demonstrated, even in *Hydra*, that these cells can change their form by their own contraction; indeed this is even highly improbable. The inner surface of this cellular layer is turned quite freely towards the cavity, which is filled with nutritive fluid containing granules. Any pigment-granules that may be present are situated within the cells, and never form a separate layer (Agassiz).

10. The supporting lamella consists of a limpid, textureless, soft, elastic substance, which, at ordinary temperatures, only swells up a little in solution of potash, or even in chemically pure sulphuric acid, and does not dissolve even when treated for half an hour with the above-mentioned reagents. The supporting lamella must be regarded as an excretion of the contractile substance, as, in *Hydra*, it occurs even in the free terminal portions of the tentacles, where the inner cellular layer is deficient. Consequently the contractile layer, both on its outer and inner surfaces, forms excretions which gradually become solid, for its own protection and support. In the *Campanulariæ* and *Sertulariæ* the external excretion forms the polyparium, and

the internal one the supporting lamella; in the *Hydridæ* the supporting lamella alone is formed; in other cases (*Gromia* &c.) only an outer skeleton makes its appearance.

11. The tentacles of the *Hydridæ* are simple tubes, the cavity of which is in open communication with that of the stomach; the granular nutritive fluid moves through the tentacles as well as through the cavities of the head and foot. From the morphological nature of the wall of the tube, two divisions must be distinguished in its length, namely, the attached and the free terminal division. On the former the wall is composed of the same constituents as on the head and, especially, on the foot; in the free division the inner, cellular layer is wanting. In the tentacles of the *Campanulariæ* and *Sertulariæ* the inner, cellular layer is also wanting, and, indeed, throughout their whole length. But from the supporting lamella septa are given off at regular intervals, dividing the cavity of the tentacles into chambers, which probably communicate with each other by a central orifice in the septum. In the fully developed state of the animal these chambers contain no cells, neither cartilage nor epithelial cells. In each chamber the contractile axial substance described by me is situated; this is of exactly the same nature as the external contractile layer, only wanting the urticating organs. In the abbreviated state the contractile axial substance fills each chamber almost completely; in a more or less extended state the chambers are filled from the stomachal cavity with a fluid which never contains granules, and appears to be clear sea-water. The contractile axial substance then occupies the axis of each chamber, extending from one septum to the other: its form differs according to the state of contraction; on the septa it spreads out like a disk, perhaps by means of processes; it often presents the form of a ramified cell. Like the outer, contractile layer, this axial substance presents no trace of a cell-nucleus. Knot-like inflations, or urticating organs, placed in front or behind in the *outer*, contractile layer, may produce the illusive appearance of a cell-nucleus.

12. The movement of the nutritive fluid takes place quite independently of any cilia that may be present on the inner, cellular layer, merely by the agency of the contractions of the outer, contractile layer.

13. The comparison of the hollow body of the Hydrozoa to the first traces or stages of development of the organism of the higher Vertebrata undertaken by Huxley and afterwards by Kölliker, has no foundation in fact; it even proceeds from erroneous suppositions, both as to the nature and signification of the first foundation of the vertebrate animal, and with regard to the structure of the body of the Hydrozoon.

14. As both the outer skeleton (*polyparium*) and the inner

skeleton or supporting lamella of the *Sertulariæ*, *Campanulariæ*, and *Hydridæ* must be regarded as hardened excretions of the contractile layer of the Hydrozoon-body, their comparison to structures formed of connective tissue is inadmissible (Kölliker).

XV.—On the Antilocapridæ. By P. L. SCLATER, F.R.S. &c.

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

GENTLEMEN,

It is very good of Dr. Gray to put me right concerning the absence of the "false hoofs" in some of the smaller Antilopean forms, such as *Nesotragus*, *Nanotragus*, and some species of *Calotragus*, which I had quite overlooked. These organs are stated, and, I believe, correctly, to be also deficient in the Pallah (*Antilope melampus*).

I did not, however, make a "useless synonym" in changing Sundevall's name *Digitigrada* into *Phalangigrada*, but merely followed M. Alphonse Milne-Edwards (Ann. Sc. Nat. sér. 5. vol. ii. article on the "*Chevrotains*") in applying the latter term (which in some respects is preferable to the former one) to the Camelidæ.

I may add that I cannot agree with Dr. Gray in considering the genera *Tragulus* and *Moschus* to be "nearly allied." M. Alphonse Milne-Edwards, in the memoir above referred to, has, in my opinion, clearly shown them to be very different, *Moschus* being affine to the Cervidæ, while *Tragulus* and *Hyomoschus* constitute a distinct family of Artiodactyles, leading off towards the non-ruminating Suidæ. It is well remarked by M. A. Milne-Edwards that, if an isolated foot of *Hyomoschus* had been found fossil, it would certainly have been referred to an animal allied to the Peccaries (*Dicotyles*).

Nor can I agree with Dr. Gray in "doubting the applicability of placental characters to zoological classification." After the labours of Von Baer, Carus, Kölliker, Milne-Edwards, Huxley, and Rolleston upon this subject, I can no longer doubt that, in the words of the last author*, "the modifications of the placental structures form a very safe basis for zoological classification;" and I believe that I am by no means singular in this opinion.

I am, Gentlemen,

Yours, &c.,

P. L. SCLATER.

11 Hanover Square.
Dec. 13, 1866.

* Trans. Zool. Soc. v. p. 311.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

June 21, 1866.—Lieut.-General Sabine, President, in the Chair.

“On the Structure of the Optic Lobes of the Cuttle-fish.” By J. Lockhart Clarke, F.R.S.

The brain of the Cuttle-fish consists of several ganglia closely aggregated around the upper part of the œsophagus. The foremost or pharyngeal ganglion, which is much the smallest, is bilobed and somewhat quadrangular. The next is a large bilobed ganglion which forms the roof of the canal for the œsophagus. Beneath the œsophagus is another large and broad mass, which is connected on each side with the supra-œsophageal masses by bands that complete the œsophageal ring.

From each side of the cephalic masses springs a thick optic peduncle which ends in the optic lobe. Each optic lobe is larger than all the other cerebral masses taken together, and has a striking resemblance in shape to the human kidney. It is completely enveloped in a thick layer of optic nerves disposed in flattened bands which issue from all parts of its substance and proceed to the back of the eye in a fan-like expansion, the upper and lower bands crossing each other in their course. The substance of each lobe consists of two distinct portions, which differ from each other entirely in appearance. The outer portion resembles a very thin rind or shell, is extremely delicate, and very easily torn from the central substance which it encloses. It consists of three concentric layers—an external dark layer, an internal dark layer, and a middle pale and broader layer containing thin and concentric bands of fibres.

The first or outer layer consists of a multitude of nuclei and a few small nucleated cells, with which filaments of the optic nerves are connected. The second or middle layer is composed entirely of fine nerve-fibres which form two sets—one vertical, and the other horizontal. The vertical fibres issue at the under surface of the first layer from the network which its nuclei form with the fibres of the optic nerves. Some are continuous with the horizontal fibres, but the majority continue downward across them to the third or inner layer. At the junction of these two layers is a row of nucleated cells which send thin processes in different directions, and with which some of the nerve-fibres are connected. The third or inner layer is composed entirely of closely aggregated nuclei, which are joined together in a network by the fibres which issue from the under surface of the middle layer.

The cortical substance, consisting of these three layers, forms only a very small portion of the optic lobe. Out of the nuclear network of the inner layer fine nerve-fibres descend into the body of the lobe which it encloses. At first these fibres are vertical, parallel, and arranged in uniform series, with scattered nuclei between them; but

as they descend to the centre of the lobe, they diverge more and more, and cross each other to form a plexus, first with oval and then with broader meshes, in which the nuclei and nucleated cells are collected into groups of corresponding shape and size.

From the plexus at the inner side of the lobe bundles converge from all parts to form the lower half of the peduncle, the upper part of which consists of masses of small nuclei, and gives attachment, by a short pedicle, to a small tubercle. This tubercle consists of closely aggregated nuclei connected by fibres which converge to its neck and escape into the peduncle of the optic lobe.

After concluding his description of the optic lobes, the author gives a short account of the structure and connexions of the remaining cerebral ganglia of the Cuttle-fish, with the view of determining their homologies.

From the nature of the parts which it supplies, the foremost or pharyngeal ganglion would seem to combine the function of the centres which give origin to the trigeminal, the olfactory, and the gustatory nerves in the vertebrata. The second bilobed ganglion appears to correspond partly to the cerebral lobes and partly to the cerebellum of fishes. The posterior portion of the subœsophageal mass is the analogue of the medulla oblongata; while the anterior portion may be regarded as the spinal cord concentrated below the œsophagus and in the neighbourhood of the feet, which derive all their nerves from that source.

MISCELLANEOUS.

The "Monde de la Mer."

[To Dr. J. E. Gray, F.R.S. &c.]

MY DEAR SIR,—I have just returned from a visit to the "Monde de la Mer," a noble aquarium opened to the public, at a charge of two francs per head, within the last week, on the Boulevard Montmartre. It is arranged as a large grotto, with cement stalactites, and the light almost entirely comes through the glass front of the aquaria.

There are no less than thirteen aquaria, with glass fronts, about 15 feet long, 4 feet deep; and there are glass facings to brick-and-cement tanks 5 or 6 feet wide. These thirteen are for salt water alone; but there are others for fresh water, and two little ponds, 10 or 12 feet across. The aquaria are lit by gaslights placed above, which light up in the most efficient manner the interior, and show every fish most perfectly.

There appears to be no confervoid growth; and doubtless the gaslight is unfavourable to such vegetation, but gives an illumination more resembling the natural condition in deep water.

A gas-engine is employed to change the water, which continually runs to a tank below, and is pumped back, the jet being thrown

with such force as to carry down a great quantity of air in very minute division—so much, in fact, that I thought it was done by an air-pump, until the attendant obliged me by allowing me to go behind the scenes and inspect the contrivance.

The “monde” de la mer in these tanks were truly wonderful: large fish a yard long, soles and skates of ample proportions, with lobster, crayfish, and numerous species of fish of brilliant colours, from the Mediterranean. Hundreds of anemones made a sort of flower-garden; and the effect was so interesting and so beautiful that it has but to be seen to be believed and appreciated.

The aquarium at the Zoological Gardens, which formerly attracted so much attention, was a mere baby to it, and gave no idea of the behaviour of the great-grandfather fish which are here contained.

It occurred to me that, if I was a child and fell in love with this beautiful exhibition, there must be hundreds and thousands of grown-up children who would also like to be introduced to the “Monde de la Mer.” Then why not get up a bigger “mer” and a more distinguished “monde” at the Zoological Gardens?

The place would be the bank sloping to the canal, looking towards the north; for fish have a decided natural objection to be cooked by a southern sun. And the moment I arrive in England I shall rush to the Zoo’ to see if perfidious Albion has copied the idea and out-mer’d and out-monde’d the “Monde de la Mer” of Paris.

I remain, my dear Sir,

Yours faithfully,

ALFRED SMEE.

Hotel Meurice, Paris.

Nov. 19, 1866.

Bursting of a Monster Aquarium at the “Monde de Mer.”

A curious accident happened two days ago at the Aquarium establishment on the Boulevard Montmartre. At about three in the afternoon the visitors were suddenly alarmed by a loud detonation. The glass of the largest of the reservoirs filled with sea-water gave way, and the contents were precipitated all over the place. The alarmed spectators hastened to make their escape, and fortunately no one was seriously hurt. One gentleman was slightly cut on the chin, the arm, and the knee by some fragments of glass. The cause of the accident is a mystery, the supposition, however, now being that the glass was not strong enough to resist the pressure of the water, as the vessel contained about 15,000 gallons, being the largest in the establishment, and measuring nearly 15 feet in length.—*Standard*, Dec. 14, 1866.

On the Eyes of Caterpillars. By HERMANN LANDOIS.

Although the eyes of caterpillars attracted the attention of so ancient an anatomist as Malpighi, the most different statements with regard to them are met with, and some recent authors have even completely denied their existence. These eyes, nevertheless,

appear to be constantly present in all species of caterpillars. They are found to the number of six on each side of the head, immediately above the articulation of the mandibles. The cornea of each of them strikes one directly, according to M. Landois, by its division into three segments. From the centre of the cornea three lines diverge at angles of 120° towards the margin, and divide this organ into three equal parts, each of which presents a curvature of its own.

Directly beneath the hypoderm (chitinogenous stratum) of the cornea, there are three crystallines, corresponding to the three parts of the cornea, and each formed of striated and nucleated fibres, arranged concentrically around the centre of the organ. Beneath this triple crystalline is an organ which M. Landois regards as an iris. It is a kind of diaphragm formed by about thirty-five fibres directed like rays from the periphery to the centre of the iris, and strongly pigmented. These fibres are very contractile, and probably of a muscular nature. The centre of the iris is pierced by a triangular aperture with rounded angles; and from each angle issues a yellow appendage, to which the author gives the name of the loop of the iris.

Beneath the iris comes that part of the visual apparatus which, in faceted eyes, has generally received the name of the *crystalline body*. According to M. Landois, this body is not perfectly limited, except by the action of reagents, and originally it was in continuity of tissue with the nervous branch which follows. In this case M. Leydig's previsions would be confirmed, and it would be necessary to regard the supposed crystalline body as a terminal nervous inflation of the optic fibres. This inflation is divided, like the cornea, the crystalline, and the iris, into three parts, each of which is continued into a nervous fibre, which may be traced, attached to the others, as far as the optic nerve. The fibres and dilatations are protected by a neurilemma.

The nervous portions of the eye are protected by three masses with violet pigment, which the author calls *enveloping bodies*; in fact they form an envelope round the optic nerve and the nervous inflation, only leaving between them a small aperture for the passage of the loops of the iris, which apply themselves to the nervous inflation. Lastly, the whole eye is protected by a muscular layer and by a double membrane which envelopes it.

M. Landois considers that the eyes of caterpillars are intermediate between simple and faceted eyes, and proposes for them the name of *compound ocelli*. In reality each of these ocelli is the complete homologue of an isolated element of a faceted eye. The author indicates in detail the homologies of these two forms of eyes—homologies which no one can miss seeing. A single surprising fact remains. In the faceted eyes, as has been demonstrated by M. Claparède, the whole organization is based upon the number four; in those of caterpillars, on the contrary, as M. Landois has just shown, it is based upon the number three. It will be interesting to ascertain by the study of chrysalids how the typical form of the eyes of the perfect insect succeeds that of the caterpillar.

The form of the eyes of caterpillars, and their position at the root of the mandibles, appear to be perfectly appropriate to the mode of life of these animals. The prehension and assimilation of food constitute the essential phenomena of their life. The exercise of sight is limited to the immediate perception of nutritive materials. The distance from the point of the mandibles to the ocelli being therefore the measure of average vision, this distance must be exceptionally short. The laws of optics necessitate in this case an extremely strong curvature of the crystalline; and this curvature is realized in all caterpillars. The office of the iris is no doubt to contract under the influence of too intense a light; for this organ is endowed with an extreme contractility. Lastly, the enveloping bodies, the muscular layer, and the enveloping membranes are very strongly pigmented, so as to concentrate the light upon the nervous elements.—*Siebold und Kölliker's Zeitschrift*, Bd. xvi. p. 27; *Bibl. Univ.* Nov. 25, 1866, *Bull. Sci.* pp. 272-275.

Deep-Sea Life in the Ocean.

In my Report to the British Association, at their last meeting, on dredging among the Hebrides, I quoted a paper by Professor Lovén on the results of the Swedish expedition to Spitzbergen in 1861 under Dr. Otto Thorell. A translation of that paper was sent to me by a friend from Copenhagen, and I had no opportunity of comparing it with the original. Professor Lovén has now pointed out to me a mistake in the translation, which, in justice to him, I hasten to correct. Instead of his saying that, from 60 to 80 fathoms down to the greatest depth known to be inhabited by animals, the bottom is "everywhere" covered with a soft and fine mud or clay, it should be "wherever" the bottom is so covered. This substitution of one word for another makes all the difference. The learned author was well aware of the existence of rocky ground, even at very great depths. I beg to offer my sincere apology to him for having thus misrepresented his views.

J. GWYN JEFFREYS.

25 Devonshire Place, Portland Place,
1st Dec., 1866.

Researches on the Geryonidæ. By Professor HÄCKEL.

Among the Craspedote Medusæ the family of the Geryonidæ is distinguished by the length of the stomachal peduncle, which causes these animals to resemble umbrellas furnished with long handles. This character certainly occurs also throughout the family Geryonopsidæ established by Agassiz, and in some Oceanidæ and Thaumantiadæ. But the Geryonidæ are distinguished from these families by the peculiar form of their generative organs, which extend like delicate leaves in the subumbrella, without projecting into the cavity of the umbrella. Gegenbaur, indeed, ascribes to the Geryonidæ another important character connected with the gastrovascular sys-

tem. Their stomachal peduncle, according to him, is destitute of gastrovascular canals, and represents a tube, hollow throughout and filled with chyme, communicating directly with the radiating canals of the umbrella. Häckel proves that this character is erroneous. The peduncle in the Geryonidæ, as in the Geryonopsidæ, is solid and hyaline, the stomach occupying only its lower or buccal extremity. From this stomach issue the gastrovascular canals, which are excavated in the peripheral layer of the hyaline peduncle, and run towards the umbrella. M. Häckel remarks that the Geryonidæ form two very natural groups, according as they are quadruply or sextuply rayed; and he therefore forms with them two subfamilies, that of the Carmarinides and that of the Liriopides. The Carmarinides, with sextuple rays, are distinguished by their large size, not only from the Liriopides, but also from nearly all the other Craspedote Medusæ; so that they may be regarded as giants among these Hydrozoa.

A very singular organ which occurs in certain Geryonidæ of both subfamilies, is a solid, gelatinous, hyaline cone, which springs from the bottom of the stomach, and, traversing its whole cavity, projects through the mouth. This organ, called by the author the "lingual cone," appears to be endowed with tactile functions; but it is also intimately connected with those of reproduction. Its existence was previously known in the four-rayed genus *Liriope*; but the author has also found it in the new six-rayed genus *Carmarina* from the Mediterranean.

Certain Carmarinides present a modification of the gastrovascular system which is unique in its kind among the Craspedote Medusæ. We find in them, besides the normal radiating canals, centripetal canals which start from the marginal canal and are directed towards the base of the stomachal peduncle, where they terminate cæcally.

The Geryonidæ appear to be furnished with a nervous system, the principal part of which presents the form of an annular cord, placed immediately beneath the marginal canal, and bearing ganglionic inflations at the positions of the marginal corpuscles. Here, therefore, we have a new champion in support of the controverted existence of a nervous system in the Medusæ. But it is as well to remark that the nervous system described by Häckel appears to be essentially different from that indicated by Agassiz; it is also distinct from the organs regarded as nervous by F. Müller in *Liriope*, and only appears to coincide with the nervous system observed by F. Müller in *Tamoya*, and by Leuckart in *Eucope*.

The tentacles of the adult Geryonidæ are at least as numerous as the radiating canals, and are then placed at the extremities of the latter. There are consequently at least four of them in the Liriopides, and six in the Carmarinides. But many species also possess interradial tentacles, which appear, likewise, to exist in all the species when young. Moreover, during a certain period of larval life, all the Geryonidæ appear to possess supplementary or accessory tentacles, inserted upon the dorsal part of the umbrella, a little above the radial tentacles and upon the same meridians as these. During this period

of development, therefore, the Liriopides possess twelve tentacles, and the Carmarinides eighteen. Whilst the radial tentacles are hollow, supple, and endowed with great mobility, the interradial tentacles are short and rigid, and scarcely possess any but a pendulum-like movement, like the tentacles of the Trachynemidæ.

The development of all the Geryonidæ presents a series of very interesting metamorphoses. The young individuals, on escaping from the egg, are very different from their parents, and, before attaining their definitive form, have to pass through various phases, some of which have occasioned the formation of separate genera. The metamorphoses of one species only (*Liriope catharinensis*) had hitherto been studied by F. Müller; but M. Häckel now makes known those of another *Liriope* and of a *Carmarina*. In all the species, whether their fundamental typical number be four or six, the tentacles are at first equal in number to the typical number, then double, and afterwards triple in number; then in the course of development the number falls to double the typical number, or even, in many species, to this number itself. The first radial tentacles, which are only rudimentary, generally disappear as soon as the second have attained a certain length. On the other hand, the solid and rigid interradial tentacles persist, in some species, until the commencement of sexual maturity, and in others even through the whole life.

Besides this mode of reproduction, M. Häckel has observed another, very strange one in the Mediterranean *Carmarina hastata*. Certain individuals of this species, both males and females, contain in their stomachs a sort of spike, formed by an agglomeration of medusiform buds. The number of Medusæ on one of these spikes may be as many as eighty-five. A more careful examination showed M. Häckel that the axis of the spike is formed by the lingual cone, to the surface of which the medusiform buds are attached by the middle of the dorsal surface of the umbrella. This cone, therefore, acts the part sometimes of a tactile tongue, sometimes of a gemmiparous organ.

It is still more remarkable that all these buds are octuply radiated, whilst all the adult *Carmarinæ* and all the larvæ which issue from them are sextuply radiated. It is therefore impossible that these buds should ever become *Carmarinæ*. Moreover the whole organization of these buds removes them from Geryonidæ, to give them place among the Æginidæ; and in fact these young buds become developed into an Æginide abundant in the Bay of Nice, and described by Häckel under the name of *Cunina rhododactyla*. This *Cunina*, which is destitute of the long stomachal peduncle, is a sexual individual as well as the *Carmarina* from which it is produced.

The two families Geryonidæ and Æginidæ must therefore henceforward be united into one (Phyllorechidæ, Häckel). Häckel, moreover, shows that the differences which separate them are not so great as has been supposed. The Æginidæ alone, among the Craspedota, have passed as being destitute of a marginal canal; but this exception disappears, the author showing that this canal also exists in them.

The so-called blind lateral diverticula of the stomach, upon which so much stress has been laid as a character peculiar to the Æginidæ, are in reality only radiating gastrovascular canals, exceptionally widened and flattened, opening at one end into the stomach and at the other into the marginal canal. Lastly, those peculiarities of the tentacles which have been indicated in the Æginidæ are met with in the provisional tentacles of the Geryonidæ.

This remarkable discovery might, to a certain extent, have been foreseen, by taking into consideration some isolated facts already known. In 1853 Kölliker described, under the name of *Stenogaster complanatus*, a small Æginide with sixteen rays, which he discovered in the stomach of an Æginide with ten rays, *Eurystoma rubiginosum*. In 1861 Fritz Müller was led to suppose, from analogy, that the *Stenogastres* were engendered by the *Eurystomata*. In fact, he observed in an Æginide of the Brazilian coast, to which he gives the name of *Cunina Köllikeri*, that individuals octuply rayed produced by gemmation in their stomach individuals covered with vibratile cilia and duodecimally radiated. These facts, brought together with that investigated by Hæckel, show that in the Æginidæ there is a dimorphism of two sexual generations, one of which is produced from the other by gemmation.

Even the existence of spikes of Medusæ, produced by the formation of numerous buds on the surface of the lingual cone of the Geryonidæ, is not so completely new as it might be thought at the first glance. As early as 1843, Krohn indicated an analogous spike in the stomach of a *Geryonia* from the Mediterranean; and in 1860 F. Müller made a similar observation on a Brazilian *Liriope*; but he believed the spike to be of foreign origin, and to have been merely swallowed by the *Liriope*.

This singular mode of reproduction of the Æginidæ evidently differs considerably from that prevailing in the other Hydroids. We have nothing to do here with an alternation of one or several asexual hydriform generations with a generation of sexual Medusæ, but we have a genetic union of two forms of sexual Medusæ very different from each other. In it M. Hæckel sees a mode of generation essentially different from the alternation of generations, and for it he proposes the name of *Allæogenesis*. Nevertheless this difference is perhaps not so profound as it seems at the first glance. We must indeed reject as forced the interpretation by which Mr. Allman seeks to refer the exceptional facts observed by M. Hæckel to the normal form of the alternation of generations. Mr. Allman, in fact, endeavours to make of the Geryonidæ an asexual generation by theoretically raising their generative organs to the rank of independent zooids or rudimentary individuals of a sexual generation. Such an interpretation seems to us to give an exaggerated importance to the generative organs, each of which is really only a modification of a radiating gastrovascular canal. In any case the existence of two sexual forms in one and the same species is not now so surprising as at the moment when M. Hæckel wrote. The development of *Ascaris nigrovenosa*, as revealed to us by the beautiful researches of MM.

Leuckart and Mecznikow, presents us, among the Nematode worms, with a very similar example of dimorphism of sexual forms.—*Bibl. Univ.* 1865, *Bull. Sci.* pp. 154-160; abstract of 'Beiträge zur Naturgeschichte der Hydromedusen, Heft 1. Die Familie der Rüsselquallen. Leipzig, 1865.

On some Crustacea of the French Coasts.

By M. HESSE.

In a ninth memoir on new and rare French Copepod Crustacea, M. Hesse describes numerous species of this class, most of which are found living in the interior of various Ascidians. The species belong to the genera *Doropygus* and *Dispontius* of Thorell and to four new genera proposed by the author.

Of the genus *Doropygus* the author describes twenty-one species, four of which had previously been observed by Thorell. He gives the following general table of their characters:—

Abdominal extremity	terminating in a rounded point; appendages straight, unarmed, with or without hairs; posterior thoracic process	large: <i>D. curculio, pulex</i> (Thor.), <i>propinquus, conicus, callipygus, deflexus, oblongus, rotundus.</i>
		wanting: <i>D. verrucosus, albidus, viridis, gibbosus, tumefactus.</i>
Abdominal extremity	terminated by a small cavity; appendages recurved and hooked, armed with points; posterior thoracic process	large: <i>D. gibber</i> (Thor.), <i>psyllus</i> (Thor.), <i>auritus</i> (Thor.).
		small: <i>D. acutus, reflexus.</i>
		wanting: <i>D. macroone, rufescens, coccineus.</i>

Most of these species occur in simple Ascidians; but the habitat of *D. oblongus* is said to be *Polyclinium stellatum*; *D. tumefactus* occurs in "an incrusting pustular Ascidian of a brown colour," found on a *Maia squinado*; *D. rufescens* inhabits a reddish, pustular, incrusting *Eucelinus*; and *D. deflexus* was found under the cortical envelope of a zoophyte attached to the feet of a *Maia squinado*.

Of the genus *Dispontius* the author describes Thorell's species *D. striatus*, and two new ones, *D. marginatus* and *D. conspicuus*.

Those which form the types of new genera are:—

1. GASTRODES, Hesse.

Closely allied to *Botachus*. *Female*. Body elongate, narrow in front, enlarging gradually to base of thorax; thorax of six segments; abdomen narrow, cylindrical, of five segments, the last terminated by four very strong opposed claws, which may be prehensile. Antennæ moderate, basal joint large and long; stem cylindrical, eight-jointed. First footjaw long and slender, terminated by a hooked claw; second and third stouter and shorter. Natatory thoracic feet biramose, furnished with points and hairs. Eye single, in the middle

of the forehead. The species, *G. viridis*, was found in *Ascidia intestinalis*.

2. CERATRICHODES, Hesse.

Male. Body clavate, narrow, elongate. Thorax of six segments, exclusive of the cephalothorax; abdomen of eight segments, which are very close and imbricated, with short rigid hairs at their posterior margins; abdominal appendages terminated by *long and straight hairs*. Eye? Footjaws: first long and slender, armed with a claw; the rest shorter and of equal thickness. Natatory feet biramose, garnished with spines and hairs. Opening of the genital orifices very apparent, with a corneous and denticulated border. Antennæ furnished at base with a very broad, flat, rounded appendage, covered with bristling hairs.

Female. Body pyriform, short. Abdomen short, with only three segments; abdominal appendages broad and flat, of moderate size, *armed with four crooked claws*. No eye.

The single species, *C. albidus*, occurs in a social Ascidian, of a red colour, which is found as a gelatinous layer on *Zostera*.

3. OPHTHALMOPACHUS, Hesse.

Male. Body long, narrow, claviform; thorax of five segments, including cephalothorax; abdomen of five segments, terminated by two appendages of moderate length, garnished with delicate divergent hairs. Antennæ short, thick, truncated at the end, and covered with hairs. Mouth unknown. First and second footjaws broad and short. Thoracic feet double; outer cylindrical one attached to a very thick femoral joint. Eye very large.

Female. Body short and thick; cephalic shield cordiform; thorax of five segments, including the first; abdomen of three segments, the last terminated by two appendages of moderate size, with short divergent hairs. Antennæ thick and short; eye very large.

The single species, *O. ruber*, is found in a reddish compound Ascidian, which forms a thin shining coating on *Zostera oceanica*.

4. PLATYTHORAX, Hesse.

Female. Body broad and clumsy; cephalic shield rounded, followed by three segments preceding a considerable enlargement on each side, destined to contain the ova. Between these there is a flat process, widened and emarginate behind, which supports a narrow cylindrical abdomen composed of five or six segments, terminated by flat appendages of moderate size, with rather short, divergent hairs. Antennæ slender, uniform in thickness, with numerous hairs. Eye inferior, in the middle of the frontal margin. Thoracic segments turned in at the margins; thoracic feet biramose.

The only species, *P. albidus*, inhabits the interior of a compound Ascidian, of a brown colour, incrusting the leg of a *Maia squinado*.

M. Hesse also describes the male of his *Botryllophilus viridis*, which is figured, together with the types of the above new genera, on the plate accompanying his memoir.—*Ann. Sci. Nat.* 5^e sér. tome vi. pp. 51–87.

On the Development of Amphioxus lanceolatus.

By A. KOVALEVSKY.

The knowledge of the development of *Amphioxus* has certainly hitherto been one of the most important desiderata of science. Hence the investigations of M. Kovalevsky, incomplete as they may be, and doubtful as may be some of his interpretations, are certainly worthy of the greatest attention.

The egg of *Amphioxus* is formed of a vitellus, surrounded by its vitelline membrane. This vitellus has the appearance of an emulsion of fatty corpuscles, and the germinal vesicle seems to be wanting in it at the period of its maturity.

The segmentation is complete and proceeds with great regularity. As soon as repeated division has brought the number of segments to thirty-two, we see in the interior of the ovule a cavity homologous with the so-called cavity of Von Baer. Six or eight hours after deposition the blastoderm presents at one point of its surface a slight depression, which gives the germ approximately the form of a hemisphere. This depression, increasing by degrees, soon causes a restriction of the cavity of segmentation, which finally presents only the appearance of a thin clear layer interposed between the two cellular layers of the blastoderm. We may note, at present, that the caecal cavity formed by the depression just described must be regarded as the primitive nutritive cavity, and that its single aperture will afterwards become the anus. We may also remark that the interior cellular layer represents the wall of the intestine, and that the cavity of segmentation becomes transformed into the perivisceral cavity.

After the phase just described, the outer blastodermic layer becomes covered with vibratile cilia, and the embryo begins to turn slowly upon itself. In this state the embryo quits the egg, and at the same time its movement of rotation becomes more intense.

A couple of hours after exclusion the wide aperture, which places the primitive alimentary cavity in communication with the outer world, begins to narrow, in consequence of a multiplication of the surrounding cells. At the same time the embryo becomes lengthened, and henceforward presents the appearance of an elongated cylindrical larva.

Upon this free larva there then makes its appearance a median dorsal furrow, the margins of which, rising by degrees, finally unite. Immediately after these dorsal ridges, some laminæ, destined to be transformed into lateral muscles, make their appearance. On the following day a dorsal cord may already be distinguished below the medullary tube. At the same time the mouth is formed at the anterior extremity, as an aperture which penetrates from the outer surface to the digestive sac. About the same period of larval life there appears in the anterior part of the body a sort of notch, which is soon covered with vibratile cilia, and constitutes the olfactory organ.

In the succeeding phase appear the branchiæ and the problematic gland (liver?). The former are produced in a manner very analogous to that in which we have seen the mouth to be formed:

on the ventral margin of the body of the animal the wall of the body becomes soldered to that of the digestive cavity, and pierced by an aperture representing the first branchial fissure. The second and third fissures are formed in precisely the same manner.

At this period also the heart makes its appearance at the ventral part, and contracts slowly. From this moment each cell of the epidermis bears a single vibratile cilium in place of the large bundle of cilia which it previously displayed.

In the course of development the number of branchial fissures increases in consequence of the division of the first-formed fissures; then the chitinous skeletons of the branchiæ and various other organs appear. From each side of the body proceeds a fold of skin, which runs to meet the opposite fold and to unite with it on the ventral line—except at one point which will represent the abdominal pore.

Lastly, the author believes he has ascertained that the terminations of the nerves of the skin are histologically continuous with the cells of the epidermis.—*Bibl. Univ.* October 25, 1866, *Bull. Sci.* pp. 193–195 (abstract of the original Russian paper).

Alleged Discovery of an Ancient Human Skull in California.

Accounts have recently been going the round of the press, of the discovery of a human skull in or beneath certain volcanic deposits in California, which has attracted much attention from the various ages that have been assigned to it. The facts of the case, so far as they have reached us from authentic sources, are as follows. The skull in question is alleged to have been found at a depth of 153 feet, in a shaft sunk in the consolidated volcanic ash, known locally as “lava,” near Angel’s Camp, in Calaveras county. Five beds of this consolidated ash were passed through, separated by beds of gravel.

The skull was found by a miner, and it soon came into the hands of Prof. J. D. Whitney, State Geologist of California, who visited the locality and investigated the matter as far as was then possible; but, owing to the presence of water and the stoppage of work in the shaft, the examination was not fully satisfactory. He has made a preliminary statement before the California Academy of Natural Sciences, but defers any extended notice until the subject can be investigated with more completeness and accuracy. He thinks the skull was found in the position claimed, and will investigate the subject when the water is pumped out of the shaft and work resumed, which is expected to be done soon.

The precise age of the beds in question is as yet uncertain. In the ‘Geology of California,’ Prof. Whitney considers that the eruption of the great mass of volcanic materials on the western slope of the Sierra Nevada began in the Pliocene age, and that it continued into the Post-pliocene, and possibly to comparatively modern times. The alleged position of the skull is a lower one than any in which the remains of the mastodon have there been found; and therefore the question of its authenticity becomes a very important one; and when the more

complete examination has been made, we will lay the results before the readers of the *Journal*.—*Silliman's American Journal*, November 1866.

On the Discovery of the Remains of a gigantic Dinosaur in the Cretaceous Beds of New Jersey. By E. D. COPE.

Prof. Cope exhibited the remains of a gigantic extinct Dinosaur, from the Cretaceous Greensand of New Jersey. The bones were portions of the under jaw with teeth, portions of the scapular arch, including supposed clavicles, two humeri, left femur, and right tibia and fibula, with numerous phalanges, lumbar, sacral, and caudal vertebræ, and numerous other elements in a fragmentary condition.

The animal was found by the workmen under the direction of J. C. Vorhees, Superintendent of the West Jersey Marl Company's pits, about two miles south of Barnesboro, Gloucester county, N. J.

The bones were taken from about twenty feet below the surface, in the top of the "chocolate" bed, which immediately underlies the green stratum which is of such value as a manure.

The discovery of this animal fills an hiatus in the Cretaceous fauna, revealing the carnivorous enemy of the great herbivorous *Hadrosaurus*, as the *Dinodon* was related to the *Trachodon* of the Nebraska beds, and the *Megalosaurus* to the *Iguanodon* of the European Wealden and Oolite.

In size this creature equalled the *Megalosaurus Bucklandii*, and with it and *Dinodon*, constituted the most formidable type of rapacious terrestrial vertebrates of which we have any knowledge. In its dentition and huge prehensile claws it resembled closely *Megalosaurus*; but the femur, resembling in its proximal regions more nearly that of the *Iguanodon*, indicated the probable existence of other equally important differences, and its pertaining to another genus. For this and the species the name of *Laelaps aquilunguis* was proposed.

The paper continues with descriptions of the mandible, femur, tibia, fibula, humerus, phalanges, vertebræ, &c.—*Ibid*.

On the Development of small Acari in Potatoes.

By M. GUÉRIN-MÉNEVILLE.

The two months of rain which have done so much mischief to agriculture appear to have had considerable influence upon potatoes, which have become diseased in various localities. This diseased condition has made its appearance among the Australian and other potatoes experimented upon by me at the laboratory of sericulture of the imperial farm of Vincennes, by the development of myriads of *Acari* belonging to the species described by authors under the name of *Tyroglyphus feculæ*, which I investigated and figured, four-and-twenty years ago, in a paper on the potato-disease, published in the 'Mémoires de la Société Impériale et Centrale d'Agriculture de la France' (1842, pl. 5. fig. 9).

What has appeared to me worthy of remark in this circumstance is the immense quantity of these animals developed in less than a

week. The platform on which I deposited my potatoes is covered with a layer of these little *Acari*, which simulate an animated dust of a grey colour. In a very short time one might collect considerable quantities of them. This living powder consists of individuals of different ages. We find in it adult specimens in copulation, gravid females, and young individuals in all stages of development.

This immense assemblage has attracted, as usual, many other small carnivorous insects, which have found in it an abundant banquet. There are larvæ and perfect insects belonging to various genera of Coleoptera, Diptera, Hemiptera, &c., to which the *Acari* attach themselves in innumerable quantities—giving them a most singular aspect. These insects, thus covered with mites and completely unrecognizable, run about amongst them, and probably devour a great number of them.

All the potatoes, which have still the most healthy appearance, are nevertheless covered with these *Acari*. As they can no longer all remain upon the surface of these, they accumulate in the interstices of the paving-stones, then upon the paving-stones themselves, on which they form a layer of several millimetres in thickness, over a space of about four square metres.

I intend to keep a certain quantity of these potatoes, to see whether they can be preserved sound for a longer or shorter time. It would be, I think, very interesting to ascertain whether these innumerable *Acari* are the consequence of the disease of the tubers (as in the pedicular disease of man) or the more or less proximate cause of an alteration which will manifest itself at a later period.—*Comptes Rendus*, October 1, 1866, pp. 570–571.

Experiments demonstrating that the members of the Newt (Triton cristatus) are only regenerated when their basal portion at least is left in its place. By J. M. PHILIPPEAUX.

In 1865 the author found that in the rabbit and the marmot the spleen is regenerated only when a portion of the organ is left behind. This observation led him to think that the regeneration of the limbs of Newts, which has been long known to occur, may also require the same condition. He therefore made some experiments on *Triton cristatus*, in which he extirpated not only the anterior limb itself, but also the scapula. In all these cases there was no appearance of regeneration. He has specimens operated upon eight months ago, in which the wound is completely healed, but not even the commencement of a regeneration of the limb is apparent.

In others, on the contrary, in which the anterior limb was cut off at the surface of the body, as was done by Spallanzani, it was reproduced, with all its bones complete, within four months. The number of bony pieces in the anterior limb of the *Triton* is stated by the author to be forty-six; the posterior limb consists of fifty-six such parts. The author believes that he will be able to demonstrate similar facts with regard to the reproduction of the fins of fishes, and thinks that it will be found a necessary condition of the regeneration of organs among the Vertebrata that some portion, at least, of the organ should be left.—*Comptes Rendus*, Oct. 1, 1866, pp. 576–578.

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XVI.—*On the Fecundation of the Fungi.* By H. KARSTEN*.

My observations on the development of the apothecium of *Cænogonium*† led me at once to the probable supposition of an analogous process in the formation of the fruit in the Fungi. I saw the fruit of a Lichen, the apothecium of *Cænogonium*, with all its spore-sacs and paraphyses, forming an hymenial stratum, develop itself from a single cell equivalent to a gonidial cell, and, indeed, after a previous coalescence, and apparently after the mingling of its contents with those of a branch of the cortical cells closely applied to its surface, which is furnished with porously thinned spots.

The question immediately arose whether the partly very similarly constructed fruit of the Discomycetes, as well as of the other allied tubular Fungi, and even those of the Hymenomycetes, were not produced in consequence of a similar process of copulation‡. The confirmation of this idea would lead to simple laws as to the multiplication of plants, expressible in the following manner:—

1. The typical form of every true species of plants is propagated and maintained by sexually produced germs.

2. Whilst the fecundated germ-cell is developed, in the Phanerogamia, into a single germ which usually rests in its envelopes for a longer or shorter period, and in the vascular Cryptogamia into one which evolves itself at once, in the cellular Cryptogamia it is developed generally into a composite fruit containing numerous seeds§.

* Translated by W. S. Dallas, F.L.S., from 'Botanische Untersuchungen,' 1866, pp. 160–169.

† Das Geschlechtsleben der Pflanzen und die Parthenogenesis, 1860, and Gesammelte Beiträge, p. 317. [Annals, 3 ser. vol. viii. p. 203.]

‡ Gesammelte Beiträge, p. 341.

§ Das Geschlechtsleben der Pflanzen und die Parthenogenesis. Ges. Beitr. p. 340.

The supposition that the mode of development ascertained, indeed, only from this single example occurs also in the other composite fruits of the Lichens and Fungi, is supported by the analogous development of the fruits of the leafy cellular Cryptogamia.

In Mosses and Liverworts the germ-cell contained in the archegonium, after fecundation by means of antherozoids in the same way as in vascular Cryptogamia, multiplies into a great number of seeds and at the same time becomes developed into an envelope for these, constructed with so many modifications that until recently it could be almost exclusively employed for the classification of these plants. In like manner, if the result obtained in the case of *Cænogonium* be found to apply also to the other Lichens and Fungi, the fertilized germ-cell of these also grows into a fruit of complicated structure, usually serving as an envelope to innumerable seeds, and here also presenting itself in such multifarious forms that it has likewise been employed in systematic botany for the arrangement of the Fungi in genera and families.

Between the two great divisions of the Cryptogamia established in accordance with their histological structure and the formation of their fruits, the vascular and cellular Cryptogamia, the Algæ, hitherto likewise but imperfectly known as regards the development of their fruit, would apparently take their place.

In order to test these ideas, as soon as I had completed the investigation of *Cænogonium*, I undertook the dissection and observation of the developmental history of the fruits of Fungi, although in their earliest stages these organs (which, from their great delicacy, elude dissection, and by the inclusion of air in all the larger interstices of their loose tissue become opaque) present to the anatomist even greater difficulties than the fruit of the lichens, which from their smallness alone are so difficult to dissect that several recent authors have been unsuccessful in performing this operation.

In *Agaricus campestris*, Linn., by gradually going back from the forms recognizable with certainty as the youngest states of the cap to smaller ones, I found an organ which, from its peculiar form and texture, I could not but regard as the first commencement of the fruit. This was an oval, almost egg-shaped simple cell, standing upon a short peduncle of the thickness of the mycelium, and of from three to four times the diameter of this, filled with albuminous matter and overgrown by filaments of the mycelium, which were at first single, but by continually increasing in number, at last form a thick rind (peridium, velum)

over the central ovicell, which in the meantime increases in size*.

A similar organ, according to Bary, was lately found by Oerstedt on the mycelium of another species of this genus, namely, *A. variabilis*. This accomplished observer also mentions elongate, reniform, pedunculated cells, containing albuminoid plasma and apparently a nucleus. Near these cells, regarded as equivalent to the female organs, Oerstedt found filamentous organs, the ends of which were generally turned away from these cells, and rarely bent towards them: these appeared to Oerstedt to have possibly the function of anthers. Without any further perceptible changes, the ovicell is afterwards enveloped by a web of mycelium-filaments, which spring from the branch bearing it; by this means the foundation of the cap is laid.

This result harmonizes to a certain extent with my above-mentioned view attained by the observation of the development of the fruit of *Cænogonium*, and corresponds both with my above-detailed observations on *A. campestris* and with those which I have since had the opportunity of making upon *A. vaginatus*, Bull. The latter, indeed, only enable us to advance one step in the elucidation of this difficult subject; but as we are so completely unacquainted with the first stages of development of the fruit of Fungi, they may nevertheless fitly be communicated here, in order to incite to a further investigation of the subject.

For the repetition of these observations I selected *A. vaginatus*, because, from its smooth mycelium-filaments, it seemed to me to be better suited to the purpose than *A. campestris*.

By going back from the developed fruits to younger states, on the mycelium of this Agaric also I found, as the first indication and commencement of the pileus, simple cells of oblong form, at first with short but afterwards with longer foot-stalks, from two to five times the breadth of the filaments of the mycelium. These had turbid albuminous contents (not shining, as in *A. campestris*); and in their centre a nuclear cell, filled with rather clearer fluid, could be recognized. The pedicels were separated by a septum both from the dilated terminal cell and from the filament of the mycelium. Once I found two such cells close together, both, however, with rather short pedicels, and without any other branches in their vicinity (fig. 1). That these bodies are not parasitic structures, but organs of the fungus itself, is shown by the continuity of these branches, and their perfect similarity in structure with those of the mycelium-filament, beset with the commencements of fruit in their immediate vicinity, from which they originated; that they cannot be

* Gesammelte Beiträge, p. 344.

regarded as gonidia or so-called spermata, but are the first commencement of the fruit of the Fungus, is also proved by their subsequent stages of development.

Thus similar oval cells, but with rather longer pedicels, had beside them a cylindrical cell likewise springing from the mycelium, and only slightly exceeding its filament in thickness. I suppose that such cylindrical cells would also have sprouted forth near each of the two cells figured (fig. 1) when these had become a little older. But I once found this cylindrical filament, which consists of two cells, and slightly exceeds the oval terminal cell of the filament first produced, closely applied to the latter, and containing a turbid fluid in its superior cell (fig. 2). The oval cell was then not filled with such uniform contents as in its younger states, but with a vesicular frothy matter, which had drawn together towards the side of the cell which was in contact with the neighbouring filament, so that in this cell, on the side opposite to the latter filament, there was a space free from the albuminous contents and filled only with watery fluid.

The most remarkable thing about this object seemed to me to be the circumstance that the oval terminal cell of the first-formed branch appeared at its point of contact with the cylindrical terminal cell of the later-formed branch to be, as it were, pressed into the latter, and even when moved and pulled, by which means the apex of the filiform branch was torn away, it did not separate therefrom, and was apparently amalgamated with it at this point of contact. Such an amalgamation of two neighbouring mycelium-filaments is very unusual in this fungus; and we must therefore suppose that these two amalgamated branches had some extraordinary relations to each other.

Moreover this spot where the amalgamation took place possessed a structure different from that of the rest of the walls of these two branches. For while in other parts the membranes of these two branch-cells presented no difference from those of the mycelium-filaments (unless, perhaps, the wall of the oval cell might be rather more delicate), this point of contact and amalgamation was rather more thick-walled, more turbid, rough, and, so far as could be judged from the position, which was not very favourable for examination, was somewhat similar to the finely porous perforated walls.

The turbid, granular contents which flowed out on the rupture of the terminal cell of this branch, and mixed with the water in which the object lay, showed small elongated cellules filled with clear contents: these, as it appeared to me, are the small dark corpuscles like granules of cell-contents, which by endosmosis of the water in which they floated became so far

expanded, and thus could be more clearly recognized than when imbedded in the turbid cell-juice within their mother cell.

From the lower parts of both branches, that bearing the cylindrical, as well as that bearing the oval terminal cell, small ramifications had sprouted (fig. 2). Similar ramifications occurred on others in greater quantity. They curved over the oval terminal cell (which had in the meanwhile grown larger), and removed this entirely from observation, not only by their own presence, but especially by their speedily collecting between them a quantity of air insoluble in water.

But in this stage of development these two cells were not always so distinctly perceptible by their uncovered inferior extremity as in the case represented in fig. 3: the rudiment of the fruit, when it had attained this small size and acquired a more or less globular form, was usually seated immediately upon the mycelium-filament.

Sometimes I detected among these mycelium-filaments, after the removal of the air by the air-pump, the vertex of a simple thin-walled cell, of about twice the size of the free oval branch-cell. Twice I succeeded in isolating the cell partially from the filaments enveloping it—that is to say, in separating the upper part, embracing two-thirds of the entire cell, from the latter; the inferior third was always so amalgamated with the filaments, which here lie closer together, that it remained united therewith (fig. 4). The very delicate membrane was somewhat folded and rumpled; cellular contents could be detected in neither case, but only a covering of the inner surface with an irregularly distributed yellowish plasma. It could not be decided whether this coating of the wall indicated the previous presence of delicate endogenous cells, which might perhaps have collapsed by the water having penetrated into the larger mother cell and pressed upon its wall.

In somewhat further developed rudimentary fruits (figs. 5, 6, 7) I have been equally unable, by preparation with needles, to set free the hitherto nearly central cell, overgrown by mycelium-filaments from beneath, or to detect any indication of it. Nor did anatomical examination with the aid of the knife furnish any satisfactory results for the formation of a clear notion of the further course of development of the fecundated ovicell*.

* If we are to regard the development of the fruit of the Fungi as a consequence of the cooperation of the two cells above described, and therefore to recognize in it a process analogous to the action of the pollen upon the embryo-sac, and characterizable as sexual, the oval pedunculated mother cell of the Fungus-fruit will correspond with the ovule of the Phanerogamia, as well as with the archegonium of the Cryptogamia, and is to be compared with a naked nucleus of the ovum, or the central cell of

as it appears to be, from analogy with *Cænogonium*. I could ascertain from it only that the outermost envelope of mycelium-filaments which forms over the central cell, and is comparable to the outer cortical layer of the apothecium of *Cænogonium*, becomes the general veil (*velum universale*) of the *Agaricus vaginatus*; further, that with the first development of the young fruit, which is soon of a globular form, the portion destined to form the peduncle of the developing fruit is produced by the increase and interlacing of the mycelium-filaments, especially those beneath the ovicell; and that the greatest accumulation of plasma occurs in the elongated cells which are here present; so that, probably, the most active formation of new cells takes place at first at the apex of this part of the peduncle (which is situated beneath the general veil), and soon afterwards a little below its apex.

Whether this cambial tissue is produced somewhat as in *Cænogonium*, from the nuclear cell which was contained in the ovicell, is a question which cannot yet be solved with certainty, although it will most probably be answered in the affirmative.

If this be the mode of development of the fruit in the Hymenomycetes, it will present the following differences from that of *Cænogonium*:—

In the apothecium of these Lichens (which, until it opens at the vertex and becomes expanded into a nearly flat disk bearing the hymenium, likewise forms a globular and completely closed body), the new generations produced in the fecundated central cell of the naked archegonium, which finally contain the spores as the last member of this series of cell-developments, are so arranged in the centre of the young fruit that all the spore-tubes lie in a radial direction.

Each of these numerous tubes produced from the fecundated germ-cell of the Lichen becomes united at its base (hitherto

the archegonium, which, even in the Algæ, generally occurs without an envelope. Hence this primitive mother cell of the Fungus-fruit, if we do not apply to it the general denomination of "ovicell," must be named the "archegonium," or perhaps, to distinguish it from that concealed in a simple stratum of cells, the "naked archegonium," as I have already explained (Bot. Untersuchungen, p. 91).

To give the name of "oogonium" to this organ on account of its want of an envelope, is just as unnecessary, and therefore unscientific, as to name the naked nucleus differently from that with one envelope, and this, again, differently from that with several coats. Who would now approve, if some one were to give different names to the simple scale-like leaf of the mosses, and to the linear grass-leaf, or the simple pedunculated leaf of a myrtle, and, again, a different name to the latter and to the composite leaf of the Leguminosæ, &c.

peripherally situated) with the tissue of the parent plant, in the same way as the fecundated germ-cell of the leafy Cryptogamia, amongst which it is especially comparable to that of the Mosses, growing by its inferior extremity into the tissue of the parent plant which conveys the nutritive fluid, and becoming more or less intimately amalgamated therewith (*l. c.* p. 92. vi. 2 c & 3, p. 94. vii. 5 & 8). By the subsequent opening and expansion of the young rudiment of the fruit, the apices of the spore-tubes and paraphyses, which previously lay together in its centre, become its extreme uppermost surface (p. 91. v. 5, 6, 9).

If I am not greatly mistaken, this condition is reproduced in the most correspondent manner in the fruits of the Liverworts which are furnished with a central column; at least, in these, up to the opening of the fruit, the elaters, which may be compared organologically with the paraphyses, are attached by their extremities to the columella (where this is present), and this may be compared with the medullary layer of the apothecium. (*Flora Columb.* xx. 23.)

According to my observations (which are certainly still imperfect) on the Discomycetes (*Peziza*, *Helvella*), similar conditions occur in these also; and there is no ground for supposing that the development of the Pyrenomycetes takes place in a very different manner, as the folds and chambers occurring in them may be explained just as simply by processes and excrescences of the inner surface of the fruit (which is simple in its earliest stages) as the separated compartments (*receptacula*) by the circumstance that the first generations of the fecundated germ-cells do not remain in close proximity, but are forced apart by the development of the medullary layer, and become isolated towards the surface of the fruit, after which each of them acquires an orifice on the peripheral side for the spore-tubes produced in it in the interim, in exactly the same way as the (in this sense) unilocular fruit of the Lichens.

Whether, and how far, a different condition occurs in the Hymenomyces, remains to be decided by future investigations.

From my observations, I conceive the production of the pileus in the Hymenomyces to take place in the same way as the isolation of the chambers of the Pyrenomycetes, namely, that the youngest generations of the fecundated germ-cell, which at first form a layer upon the peduncle developing itself beneath this, are forced asunder, penetrated, and overgrown by it, so that the cambial hymenium surrounds the apex of the peduncle in a circular form beneath the tissue of the pileus which grows over it, and from this grows downwards in various forms.

The most significant and important difference in the development of the hymenium of the Fungi, which is even indicated in

the distinction between asco- and basidiospores, and, in my opinion, increases the difficulty of understanding the development of the latter, consists in the fact that the spores of the Lichens and Ascomycetes are produced in a simple regular sequence of endogenous cell-development from the one fecundated ovicell, and only the last generation of the spore mother cells is slightly produced *downwards* in a peduncular form, becoming united with the subjacent tissue in the Basidiomycetes; on the contrary, a sprouting of the cambial hymenium-cells, which multiply and regenerate themselves for the development of the spores, takes place at a more or less early period of development. By this means, as also by the amalgamation of these superiorly elongated and branched hymenial cells of the Basidiomycetes with the neighbouring tissue of the pileus, the limits of the two tissues (of the pileus and hymenium) are more difficult to recognize than in most of the Ascomycetes.

EXPLANATION OF THE FIGURES.

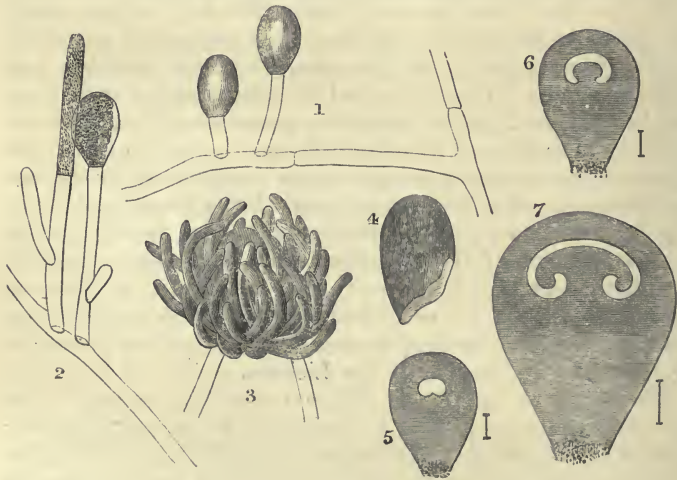


Fig. 1. Two naked archegonia of *Agaricus vaginatus*, Bull.

Fig. 2. A similar archegonium, and near it a cylindrical branch-cell amalgamated with it at the point of contact.

Fig. 3. A young fruit-rudiment, in the middle of which a large cell is to be seen.

Fig. 4. The large cell set free.

Fig. 5. Longitudinal section of an older fruit-rudiment, already covered by the cortical layer above this central cell.

Figs. 6 & 7. Two other young but more developed fruit-rudiments.

XVII.—Description of a new Madeiran Pupa.

By R. T. LOWE, M.A.

Pupa Wollastoni, Lowe. (§ *Alvearella*, Lowe.)

T. majuscula, solidiuscula, compacta, curta, late abbreviato-oblonga, utrinque obtusa, latitudine per anfractus 2–2½ ultimos subæquali $\frac{2}{3}$ – $\frac{5}{6}$ longitudinis æquante, deinde subito per reliquos anfractus in apicem umbonato-prominulum contracta, tota obsolete striatula lævigata nitens fusco-umbrina (spira apicem versus alba decorticata), angustissime pallide 1–2-fasciata; anfractibus sex planatis v. convexiusculis, 2–3 ultimis infra suturam subcanaliculatam abrupte gibboso-prominentibus scalatis, ultimo antice medio distinctius concaviusculo v. leviter pone labrum spiraliter subcanaliculato, striolis subflexuoso-obliquis obsolete transversis, sutura impressa exarata profunda; apertura subtrilobato-auriformi s. triangulari, angulis rotundatis, ringente, 5-plicata, plicis 2 ventralibus exteriore majore, 2 columellaribus inferiore majore, 1 palatali, 2 ventralibus columellarique inferiore subæqualibus conspicuis magnis, columellari superiore palatalique minoribus subinconspicuis immersis; labro subincrassato reflexiusculo superne inflexo-sinuato, denticulo ad sinum distincto intus prominulo, sinu respirationis sub-completo distincto.

Longit. 3 millim.; diam. 2½; apert. 1 longa, 1 lata; anfr. 6.

Hab. in ora Maderæ septentrionali, inter exempla haud pauca *P. concinna* Lowe, in convalle “Rib. do Inferno” (ut fertur) propter illustr. Baronem do Castello de Paiva collecta, a cl. Wollastono detecta. Nomen itaque ferat species pulcherrima in honorem oculatissimi *Puparum* Maderensium indagatoris, qui tantis speciebus novis genus jam olim locupletavit.

At once distinguished from *P. concinna* Lowe by its much greater proportionate breadth and short, thick, squarish figure; and from *P. gibba* and *P. abbreviata*, besides other differences, by its being so much larger. There is also much about it which reminds one of *P. cassida* and *P. cassidula*: but it is most distinct from all, especially by the abrupt contraction of the spire above the last two or three volutions, and by the scalariform character of these, each rising up into a blunt keel or ridge below the deeply impressed or subcanaliculated suture. The colour also is peculiar, being more of a dark umber than chestnut-brown, with two remote, narrow pale bands, one at the base, the other on the infra-sutural ridge or shoulder at the top of the last volution; but these will probably prove variable, and even in the present example the upper band is obscure and inconspicuous. The spire is abruptly contracted above the second or third volution into a short obtuse decorticated umbo; the lowest two or three volutions are of nearly equal breadth, or broadly

and shortly barrel-shaped, and the last is spirally concave or slightly grooved or channelled a little way backwards from the outer lip below the middle. The aperture, both in shape and in the form, size, and proportion of its plaits, differs from that of all the species above mentioned. The umbilicus is moderately large and infundibuliform.

A unique example of this fine new *Pupa*, with the remains of its animal still present in the aperture, was detected by T. Vernon Wollaston, Esq., the well-known explorer of the Atlantic insect fauna, and author of 'Insecta Maderensia,' 'Canariensia,' &c., in a box containing a number of specimens of *P. concinna* Lowe, sent to him from Madeira, about a year ago, by the Baron do Castello de Paiva, and marked "Rib. do Inferno." Though some doubt therefore must necessarily attach to the precise habitat of this particular single specimen, there can be no question whatever, with any one whose eye has become at all versed in the aspect of Madeiran *Pupæ*, as to its having been really collected in the north of the island, and probably in one of the few haunts of *P. concinna*—namely, at the head of the Rib. de João Delgado (not far remote from that of the Rib. do Inferno) or of the Boa Ventura on the north side of the Pico Casado, at a considerable elevation.

This discovery is therefore a fresh instance of the great obligations of naturalists to the indefatigable exertions of the Baron do Castello de Paiva, who, though unhappily precluded by ill health from prosecuting his botanical and zoological researches personally, is yet contributing continually, by his employment or encouragement of others, some new acquisition of interest or importance to the domains of what is now termed, euphemistically, "science."

XVIII.—Remarks on the History of *Dreissena polymorpha*.

By Dr. OTTO A. L. MÖRCH.

IN a review of 'The Record of Zoological Literature' (Ann. & Mag. N. Hist. Dec. 1866, p. 494) an extract is given from a critique of Dr. E. von Martens, to the effect that my opinion as to the identity of *Pinna fluviatilis*, Sander, with *Dreissena polymorpha* depends on an analysis of Sander's account and on "the analogous fact that the occurrence of the genus *Unio* in Denmark remained unknown to so careful an observer as O. F. Müller."

This is a mistake. I rely mainly on the facts that Sander refers his shell to the genus *Pinna*, and that he expressly states that his shell is not figured in Schröter's work on freshwater shells,

which contains ten figures of species of the genus *Unio*, including two or three of *U. batavus*. It therefore seems to me impossible that the *Pinna fluviatilis* could be *U. batavus*, as Dr. Gysser supposes.

H. Sander, Professor at the Gymnasium Illustre in Carlsruhe, who died at the early age of twenty-eight, was certainly not a professed conchologist; but several volumes of his sufficiently show that he was a person of unusual intelligence, and had a considerable knowledge of natural history. As he chiefly occupied himself with the fauna of his native country (entirely an inland one), it is not surprising that he regarded *Anodonta* as the type or analogue of *Mytilus*, and that he did not place his new shell in the same genus. After much study, investigation, and comparison, he came to the conclusion that the shell in question must belong to the genus *Pinna* of Linné, to which genus he likewise refers *M. edulis*, having seen the latter during his journey through Belgium. Sander gave his shell the name of *fluviatilis* on account of its having a different habitat from *M. edulis*. *Dreissena* is the only freshwater shell that has any resemblance to *Pinna*. Sander's description relates to the colour only, viz.: outside dark green; inside blue, with yellow stripes ("Streifen"), which, when held towards the light, are iridescent. The last expression is translated by Dr. Gysser as "perlmuttern" (nacreous), although that word is used by Sander in the same page for the inside of *Anodonta*, and not for his shell. The rays in *Unio* are visible mostly on the outside. The fulgurate markings of *Dreissena* are not always present, nor are they easily perceptible in full-grown specimens; but may they not have been meant by "Streifen"? Some specimens are stated by Sander to attain the size of 2 inches (Rhenish?). I have not observed any larger than 45 millims., or nearly $1\frac{3}{4}$ inch. Perhaps Sander's measurement was taken from memory or judged by the eye. Two inches would not be an extraordinary size for any *Unio* except *U. batavus*; and that size is mentioned by Sander as unusual and only attained in certain specimens.

The disappearance of marine Mollusca from places which they used to inhabit is by no means infrequent: it has been explained by Mr. Jeffreys in his work on British Conchology. Similar instances among the freshwater Mollusca may fairly be presumed. Some years ago, *Limnæa peregra* was common in a small pond in the park of Frederiksberg; it is now no longer to be found there, although other species remain. *Apus productus* is said to have disappeared from places where it was formerly abundant. Dr. von Martens informs me that the water of the little river Alp is very impure, in consequence of its receiving all the drainage of the town of Carlsruhe; Professor Alex. Braun

has only found in it a single plant, a small Alga. This circumstance seems sufficient to account for the disappearance of *Dreissena*. Previous to 1780, Carlsruhe was, no doubt, much smaller than it is at present, and the water was therefore more pure.

It is not impossible that the small rivulet mentioned by Sander may have become, since 1780, unsuitable for the *Dreissena*. Perhaps the quality of the water may have changed, or an increase in the number of water-fowl or fishes may have destroyed the *Dreissena*. Mr. James Bryant, the discoverer of *Dreissena* in England, used it as bait in fishing for perch in the Thames. The circumstance that *Dreissena* has not been observed in the loess of the Rhine is not a proof of its absence from that widespread deposit: I believe neither *Unio* nor *Anodonta* has hitherto been detected in it. Nor, in my opinion, can the silence of writers be regarded as a proof of the non-existence of *Dreissena* in the west of Europe previously to 1824. The freshwater shells were so little investigated before the time of C. Pfeiffer and Rossmässler, that even *Unio tumidus* was not known out of Denmark until 1825. *U. pictorum* and *U. batavus* were chiefly known to Schröter and preceding conchologists from Nuremberg colour-boxes.

The alleged migration of *Dreissena* seems to be rather too sudden, if not too swift. In 1824 it was noticed in the Thames, in 1825 in the Niemen, and in 1826 in the mouth of the Rhine. Its appearance is more like that of *Miastor*, which was first observed at Astrakhan: as soon as the attention of naturalists was called to it, *Miastor* was found in every place where it might be expected to occur. *Dreissena* may owe a great deal of its rapid distribution to commerce, or perhaps to the pontoon-trains of the armies of Napoleon; but I still deny that there is any proof that it was introduced everywhere in this century, principally between the years 1824 and 1828.

XIX.—On the Menispermaceæ.

By JOHN MIERS, F.R.S., F.L.S. &c.

[Continued from p. 29.]

37. DIPLOCLISIA.

This genus was proposed by me, in 1851, for a small set of plants of which the *Cocculus macrocarpus*, W. & A., is the type. It differs from *Cocculus*, *Nephroica*, and *Holopeira* in habit and the structure of its putamen and seed. These differences are so

manifest that it is difficult to conceive how it was possible that such experienced botanists as the authors of the 'Flora Indica' and the 'Genera Plantarum' refused to acknowledge *Diploclisia*, and why they should have merged it, together with *Nephroica* and *Holopeira*, into *Cocculus*. In its habit there is nothing resembling a single species of either of those genera; for the typical plant bears much the appearance of *Chondodendron tomentosum* of the 'Flora Peruviana,' agreeing in its distant, nearly orbicular, large leaves, with crenately sinuated margins, supported upon very elongated slender petioles, and where the nerves as well as their branches terminate in the crenatures of the margin, and do not anastomose, as in all the genera before mentioned. The ♂ inflorescence is racemose, long and slender, with short branches bearing from one to three pedicellated flowers; the ♀ raceme is still more elongated, quite simple, with extremely lengthened pedicels; the sepals are ovate and prettily maculated; the petals cuneately rhomboid, with the lateral angles inflexed; the filaments are much thickened and incurved at the apex, in which is dorsally imbedded a 2-celled anther, which bursts bivalvately by a horizontal fissure: the ♀ flower has six sterile stamens, a glabrous ovary, with a short thick style, surmounted by a horizontally reflected, one-lipped, narrowly cup-shaped stigma with a very crenulated margin. The drupe is oblong, in one species being unusually large; its putamen, like that of *Tiliacora* and *Chondodendron*, is oblong, greatly compressed, of coriaceous texture, with a carinal periphery and a prominent, radiately striated, horseshoe-shaped ring upon the outer edge of each face, leaving a somewhat falcate, very deep depression, extending from the base beyond the centre, with a prominent narrow rib down its middle; its condyle is internal, in the form of a linear septum connecting the two opposite hollows in the line of the projecting ribs; thus it divides the cell nearly into two pouches, giving it the form of a horseshoe with its long legs almost parallel: the seed is therefore hippocrepiform, not cyclical as in the other genera before mentioned; the embryo, imbedded in fleshy albumen, partakes of the same form, has linear, strap-shaped, very long, flattened, incumbent cotyledons; but the radicle is extremely short, somewhat conical, a third or a fourth of their breadth, and is in one species only one-eighteenth, in another one-twelfth part of their incurved length. But it is not alone in these extremely dissimilar floral and seminal characters that this incompatibility exists: *Diploclisia* partakes of the rule which prevails throughout the *Menispermaceæ*—that where such differences exist, we may rely on finding a corresponding diversity in the habit of the plants of the genus. These combined circumstances fully

justify a strong protest against the attempt to confound *Diploclisia* with *Cocculus*, *Nephroica*, and *Holopeira*.

DIPLOCLISIA, nob. ;—*Flores* dioici. *Masc.* *Sepala* 6, biserialia, interiora alterna, duplo majora, cuneato-ovata, subconcava, sæpissime lineis parallelis interruptis maculatim picta, æstivatione imbricata. *Petala* 6, dimidio minora, cuneato-rhomboidæ, apice obtusiuscula, lobis lateralibus obtusis et involutis, guttatim picta. *Stamina* 6, petalis opposita et paullulo longiora; *filamenta* imo tenuiora, superne latiora et valde incrassata, intus plana, extus convexa, carnosula, guttatim picta, apice gradatim inflexa; *antheræ* subglobosæ, sub-4-lobæ, summo filamentorum dorsaliter subimmersæ, introrsæ, 2-loculares, loculis parallelim adnatis, rima transversa 2-valvatum hiantibus. *Ovaria* rudimentaria 3, centralia, punctiformia.—*Fœm.* *Sepala* et *petala* masc. *Stamina* sterilia 6, petalis æquilonga, imo gynæcii orta, compresso-filiformia, extus convexiora, subincurva, glandulis 2 ovalibus apice notata. *Ovaria* 3, gibboso-oblonga, glabra, gynæcio conico 3-gono insita, erecta, 1-locularia, *ovulo* unico, lateri interiori appenso. *Stylus* validus, teres, angulo interno excentricus et erectus. *Stigma* horizontaliter expansum, extus subunilabiatum vel cymbiforme, valde concavum, marginibus crenatoplicatis. *Drupæ* 3, vel abortu 1, magnæ, obovato-oblongæ, sarcocarpio parvo viscido, stylo persistente basi contiguo notatum. *Putamen* majusculum, longe obovatum, valde compressum, subincurvum, circa peripheriam carinatum rugis irregularibus radiatim sulcatum, utraque facie lacuna longitudinali imo angustiore incurva excavatum, et hinc linea prominente liratum, 1-loculare; *condylus* internus, angustissime septiformis, liras externas adversus, a basi ultra medium loculi protensus, loculo hoc modo longiuscule bimarsupiato et hippocrepiformi. *Semen* loculo conforme, transverse crenulatum; *integumentum* membranaceum, raphe lineari chalazaque ventrali ad condylum affixum: *embryo* hippocrepicus, intra *albumen* simplex subparcum sepultus, *cotyledonibus* late linearibus, foliaceis, carnosulis, incumbentibus, *radicula* brevissima tereti supera ad stylum spectante multoties longioribus.

Frutices *volubiles* *Indiæ orientalis*, ramulis *longissimis*, *dependentibus*; folia *palata* vel *subpeltata*, *suborbicularia* vel late *subdeltoidea*, *vix cordata*, *marginibus cartilagineis et subcrenatis*, *glaberrima*, 5-*nervia*, *nervis externe ramosis*, *ramisque in crenaturis marginalibus terminantibus*, *subtus sæpe cretaceo-glaucâ*, *longissime petiolata*; *racemi graciles*, *valde elongati*, *in axillis solitarii vel plurimi*, *e cicatricibus post foliorum delapsam, fasciculati, penduli*, *floresque omnino glabri*.

The following species will be described in the third volume of the 'Contributions to Botany':—

1. *Diploclisia macrocarpa*, nob. in Ann. Nat. Hist. 2 ser. vii. 42; —*Cocculus macrocarpus*, *Wight*, *Ill.* i. 22, tab. 7; *W. & A. Pr. Fl. Ind.* i. 13.—In Malabaria: *v. s. in herb. Mus. Brit. et Hook.*, sine foliis in fructu (*Wight*, 41).
2. — *inclyta*, nob.; —*Cocculus macrocarpus*, *Hook. et Th. Fl. Ind.* i. 191 (non *Wight*).—In India orient.: *v. s. in herb. meo*, Peradenia, Ceylon (*Gardn.* 29); *in herb. Hook.*, Ceylon (*Thwaites*, 1052), Courtallam (*Wight*, 27), Mangalore (*Hohenhacher*, 836), Concan (*Gibson*), Bombay (*Law*).
3. — *lepida*, nob.—In regione Malayana et Khasya: *v. s. in herb. Hook.*, Chittagong (*Griffiths*), *ibid.* (*Hook. & Th.*), Amherst, Tenasserim (*Falconer*), Khasya (*Hook. & Th.*).
4. — *pictinervis*, nob.—In India et China: *v. s. in herb. Mus. Brit.* ♂, Ind. or. (*Soc. Unit. Fratr.*); ♀, China merid. (*Seeman*, 2459).

38. TRISTICHOCALYX.

This genus has been established by Dr. Mueller, upon sufficiently valid grounds, for an Australian plant which had been referred to *Pachygone* by Mr. Bentham; but the structure of its seed shows that it belongs to a different tribe, the *Platygoneæ*, its station being near *Cocculus*. Dr. Mueller considered that its place was close to *Tinomiscium*: but it does not bear the slightest analogy with that genus; in habit it resembles some species of *Limacia*. Dr. Mueller's description of the fruit and seed is not as clear as might be desired; but if I understand it rightly, the embryo is imbedded in copious simple albumen, has a superior short terete radicle, with somewhat large, oval, thin, foliaceous cotyledons, which are incumbently curved, with one face directed to the condyle, as in *Cocculus*; at least, that is what I understand by his expression "cotyledones latæ, tennerrime membranaceæ, sibi applicitæ." There is a seed of this plant in the Hookerian herbarium, which has been broken into fragments in the attempt to analyze it: there we find some portions of the albumen, which is of a solid waxy consistence; the radicle is terete, attached to half of one of the cotyledons, the other one being deficient. From this and the broken putamen, assisted by Dr. Mueller's details, I have drawn up the following generic character.

I may take this opportunity of recommending any botanist desirous of analyzing any Menispermaceous seed to adopt the method I have always successfully followed:—after macerating and freeing the putamen from its pericarpial covering, to intro-

duce the point of the dissecting-knife along the peripheral line of suture, when it is easily separated into two valves, leaving the kernel in an entire state: we thus see the true form of the cell, its position with regard to the condyle, and the mode of attachment of the seed, the embryo and the albumen, if present, being thus obtained whole and uninjured.

In the herbarium of the late Dr. Lindley, I found an Australian plant, collected in Capt. Mitchel's exploring expedition, which may be considered a second species of this genus: this has enabled me to render the generic character more complete.

TRISTICHOCALYX, F. Muell.—*Flores* dioici. *Masc. Sepala* 9, 3-serialia, extus alternatim minora, exteriora lanceolata, interiora elliptica, subacuta, æstivatione imbricata. *Petala* 6, sepalis dimidio breviora, imo cuneata, rotundatim sub-3-loba, lobis lateralibus, involutis, stamina circumdatis. *Stamina* 6, libera, petalis opposita et æquilonga; *filamenta* teretia, apice incrassata; *antheræ* dorso introrsus affixæ, subglobosæ, sub-4-lobæ, 2-loculares, loculis sine connectivo collateralibus, rima transversa dehiscentibus.—*Fœm.* nondum cogniti. *Drupa* (reliquis abortivis?) solitaria, gibboso-ovata, exsicca; *putamen* reniformi-subglobosum, paulo compressum, subosseum, 1-loculare, latere ventrali *condylo* interno paulo intruso notatum. *Semen* nephroideum: *embryo* in *albumine* copioso cereaceo albido immersus, subincurvus, *cotyledonibus* ovatis, tenerime foliaceis, incumbentibus, *radicula* brevi tereti supera ad stylum subbasalem spectante multo longioribus.

Frutices *Australasici* volubiles; folia elliptica, acuta, petiolata, 3-5-nervia, crassiuscula, supra nitentia, subtus pubescentia: paniculæ ♂ axillares, solitariae vel geminae, folio breviores, puberulæ; flores parvi, pedicellati.

The two species will be fully described in the third volume of the 'Contributions to Botany':—

1. *Tristichocalyx pubescens*, F. Mueller, Fragm. iv. ;—Pachygone pubescens, *Benth. Fl. Austr.* i. 58.—In Australia boreali-orientali: v. s. in herb. Hook., Quail Island (Flood).
2. ——— *diffusus*, nob.—In Australia interiore: v. s. in herb. Lindl. (Mitchel's Exped.).

39. LEGNEPHORA.

The type of this genus is a plant from Australia, the *Cocculus Moorii* of Dr. Mueller, which Messrs. Bentham and Hooker referred to a well-known Indian species, *Pericampylus incanus*; and in my description of that species I have alluded to the great discrepancies existing between them. It differs from that genus

in its glanduliferous, cuneate, orbicular petals, in its free stamens in the ♂ flower, and in the want of petals, in its peculiar sterile stamens, and a different stigma in the ♀ flower, and in the widely different form of the putamen and structure of the seed. The leaves are broadly ovate, often cordate at base, with five straight basal nerves reaching nearly to the apex, and much branched externally, polished and reticulated above, glauco-pruinose beneath, on a pubescent petiole more than half their length. The ♂ axillary panicle is about the length of the petiole, with somewhat verticillate branches: the ♀ inflorescence is much shorter, with a bifurcate peduncle, each branch bearing about three alternate pedicellated flowers: the ♂ flower has six sepals, six petals, and six free stamens: the ♀ flower has six sepals, no petals, six sterile stamens opposite the sepals, the filament being much compressed and dilated considerably towards the apex, which is truncated, bearing a cup-shaped gland immersed in each angle: the putamen is cuneately orbicular, greatly compressed, with an excentral, concave, scutiform impression; around the hippocrepiform cell it has a very broad wing, formed of five flat plates (one peripheral, two lateral on each side), cleft into pergamineous or soft teeth, somewhat imbricated and radiating in a direction parallel with the faces, and from which the mesocarpal pulp, in which they are imbedded, is with difficulty separated*. I have not seen a perfect seed; but Dr. Mueller states (Fl. Austral. i. 56) that the embryo is in the axis of the albumen, with narrow cotyledons closed against each other—a definition scarcely comprehensible; but, as he refers his plant to *Cocculus*, we may interpret his meaning to be that the embryo has incumbent cotyledons imbedded in albumen, as in that genus; and on this evidence I have placed *Legnephora* among the *Platygoneæ*, after *Tristichocalyx*.

LEGNEPHORA, nob.—*Flores* dioici. *Masc.* *Sepala* 6, biseriata, subæqualia, elliptica, vix acuta, extus pilosa, 3 exteriora paulo angustiora, æstivatione imbricata. *Petala* 6, squamiformia, sepalis opposita et 6-plo breviora, cuneato-rotundata, lateribus glanduloso-incrassatis, glabra, carnosula. *Stamina* 6, petalis æquilonga et opposita; *filamenta* teretia, sursum gradatim incrassata; *antheræ* subglobosæ, filamento 2-plo latiores, dorso affixæ, introrsæ, 2-loculares, loculis connectivo angusto paululo excurrente sejunctis, utrinque rima transversali 2-valvatim dehiscentibus.—*Fœm.* *Sepala* ut in masc. *Petala* nulla. *Stamina sterilia* 6, sepalis opposita et 2-plo breviora, cuneato-lineararia, apice dilatata et truncata, subcanaliculata,

* Hence the generic name, from λέγνη (*fimbria*), φέρω (*fero*).

cum glandula concava in quoque angulo semiimmersa. *Ovaria* 3, gibboso-globosa, pilosula, 1-locularia, 1-ovulata. *Stylus* brevissimus aut obsoletus. *Stigma* cordato-orbiculatum, concavum, indivisum, horizontaliter reflexum. *Drupæ* 3, vel abortu pauciores, compresso-globosæ, carnosæ, stigmatibus basin versus notatæ: *putamen* cuneato-orbiculare, valde compressum, tenuiter osseum, utraque facie carina hippocrepiformi prominula circa excavationem excentricam obovatam scutiformem signatum, carina marginali latissima, e laminis pergamineis 5 (quorum 1 peripherica, et utrinque laterales 2) profunde fimbriatim incisus, secta in lacinias irregulares, parallele radiantibus, ad pulpam carnosam arcte adhærentes, 1-loculare, loculo hippocrepico aut subcyclico; *condylus* omnino internus, scuto externo multo brevior, vacuus, clausus. *Semen* (vix maturum visum); *integumentum* loculum implens, membranaceum, medio ad latus internum *chalaza* notatum et hinc intra condylum insinuatum: *embryo cotyledonibus* lineari-oblongis in *albumine* sepultus.

Frutex *Australiae orientalis, scandens*; folia *petiolata, ovata, e basi 5-7-nervia, supra glabra, nitida, subtus glauco-pruinosa*; panicula ♂ *axillaris, tomentosa*: racemus ♀ *axillaris et terminalis, sub-6-florus*; *drupæ glabræ*.

The following species will be described in the third volume of the 'Contributions to Botany':—

Legnephora Moorii, nob.;—Cocculus Moorii, *F. Muell. Fragm. i. 162*;—Pericampylus incanus, *Benth. (non nob.) Fl. Austral. i. 58*.—In Australia: *v. s. in herb. Hook.*, ♂, Wide Bay, Queensland (Oldfield), Macarthur (Backhouse); ♀, Burnett River (Mueller).

40. SARCOPETALUM.

This genus was established by Dr. Mueller in his 'Flora of Victoria' (p. 26, tab. suppl. 3), where the typical plant is described and figured. Its chief peculiarity consists in its monadelphous stamens in the ♂ flower, the central column being divided, near its summit, into two or three antheriferous forks; its sepals vary in number from two to five; its petals are three to five, longer than the sepals, extremely fleshy, and tumidly scrotiform: the ♀ flower has four small, denticulated, subrhomboidal sepals, four or five much larger, very fleshy, scrotiform petals, with as many shorter sterile stamens attached to their claws; three to six ovaries, with a deeply 2-3-fid reflected stigma; subglobose drupes, with a reniformly orbicular, compressed, testaceous putamen, having externally on each side a semicircular excentric impression, and an internal condyle that intrudes

a short distance within the reniform cell, and which is hollow, with a minute foramen opening externally on each side; each face of the outer broad hippocrepiform ring is covered with about seven rows of close, prominent, short tubercles. The seed has a membranaceous integument that fills the cell, with a broad chalaza near the condyle, to which it is attached: the nucleus of the only seed I was able to examine was not fully developed; it evidently contained albumen, as Dr. Mueller affirms; but the form of the embryo was not visible: from this circumstance, coupled with the similarity in form of the condyle and the shape of the cell, and the resemblance of the integument, to those in *Legnephora* and *Tristichocalyx*, I have placed this genus in contiguity with them, all being of Australian origin. The details of the ♂ flower, which I have not seen, are copied from the description of Dr. Mueller.

SARCOPETALUM, F. Mueller.—*Flores* dioici. *Masc.* *Sepala* 2-5, parva, membranacea, biseriata, exteriora minora. *Petala* 3-5, sepalis majora, inæqualia, valde crassa et carnosâ, subcuneata, obovata, apice sub-2-loba vel scrobiformia. *Stamina* 3, monadelphâ; *filamenta* in columnam centram alte coalita, apice breviter furcata et antherifera; *antheræ* bilobæ, lobis ovalibus, parallelim segregatis, vel imo divergentibus, dorso adnatis, subextrorsis, sutura oblique longitudinali utrinque dehiscens. — *Fœm.* *Sepala* 4-6, parva, biseriata, exteriora paulo minora, rhomboidea vel acute triangularia, plus minusve profunde inciso-dentata, membranacea, delicatule reticulata, glabra. *Petala* 4-6, sepalis longiora, forma scrobiculata marium, carnosâ, glabra. *Stamina sterilia* eadem numero ac petala, iis opposita et dimidio breviora, linearia, imo latiora, apice glandulis 2 segregatis munita. *Ovaria* 3-6, gibboso-ovata, glabra, gynæcio paulo elevato insita. *Stylus* teres, subito reflexus, apice in *stigmata* 2 divaricata subulata profunde divisus. *Drupæ* 3 (vel plurimæ?), gibboso-ovatae, compressæ, stylo fere basali notatæ, glabræ, longiuscule stipitatae, pulposæ: *putamen* tenuiter testaceum, reniformi-orbiculatum, valde compressum, utraque facie excavatione lata scutiformi impressum, ambitu hippocrepiformi tuberculis crebriter scrobiculato-rugosum, 1-loculare; *condylus* internus, parvus, ad sinum paulo intrusus, vacuus, utrinque foramine minuto extus perforatus. *Semen* loculum implens, reniformi-ovatum; *integumentum* membranaceum, lateraliter *chalaza* notatum, et hinc intra condylum insinuatum: *embryo* (forma ignota) *albumine* inclusus.

Frutex *Australiae orientalis, scandens*; folia *petiolata, peltata, vel obsolete peltata, deltoideo-ovata, imo cordata, vel omnino*

ovalia, apice subacuta, e basi 7-nervia, transversim venosa et reticulata, glaberrima, supra nitida, subtus pallide glauca: racemi ♂ in nodis annotinis aphyllis plurimi, fasciculati, vel in axillis solitarii, petiolo breviores, spicatiflori, et bracteolati; flores alternatim pedicellati: racemi ♀ simillimi.

The details of the following species will appear in the third volume of my 'Contributions to Botany:—

Sarcopetalum Harveyanum, F. Muell. Fl. Vict. 27, tab. suppl. 3; Benth. Fl. Austral. i. 57.—In Australia: *v. s. in herb.* Hook. ♀, Swany River (Mueller), Victoria (Mueller), Moreton Bay (Oldfield), Illawarra (Cunningham, 178).

41. HYPERBÆNA.

This genus was proposed by me in 1851 for a plant which I found in the neighbourhood of Rio de Janeiro, that had only male flowers. As its fruit was then unknown, the genus was placed among those of dubious position. At that time also, for want of better knowledge, the fruit of *Cocculus Domingensis*, DC. was supposed to belong to *Anelasma* (the fruit of which was also unknown)—a supposition suggested by the circumstance, then mentioned, of the remarkable similarity in the external aspects of the species of *Hyperbæna* and *Anelasma*. Soon afterwards I ascertained that *Cocculus Domingensis*, of which ♂ flowers only were then known, belonged to *Hyperbæna*; and having seen its fruit, I was thus enabled to place it with confidence in the exalbuminous tribe of the *Pachygoneæ*. The authors of the 'Genera Plantarum' (i. 38) state that *Hyperbæna* scarcely differs from *Cocculus*, except in its seed; but those botanists appear to have entertained a general but not very defined idea of the real structure of *Cocculus*. In *Hyperbæna* the form of the petals is different: they are always more oval, never linear, nor with deeply inflected basal lobes; the anthers are otherwise constructed and differently affixed; added to which, the mode of inflorescence in both sexes is so distinct, and the aspect of the leaves so remarkable, that it is always easy to discriminate one genus from the other by a mere glance at the specimens. The leaves are usually oblong, with an acuminate apex, coriaceous, glabrous, shining, with distant nervures all alternating and arching together within the margin and immersed in the parenchyma. The inflorescence is peculiar, and greatly resembles that of *Anelasma*, generally consisting of a very elongated, slender rachis, with numerous filiform, lax, corymbose branches and very minute pedicellated flowers; from two to four of these raceme-like panicles issue from a tuft of hairs placed at a considerable distance above each axil. The embryo, without albu-

men, has large, fleshy, accumbent cotyledons, which nearly fill the entire space of the cell of the putamen. This genus is confined entirely to the South-American continent, the Antilles, and Mexico.

Dr. Eichler, in his monograph of the Brazilian *Menispermaceæ*, refers all the species of *Hyperbæna* which he describes to the genus *Pachygone*, the plants of which are exclusively of Asiatic origin. No botanist will second this conclusion who attentively compares the structure of the two genera. In *Pachygone* the petals are more linear, inflexed at the summit, with basal auricular lobes which incurvingly embrace and conceal the base of the filaments and the 4-lobed introrse anthers, without intervening connective, burst bivalvately by a horizontal fissure, all as in *Cocculus*, and quite different from *Hyperbæna*: the latter genus has also another form of putamen, with a very different kind of condyle. Besides the difference in the floral and seminal characters, the general aspect of the plants, and more especially the peculiar mode of venation of the leaves, render it impossible for any attentive observer to confound the one genus with the other.

Mr. Bentham acknowledged the validity of *Hyperbæna* (Journ. Proc. Linn. Soc. v. Suppl. 50), but made great perplexity among the species by fusing together my *H. Mexicana*, *Hostmanni*, *Moricandi*, *valida*, and *graciliflora* into his *H. reticulata*, a species founded on a plant quite foreign to the genus: this is the *Cocculus reticulatus*, Mart., the *Anomospermum reticulatum*, Eichl. Fl. Bras. fasc. xxxix. 171, tab. 37. f. 3.

I have here indicated fifteen very distinct species, of which the first twelve, as in the typical plant, have an elongated slender inflorescence, while the last three present in each axil a fascicle of several extremely short panicles, with numerous flowers crowded into an almost sessile oblong head.

HYPERBÆNA, nob.—*Flores* dioici. *Masc.* *Sepala* 6, obovata vel ovalia, biseriata, 3 interiora majora, sæpe glandulis resinosis medio notata. *Petala* 6, dimidio minora, subbiseriata, ovata, integra, subplana vel rarius lateribus subintroflexa. *Stamina* 6, biserialia, petalis opposita et rarius longiora; *filamenta* apice incrassata et subdilatata; *antheræ* subdidymæ vel 2-lobæ, lobis ovatis aut subglobosis, imo divergentibus, marginibus filamenti adnatis, plus minusve segregatis, utrinque rima laterali longitudinaliter dehiscentibus.—*Fem.* *Sepala* et *petala* eadem ac masc. *Stamina sterilia* 6, petalis dimidio breviora et opposita, apice 2-glandulosa. *Ovaria* 3, gibbosa, gynæcio brevi hirsuto collocata, 1-locularia, *ovulo* unico latere ventrali appenso munita. *Stylus* excentricus, ex angulo interno ortus,

teres, brevis. *Stigma* stylo continuum, tenuiter subulatum, longiusculum, horizontaliter reflexum, superne valde sulcatum. *Drupæ* 3, vel abortu solitariæ, obovatæ vel subglobosæ, styli vestigio pedicellum versus notatæ, *sarcocarpio* crasso coriaceo vestitæ: *putamen* subovatum, paulo compressum, utrinque a basi ultra medium sulcatum, coriaceum, rarius duriusculum, 1-loculare; *condylus* transversim septiformis, a basi ultra medium loculi subdiagonaliter (rarius paulo brevitus) protensus; locus exinde conspicue subbimarsupiat. *Semen* hippocrepice plicatum, loculum implens, exalbuminosum; *integumentum* membranaceum, circa condylum replicatum et per raphen et chalazam ei ligatum: *embryo cotyledonibus* magnis, carnosus, accumbentibus, medio subito replicatis, *radicula* brevissima, tereti, subsupera, ad styli vestigium basale spectante.

Frutices scandentes *Americæ meridionalis et Mexicani*; ramuli flexuosi, axillis nodosi; folia oblonga, apice sæpius attenuata, sæpe crassa coriacea, alternatim nervosa, glaberrima, petiolata; paniculæ axillares, racemosæ, plurimæ, sæpius rachi elongata gracili, ramis filiformibus, glabræ, e gemmula pilosa longe supra-axillari ortæ, folio sæpius longiores rarius plurimæ, petiolo breviores, in capitulum axillare approximata; flores glabri, minusculi.

The following species will be described in the third volume of my 'Contributions to Botany':—

1. *Hyperbæna nemoralis*, nob., Ann. Nat. Hist. 2 ser. vii. 44;—*Hyperbæna Tweedii*, nob. l. c. 44: v. v. ♂, Rio de Janeiro: v. s. ♀, in herb. Hook., Porto Alegre, prov. Rio Grande (Tweedie).
2. — *graciliflora*, nob.;—*Hyperbæna reticulata*, Benth. (in parte) Journ. Linn. Soc. v. Suppl. 50;—*Pachygone Domingensis*, Eichl. (in parte) in Mart. Fl. Bras. xxxviii. p. 98.—In Guiana Brasiliana: v. s. ♂ in herb. variis, Rio Cassiquiari (Spruce, 3167).
3. — *Moricandii*, nob. l. c. 44;—*Hyperbæna reticulata*, Benth. (in parte) l. c. 50;—*Pachygone Domingensis*, Eichl. (in parte) l. c. 198.—In Brasilia: v. s. in herb. Hook. ♂, Ilheos (Moricand, 2346).
4. — *Hostmanni*, nob. l. c. 44;—*Hyperbæna reticulata*, Benth. (in parte) l. c. 50;—*Anelasma minutiflora*, Sagot, in herb.;—*Pachygone Domingensis*, Eichl. (in parte) l. c. 197, tab. 47. fig. 2.—In Guiana: v. s. in herb. Hook., Surinam (Hostmann), Guiane Française (Sagot, 833).
5. — *Mexicana*, nob. l. c. 44;—*Hyperbæna reticulata*, Benth. l. c. 50;—*Pachygone Domingensis*, Eichl. (in parte) l. c. 198.—In Mexico: v. s. ♂ in herb. Hook. (Jungensen, 91).

6. *Hyperbæna Domingensis*, Benth. (in parte), l. c. 50;—*Cocculus Domingensis*, *DC. Syst.* i. 528, *Prodr.* i. 99; *Deless. Icon.* i. tab. 96; *Griseb. Fl. Br. W. Ind.* p. 10;—*Anelasma Domingensis*, *nob. olim*, l. c. 43;—*Pachygone Domingensis*, *Eichl. l. c.* 197.—In Antillis, ♂, San Domingo (Poiteau): *v. s. in herb. Hook.* ♂, Villa Monte Verde, Cuba (Wright, 1105), Domenica (Imray, 453); *in herb. De Candolle* ♀, Guadeloupe (Krauss, 1615); *in herb. Benth.*, Jamaica (Forsyth).
7. — *rotundiuscula*, *nob.*—In Cuba: *v. s. in herb. Hook.* ♀, Cuba (Wright, 23).
8. — *retinervis*, *nob.*—In Antillis: *v. s. in herb. De Cand.*, Puerto Rico (Bertero).
9. — *Prioriana*, *nob.*—In Antillis: *v. s. in herb. Dr. Alex. Prior*, ♂ et ♀, Jamaica (Prior).
10. — *valida*, *nob.*;—*Hyperbæna reticulata*, *Benth. l. c.* 50;—*Pachygone Domingensis*, *Eichl. (in parte) l. c.* 198.—In Antillis: *v. s. in herb. Hook.* ♀, Jamaica (Purdie).
11. — *longiuscula*, *nob.*—In Cuba: *v. s. in herb. Mus. Brit.* ♀, Cuba (Wright, 1854).
12. — *cuneifolia*, *nob.*—In Cuba: *v. s. in herb. Hook.* ♂, Cuba (Wright, 1853); ♀, Villa Monte Verde (Wright, 1104); *in herb. Mus. Brit.* ♂ et ♀, Cuba (Wright, 1853).
13. — *crebriflora*, *nob.*—In Cuba: *v. s. in herb. Mus. Brit.* ♂ et ♀, Cuba (Wright, 1855).
14. — *banisteriæfolia*, *nob.*;—*Cocculus banisteriæfolius*, *A. Rich. Ann. Sc. Nat.* xvii. 136; *Walp. Rep.* i. 95;—*Cocculus oblongifolius*, *Mart. in Fl. Beibl. xxiv. Append.* ii. 43; *Walp. Rep.* ii. 748;—*Pachygone oblongifolius*, *Eichl. Mart. Fl. Bras.* xxxviii. 197, tab. 47. fig. 1.—In Brasilia, *v. v.* ♂ in sinu Jurujuba, prov. Rio de Janeiro: *v. s. in herb. Mus. Brit.* ♂, Rio de Janeiro (Bowie).
15. — *Columbica*, *nob.*;—*Pachygone Columbica*, *Eichl. l. c.* 198.—In Colombia.

[To be continued.]

XX.—On the Muscular Force of Insects. (Second Note.)

By FÉLIX PLATEAU*.

It will be remembered that in my former note on the muscular force of insects, I arrived, by determining the relations between the mean weights pulled, pushed, or raised by a great number

* Abstract, communicated by the author, from the 'Bulletin de l'Acad. Roy. de Belgique,' 2^e série, tome xxii. For the former note see 'Annals,' February 1866.

of species, and the mean weight of each of these species, at the relative values of the strength of insects. From the comparison of these values I deduced the following law:—*In the same group of insects, the force varies inversely to the weight*—that is to say, that of two insects belonging to the same group the smaller presents the greatest strength. There were, however, some cases in which this law was not, or only incompletely, verified—namely, when species of the same group differed but slightly in weight: I justly attributed these exceptions to the insufficient number of individuals experimented upon; for having this year resumed these same trials, doubling the number of individuals (that is to say, raising it to twelve), I found the law above referred to perfectly confirmed, both by the mean relations and by the maximum individual relations, even with species differing so little in average weight as *Donacia Nymphææ* and *Crioceris merdigera*, belonging to the group Eupoda.

I indicated this group of Eupoda as exceeding all others in traction-force. Fearing that this supremacy was only to be ascribed to the stiff brushes with which, besides the claws, the tarsi of these animals are furnished, and which enable them to adhere with great force to plants, I wished to ascertain whether the Longicorns, which possess the same accessory appendages of the tarsi, also surpassed other insects with simple claws; but both *Saperda carcharias* and *Strangalia armata*, with which I experimented on this point, gave me only results analogous, or even sometimes inferior, to those furnished by insects of weights respectively nearly approaching those of these insects, and only possessing simple claws. The supremacy of the Eupoda must therefore be attributed solely to a great muscular force, which is explained partly by the great volume of the posterior femora of those insects, and partly by their small weight.

I had no time, during my former investigation, to make experiments upon the leaping of the Orthoptera. The present note is devoted to this manifestation of muscular force. I have tried what is the maximum weight that these insects can move in leaping. The method employed is nearly the same as that of which I availed myself in the case of flight. I attach to the body of the animal, by means of a thread, a little ball of wax, taking care to make it at first too light, so that it may be easily carried away by the insect. I then increase the weight of this mass, by the addition of fresh portions of wax, until the insect can no longer raise it more than 1 centimetre in height. It will be easily understood that I could not go further; for the real maximum weight would be that which the insect could not raise except to an infinitely small extent, or, in other words, which would fix it to the ground; and it would have been difficult to

know whether this point had not been exceeded. I will add that, in order to obtain the force developed solely by leaping, I always fastened together the wings and elytra, so as to prevent the insect from making use of those organs of locomotion. The mean relations representing the force were obtained, as in the other cases, by calculating the relation between the mean of the weights raised by the individuals of each species and the mean weight of the species. My experiments were made chiefly upon two species of Acridiidae, *Edipoda grossa*, and *Æ. parallela*. These species weighed respectively 0.646 gr. and 0.194 gr., and raised a mean weight of 1.064 gr. and 0.638 gr. The proportions indicating their relative force are therefore 1.647 and 3.288; and we see that, in the case of the leaping of the Orthoptera, we have a further verification of the law according to which, in the same group of insects, the lightest are comparatively the strongest.

The difference of structure existing between the Locustidae and the Acridiidae prevented my comparing the great Green Grasshopper (*Locusta viridissima*) with the above-mentioned Acridiidae; I have, however, made some experiments on the Green Grasshopper, and this animal, which is heavier than *Edipoda grossa*, has given me a smaller proportion.

This fact, with others which will be found in my note, has led me to inquire whether the law according to which the smaller insects possess a more considerable force, instead of being limited to the subdivisions of entomological classification, does not extend to the whole class of Insects. When the twenty-one species on which I have experimented are arranged (for traction, for example) in the ascending order of their mean weights, we find that the series of corresponding mean relations which express the force, although manifesting a tendency to decrease from the lightest to the heaviest insect, nevertheless presents numerous departures therefrom, which must be attributed to the differences of structure in the genera in question. But the result is clearly defined if we divide the whole of the species tried into three groups, of which the first contains the lightest insects, the second those a little superior in weight, and the third the heaviest, and take for each of these groups the mean of the relations expressing the forces. This is what I have done. In the first group the weights, all less than 1 decigramme, go from 0.015 to 0.090 gr.; in the second the weights, all superior to 1 decigramme, go from 0.111 to 0.540 gr.; and in the third from 0.940 to 1.905 gr.

As regards flight, the insects upon which I have experimented being all very light, I have only formed two groups of them—that of the species weighing less than 1 decigramme, and that

of the species of greater weight. The following table contains the results of these arrangements :—

	Number of Species.	Means of the mean relations.	
Traction	{ 1st group	9	26.2
	{ 2nd „	9	19.0
	{ 3rd „	3	9.2
Flight	{ 1st group	7	1.3
	{ 2nd „	7	0.5

from which we see that the mean forces are still in inverse proportion to the weights. It appears to me, therefore, that we may assume, in a general way, and without regard to zoological affinities, that the force of insects is more considerable in proportion as their size and weight are less.

I devote the concluding portion of my present paper to replying to some objections which have been raised by my former note. I think it needless to reproduce these objections, with the exception of a single one which has been made by the journal the editors of which have the kindness to lend me their pages at the present moment.

In speaking of the flight of insects I remarked that it did not in any case furnish me with such high results as traction and pushing, probably because insects have never, like certain animals, to transport from place to place burdens of considerable weight. The 'Annals and Magazine of Natural History' said, with regard to this passage, "M. Plateau seems here to have forgotten the Sand-Wasps, many of which carry caterpillars of comparatively large size to their burrows." I by no means deny that the *Sphegidæ* transport, by flight, caterpillars of considerable size, but I cannot admit that these caterpillars possess comparatively great weights. In support of my assertion I here give the results of experiments which I have made upon *Sphex sabulosa*. In the following table will be found the maximum mean weight which this species can raise by the force of its wings alone, and the relation of this weight to the mean weight of the insect :—

	Number of individuals.	Mean weight.	Mean maximum weight raised.	Mean relation.	Individual maximum relation.
<i>Sphex sabulosa</i>	8	gr. 0.066	gr. 0.042	0.636	0.800

These numbers superabundantly prove, it seems to me, that the *Sphex* cannot raise by flight alone an additional weight even equal to its own; moreover I greatly doubt whether, in the case of caterpillars exceeding this weight, or even merely equalling it, these insects do more than drag them along, as is shown by a curious observation made by the naturalist Boitard*, who saw this same *Sphex sabulosa* just mentioned, despairing of conveying by flight a caterpillar which it had just killed, get astride of its victim, raise this a little by means of its intermediate legs, and drag it to a great distance by walking with its anterior and posterior feet. It is therefore almost traction only that we have to do with here; and we know, from my investigations, how great may be the strength of insects under these circumstances.

XXI.—*Notulæ Lichenologicae*. No. XII.

By the Rev. W. A. LEIGHTON, B.A., F.L.S.

On the Cladoniei in the Hookerian Herbarium at Kew.

SINCE the publication of my paper on the *Cladoniei* in the November Number of the 'Annals,' I have accidentally discovered that if the hypochlorite of lime be immediately applied to specimens of *Cladoniae* already moistened with hydrate of potash, some very remarkable reactions are produced. For instance, if only a very slight and scarcely observable yellow reaction be produced by the hydrate of potash, the immediate application of the hypochlorite of lime will bring out a full-coloured yellow reaction, which colour may either remain permanent or be eventually obliterated. This reaction is symbolized hereafter thus, $Kf + C+$. In other cases, where the hydrate of potash produces a yellow reaction, that reaction is still further increased by the hypochlorite of lime (symbolized $K + C+$). Again, where the hydrate of potash brings out a yellow reaction, that coloured reaction is immediately obliterated by the hypochlorite of lime (symbolized $K + C-$). Again, where the hydrate of potash produces no reaction at all, the application of the hypochlorite of lime excites a most distinct and full yellow reaction (symbolized $K - C+$). And, lastly, in some species there is a double negative reaction, or, rather, no reaction at all takes place (symbolized $K - C-$).

This new mode of testing enables us to distinguish more accurately and definitely the limits of the different species or forms, and appears to afford a more satisfactory confirmation than that obtained by the application of the hydrate of potash alone.

* *Curiosités d'Histoire Naturelle*, Paris, 1862, p. 92.

Having recently, through the kindness of the learned Director, Dr. Hooker, had an opportunity of thoroughly examining the extensive collection of *Cladonici* in the Hookerian herbarium at Kew, I have had ample means of applying these tests, and now proceed to make known the results.

This valuable collection comprises the herbarium of the late Mr. Dawson Turner (which contains various authentic specimens received from Dr. Acharius himself), the herbarium of the late Mr. Borrer (which is kept separate), and a large general collection from all portions of the globe.

The Acharian specimens (like all those which I have seen elsewhere) are mere scraps, and scarcely merit the character of herbarium specimens, though highly valuable and interesting as relics of the great father of lichenology, and remarkably useful and sufficiently satisfactory in aiding us to a knowledge of the particular plants meant by this distinguished author.

The Borrerian herbarium contains better and larger specimens of our British *Cladonia*; but, from the circumstance of various different species being found intermingled under similar names, it is often exceedingly difficult to ascertain what precise ideas this acute and observant lichenist really possessed concerning these lichens.

The same intermingling was also remarked throughout the large general collection.

The value of the chemical tests in furnishing us with additional and confirmatory specific characters becomes at once plainly manifest, inasmuch as it facilitates the arrangement of specimens under their proper species, which the intelligent observation and skill of Acharius, Turner, Borrer, Sir W. J. Hooker, Churchill Babington, Dr. Nylander, and others, depending on external characters and aspects alone, have failed to effect. Not that it is desired to depreciate in the slightest degree the learning and acuteness of these giant intellects, who must ever command our deepest veneration and respect, but rather to evidence by these facts the real utility and value of these chemical tests.

The following is the reaction observable in, and the determination of, the specimens received from Acharius himself in the herbarium of the late Mr. Dawson Turner, preserved in the herbarium at Kew:—

“*cæspititia*,” K — C —, true.

“*strepsilis*,” K — C —, like a state of *sobolifera*, Dél.

“*alcicornis*,” K — C +, true.

“*endiviæfolia*,” K f + C +, true.

- “fimbriata,” K - C -, true, but with two specimens of *deformis* added.
- “trachyna,” K + C +, resembling a small stout *gracilis*, but really = *ecmocyna* (Ach.).
- “pleolepis,” K + C +, like a leafy *gracilis* = *ecmocyna* (Ach.).
- “scabrosa,” K - C -, = our Leicestershire specimens of *squamosa*, Hoffm.
- “nivea,” K + C +, = our *C. pungens*, Fr., var. *foliosa*, Flk.
- “exoncera,” K + C +, = *ecmocyna* (Ach.).
- “elongata,” = *gracilis*, Mass. Lich. Ital. 19 c.
- “macilenta,” K - C -, = *bacillaris*, Ach.
- “apolepta,” K - C -
- “styracella,” K - C -
- “scolecia,” K - C -
- “brachytes,” K - C -
- } = *bacillaris*, Ach.
- “digitata,” K + C -, true.
- “deformis,” K + C +, true.
- “bellidiflora,” K - C -, true.
- “turgida,” K + C +, = true *turgida*, Hoffm.
- “cetrarioides,” K + C +, = a state of *turgida*, Hoffm.
- “parecha,” K + C +, = *turgida*, Hoffm.
- “crispata,” K - C -, true.
- “sparassa,” K - C -, a mixed lot of specimens; one like our *squamosa*.
- “symphycarpa,” K + C -, is precisely like the small form of *cariosa* collected by Sir J. Richardson, Arct. Am. Lich. 10.
- “cariosa,” K + C -, true.
- “botrytes,” K - C -, true.
- “aggregata,” K - C -, true.
- “uncialis,” K - C +, true.
- , “var. *obtusata*,” K - C +, = stout *uncialis*, Hoffm.
- “aduncus,” K - C +, = branched state of *uncialis*, Hoffm., with short recurved branches.
- “var. *biuncialis*,” K - C +, = branched state of *uncialis*, Hoffm., erect.
- “pungens,” K + C +, = the usual matted subulate form.
- “exoncera,”
- “lumbricalis,” } K + C +, = *ecmocyna* (Ach.).
- “chordalis,” } K - C -, = *cornuta*, Fr.
- “merista,” }
- “radiata,” K - C -, true.
- “rostrata,” K - C -, like *gracilis*, Hoffm., the state from Aldershatt.
- “subulata,” K - C -, = small *cornuta*, Fr.
- “anomæus,” K - C -, = *degenerans*, Flk.
- “allotropa,” K - C -, like stout *gracilis*, Hoffm.

- "spadicea," } K - C -, = short forms of *furcata*, Hoffm.
 "incrassata," }
 "epermena," K - C -, = upper left-hand specimen of *C. furcata*, Moug. & Nestl. 852.
 "spinosa," K - C -, = lower specimen of M. & N. 852.
 "rigida," K - C -, = state of *furcata*, Hoffm.
 "phocellidioris" (so named in Acharius's handwriting), K - C -, like *crispata*, Flk.
 "donomacra," K - C -, like Bohler's Lich. Brit. 7; a state of *gracilis*, Hoffm.
 "lepidota," K - C -, = Tuck. Am. Sept. 32, *C. furcata*, var. *racemosa*, Flk.
 "ceranoides," K - C -, looks like a dwarf stunted state of *furcata*, Hoffm.
 "delicata," K + C -, true.

The herbarium of the late Mr. Borrer is preserved at Kew, and is kept separate from the Hookerian collection. An examination of it gives the following results:—

I. *Cl. endiviaefolia*, Dicks., contains six specimens, viz.

No. 1. An original specimen from Dickson himself, K f + C +.

No. 2. K f + C +. "Newhaven, Sussex."

No. 3. K f + C +. "Start Point, Devon."

No. 4. K f + C +. "Esher, Surrey, April 1806."

No. 6. K f + C +. "Rackham Common, Sussex, coll. Jenner."

All = *endiviaefolia*, Fr.

No. 5. K - C -. Not localized. This specimen appears like *ceratophylla*, Eschw., and is probably a foreign specimen which has been accidentally intermixed.

II. *Cl. pyxidata* (L.). Three sheets.

1st sheet has ten specimens:—

No. 1 comprises three specimens, K - C -, = *pityrea* (Ach.).

"Wishman's Wood, Dartmoor, 1836."

No. 2 comprises three specimens, K + C -, = *macilenta*, Hoffm.

f. *polydactyla*, Flk. "Burton Mill-pond, Sussex, coll. Jenner."

No. 3, mere thallus. "Hungershall rocks."

No. 4 comprises three specimens: one, K - C -, = probably a clavate state of *bacillaris*, Ach.; the other two, K + C -, one = *macilenta*, Hoffm., f. *polydactyla*, Flk., and the other = *macilenta*, Hoffm., f. *clavata* (Ach.). "Kynance Cove, Cornwall."

Sheet No. 2 has eleven specimens.

No. 1, K - C -, mere thallus, "from Miss Hutchins, marked

Bæomyces epiphyllus." This it is not, as *epiphyllus* (*Cl. delicata*) has reaction K + C—.

No. 2, K + C—, "from Bohler, marked No. 23," = *digitata*, Hoffm.

No. 3 comprises three specimens of thallus, K + C—, probably of *cariosa*, Flk. "from Turner, not named."

No. 4 comprises three thalline specimens similar to No. 2, "from Turner, marked *Bæomyces scolecinus*." These are also probably referable to *cariosa*, Flk.

No. 5, "not localized," K— C—, mere thallus.

No. 6 comprises two specimens, K— C—, "Craig Nick, Forfar, coll. Gardiner," = *pyxidata*, Fr., f. *pityrea* (Ach.).

Sheet No. 3 has seven specimens.

No. 1, K f + C +, "Scotland, 1810?" = *cornucopioides*, Fr.

No. 2, K— C—, "from Rev. T. Salwey," = *pyxidata*, Fr., f. *pityrea* (Ach.).

No. 3, two specimens, K— C—, = *pyxidata*, Fr., "from Rev. Churchill Babington as '*C. neglecta*.'"

No. 4, K + C—, "Bohler's No. 204," = *digitata*, Hoffm.

No. 5, K— C—, "Hungershall Rocks, Sussex, 6/40. Coll. Jenner," = *pyxidata*, Fr., f. *pityrea* (Ach.).

No. 6, K + C—, "not localized," = *macilenta*, Hoffm., f. *clavata* (Ach.).

III. *Cl. gracilis* (L.) has three sheets.

Sheet No. 1, inscribed "*Cladonia gracilis* (L.) var. *hybrida*, Fries, = *C. gracilis*, E. B. 1284 & Auct. Angl.," comprises ten specimens:—

No. 1 comprises four specimens, K— C—, "not localized," = *gracilis*, Hoffm., f. *chordalis*, Ach.

No. 2, two specimens, K— C—, "not localized," = *pyxidata* var. *pityrea*, f. *cornuto-radiata*.

No. 3, two specimens, K— C—, "Forfarshire;" one = "*donomacra*," Ach. ! in herb. D. Turner ! the other = *gracilis* f. *furcata*, Schær. Enum. t. 7. f. 2 i, and Dill. xiv. f. 13 n.

No. 4, two specimens, K— C—, "Sidlaw Hills, Forfar, coll. Gardiner," = "*donomacra*," Ach. ! in herb. D. Turner.

Sheet No. 2 has nine specimens remaining (one having fallen off), and is inscribed "*Cladonia gracilis* (L.), varieties *verticillata* and *cervicornis*."

No. 1, "var. *verticillata*, Broadwater Forest, Tunbridge Wells, coll. Jenner," has fallen off.

No. 2, "var. *cervicornis*, Dartmoor, K + C—, = *cervicornis*, Schær.

No. 3, "Barmouth, Rev. T. Salwey," K - C -, = *verticillata*, Flk.

No. 4, "Llyn Howel, from Rev. T. Salwey," K + C -, = *cervicornis*, Schær.

No. 5, "B. *alcicornis*, β , Dyke J. Br.," K - C -, = *verticillata*, Flk.

No. 6, two specimens, "Rusthall Common, Kent," K + C -, = *cervicornis*, Schær.

No. 7, "Birkstall, Westmoreland, coll. Robertson," K - C -; mere thallus.

No. 8, "Bantry, Ireland, from Miss Hutchins, as *L. foliaceus*," K + C -, = *cervicornis*, Schær.

No. 9, "from Bohler, marked No. 11," K - C -, = *verticillata*, Flk.

Sheet No. 3, seven specimens, inscribed "*Cladonia gracilis* (L.) var. *cariosa*, *C. cariosa*, Flk. Borrer, E. B. S. 2761."

No. 1, three specimens, "Horsmonden, Sussex, coll. Jenner," K + C -.

No. 2, "Teesdale, Durham, 1814, coll. Robertson," K + C -.

No. 3, "Ecclesbourne, near Hastings, 1839, coll. Jenner," K + C - (a packet of three or four specimens).

No. 4, "St. Leonard's Forest, Sussex," K + C -.

(All referable to *C. cariosa*, Flk.)

IV. *C. squamosa*, Hoffm. Two sheets, thus inscribed.

Sheet No. 1, eleven specimens:—

No. 1, three specimens, "from Mr. Jenner," K + C -, = *delicata*, Flk., var. *subsquamosa*, Nyl.

No. 2. Five specimens from Bohler's Lichens 105, 191, 106, 300. 105, 191, 106, K - C -, = *squamosa*, Hoffm.; 300, K + C -, = *delicata*, Flk., var. *subsquamosa*, Nyl.

No. 3, "Sidlaw Hills, Forfar, coll. Gardiner," K - C -, = *squamosa*, Hoffm.

No. 4, two specimens, "not localized," K f + C +, = *vestita*, Ach.

Sheet No. 2, inscribed "*C. squamosa*," contains one specimen from "lake above Llyn Bodlyn, Wales," K - C -, = *squamosa*, Hoffm.

V. Sheet inscribed "*Cladonia delicata*, Ehr., *Scyphophorus parasiticus*, Hook.," containing seven specimens from "rotten rails in St. Leonard's Forest, Sussex," all K + C -, = *delicata*, Flk.

VI. Sheet inscribed "*Cladonia cæspititia*, Eng. Bot.," containing six specimens.

No. 1, "from Sowerby, the original plant of E. B. 1796, gathered by Lyell in Hampshire," K— C—.

No. 2, "Archingley, Sussex, Mr. Jenner," who finds it common on the Sussex sand-rocks," K— C—.

No. 3, two specimens, "Hassocks, Sussex," K— C—.

No. 4, two specimens, "Hungershall rocks," K— C—.

(All true *pyxidata*, var. *cæspititia*, Flk.)

VII. Two sheets, inscribed "*Cladonia furcata*, Hoffm."

Sheet No. 1, containing eleven specimens:—

No. 1, "Old wall, White Hill, Forfarshire," coll. Gardner. Five specimens, of which four have K— C—, = *furcata*, Hoffm., and the other one has K+ C+, = *pungens*, Fr.

No. 2, three specimens, "not localized," K— C—, = *furcata*, Hoffm., forma *recurva* (Hoffm.).

No. 3, two specimens, "Ben-na-Bourd, Aberdeen, coll. Gardner," K— C—, = *furcata*, Hoffm.

No. 4, "Baldoran Woods, coll. Gardner," K+ C+, = *pungens*, Fr.

Sheet No. 2, containing seven specimens:—

No. 1, two specimens, "Linn of Dee, coll. Gardner," K— C—; = *furcata*, Hoffm.

No. 2, "Craig Nick, coll. Gardner," K— C—, = *degenerans*, Flk.

No. 3, "White Hill, Forfarshire," coll. Gardner, K— C—, = *furcata*, Hoffm.

No. 4, "Tay Bank, West water, coll. Gardner," K+ C+, = *pungens*, Fr.

No. 5, "Craig Koynoch, coll. Gardner," K— C—, Apparently a state of *gracilis*, Hoffm.

No. 6, "Glen Callater, coll. Gardner," K— C—, = *squamosa*, Hoffm.

VIII. Sheet inscribed "*C. rangiferina*," containing two specimens from "Deerhill Wood," coll. Gardner, and two specimens from "Sands of Barrie," coll. Gardner. All Kf+ C+, = *sylvatica*, Hoffm.

IX. Sheet inscribed "*Cladonia uncialis* (L.)," containing five specimens.

No. 1, two specimens, "Llyn-y-Cwm Bychan, Merioneth," K— C+, = *uncialis*, Hoffm.; unusually fine large specimens.

No. 2, two specimens, "summit of the Bassier Clova, Forfar, Gardner," K— C+.

No. 3, "Sidlaw Hills," coll. Gardner, K - C +.

Nos. 2 & 3 = *aduncus*, Ach. ! See authentic specimen from Acharius in herb. D. Turner !

X. Sheet inscribed "*Cladonia papillaria*, Ehrb.," containing one specimen "not localized," K + C +, = *Pycnothelia papillaria* (Hoffm.).

XI. Sheet inscribed "*Cladonia deformis* (Linn.)," containing ten specimens.

No. 1, four specimens, "Ben Ferrog," K f + C +.

No. 2, "Linn of Dee, Aberdeen, coll. Gardner," K f + C +.

No. 3, "Westmoreland, Robertson," K f + C +.

No. 4, "Amberley wild brook, Sussex, coll. Jenner," K f + C +.

No. 5, three specimens "not localized," K f + C +.

(All referable to *deformis*, Hoffm.)

XII. Sheet inscribed "*Cladonia bellidiflora* (Ach.)," containing fourteen specimens.

No. 1, four specimens, "Ben Ferrog." Of these the first and fourth, K - C -, = *bellidiflora*, Schær., and the second and third, K f + C +, = *vestita*, Ach.

No. 2, four specimens, "not localized," of which 1, 2, 3, K f + C +, = *vestita*, Ach., and 4, K - C -, = *bellidiflora*, Schær.

No. 3, three specimens, "Aberdeen," coll. Gardner, K f + C + = *vestita*, Ach.

No. 4, three specimens, "Ben-na-Bourd, Braemar, coll. Gardner," K f + C +, = *vestita*, Ach.

XIII. Sheet inscribed "*Cladonia coccifera* (L.)," containing fourteen specimens.

No. 1, two from "Linn of Dee," coll. Gardner, K + C -, = *macilenta*, Hoffm., f. *polydactyla*, Flk.

No. 2, two specimens, "Craig Koynock," coll. Gardner, K + C -, = *digitata*, Hoffm.

No. 3, two specimens, "Ben-na-Bourd," coll. Gardner, K f + C +, = *cornucopioides*, Fr.

No. 4, two specimens, "Braemar," coll. Gardner, K f + C +, = *cornucopioides*, Fr.

No. 5, two specimens, "Sidlaw Hills," coll. Gardner, K - C -, = *Flörkeana*, Fr., var. **bacillaris*, Ach.

No. 6, four specimens, "Ben-na-Bourd," coll. Gardner, K - C -, = *Flörkeana*, Fr.

XIV. Sheet containing three specimens from "Ben Ferrog," K f + C +, = *cornucopioides*, Fr., f. *pleurota*.

XV. Sheet inscribed "*Cladonia coccifera*, varieties *filiformis* and *digitata*," containing seven specimens.

No. 1, two specimens, "Blackland Common, Henfield, Sussex," K + C—, = *macilenta*, Hoffm., f. *clavata* (Ach.).

No. 2, two specimens, "Amberley wild brook, Sussex," K + C—, = *macilenta*, Hoffm., f. *polydactyla*, Flk.

No. 3, two specimens, "from Miss Hutchins, as *Bæomyces macilentus*," K + C—. Probably a state of *macilenta*, Hoffm.

No. 4, "Sussex, Mr. Jenner," K + C—, = *macilenta*, Hoffm., f. *polydactyla*, Flk.

In the following particularization of the general collection, the localities have been placed under countries, which will enable us to obtain an approximate notion of the geographical distribution of the species.

The division of the genus *Cladonia* into three genera may be objected to; but as these are really natural groups, it seems perfectly indifferent whether they be distinguished as genera or sections. Practically the division will be found useful; and, in a philosophical sense, *Cladonia* and *Pycnothelia* may be generically separated upon quite as good grounds as *Evernia* from *Parmelia*, *Coniocybe* and *Trachylia* from *Calicium*, and even as *Lecidea* from *Lecanora*.

Tribe CLADONIEI, Nyl.

I. PYCNOTHELIA, Ach., Duf., Nyl. (K + C—).

1. *P. papillaria*, Hoffm.

Britain:—Appin (very fine) (Capt. Carmichael), Ben Nevis (Sir W. J. Hooker), Killarney (Miss Hutchins), Hill above Loch Callater (A. Croall).

Europe:—Vosges (Dr. Mougeot), B. de Bigorre (Mr. R. Spruce).

II. CLADONIA, Nyl.

A. *Phæocarpæ*.

* Reaction (K f + C +).

1. *C. endiviaefolia*, Fr. (K f + C +).

Britain:—Carse of Ardersier (A. Croall).

Europe:—Vosges (Dr. Mougeot), near Volterra, Italy (Sir W. J. Hooker), Switzerland (Seringe), Spain (Dr. Römer), Landes de l'Andalousie en Espagne (Hb. E. I. C.), S. de Arabida, Portugal (Welwitsch), Sierra de Chiva in decliv. sept. mont. la Casaleta (Sir W. J. Hooker), Gryphiæ.

Africa:—Algeria (Bové), Canaries (Dr. Leman).

** Reaction (K + C+).

2. *C. lepidota* (Ach.) (K + C+).

Australasia:—Victoria Ranges (Wilhelmi).

3. *C. ecmocyna* (Ach.) (K + C+) = Schær. L. H. 65.

Europe:—Grimsel, Switzerland (Sir W. J. Hooker).

North America:—Cascade Mountains, British Columbia (Dr. Lyall).

South America:—Falkland Islands (Dr. J. D. Hooker and T. Edmonstone), Juan Fernandez Island (Mr. Cuming), Chiloe (Cuming), Peru (Cuming).

4. *C. pungens*, Fr. (K + C+).

Britain:—Thetford (Sir W. J. Hooker), Esher Common, Surrey (Mr. Borrer), Baldoran (Mr. W. Gardner).

Europe:—Sardinia (?), Gryphiæ, Helsingfors (?).

Africa:—Canaries and Peak of Teneriffe (Dr. Leman), Madeira, 2500 ft. (Dr. J. D. Hooker), Algeria (Bové).

India:—Kollong, Khasia, reg. temp. 5000 ft. (Dr. J. D. Hooker), Sikkim, reg. temp. 9000 (Dr. J. D. Hooker), Churra Khasia, reg. subtrop. 4000 (Dr. J. D. Hooker).

Tropical America:—Batum ad r. Negro (Dr. Fischer), St. Domingo (Dr. Schomburgk).

South America:—Falkland Islands (Dr. J. D. Hooker).

Australasia:—Sunday Island (Milne), Van Diemen's Land (Gunn).

Var. *foliosa* = *nivea*, Ach. ! in hb. Kew.

Britain:—Thetford Heath.

Africa:—Teneriffe (Bourgeau).

Tropical America:—Jamaica.

5. *C. turgida*, Hoffm. (K + C+).

India:—Kankola, Sikkim, reg. alp. 14,000–15,000 feet (Dr. J. D. Hooker).

A specimen in herb. D. Turner, at Kew, marked "*Bæomyces parechus* Achar. ab ipso," received from Dr. Mohr, 1805, and others marked, in Mr. Borrer's handwriting, "var. *turgida*, Dr. Acharius, 1809," and "var. *cetrarioides*, Dr. Acharius, 1809," all have the reaction K + C+, and are recognized as *C. turgida*, Hoffm., by Dr. Nylander (teste seipso in herb. Kew).

Var. *lacunosa*, Dél.

A specimen from Labrador, marked by Dr. Nylander "*Cl. turgida*, var. *lacunosa*, Dél., Nyl.," has the reaction K + C+ especially distinct, if C be used after K. This reaction occurs

also in Tuck. Am. Sept. Lich. 36, *Cl. Boryi* = *C. lacunosa*, Nyl. Syn. 215, which must be therefore henceforth regarded as a var. of *turgida*.

*** Reaction (K + C-).

6. *C. cervicornis*, Schær. (K + C-).

Britain:—Highlands of Scotland (Sir W. J. Hooker), Sidlaw Hills (Mr. W. Gardner), Ben-na-Bourd (A. Croall).

Europe:— ? (Dr. O. Swartz).

Australasia:—Falls, New Norfolk, Tasmania (Mr. Oldfield), New Zealand (Dr. J. D. Hooker).

7. *C. firma*, Nyl. (K, red).

North America:—Observation Island (Scouler).

Tropical America:—Jamaica (Lambert).

Australasia:—New Zealand (Dr. J. D. Hooker).

8. *C. cariosa*, Flk. (K + C-).

Britain:—Ireland (Miss Hutchins).

Europe:—R. Grionne (M. Schleicher), Gryphiæ.

North America:—Ohio (Lee & Peck), North America (Mrs. Mery).

9. *C. diplotypa*, Nyl. (K + C-).

Africa:—Cameroon Mountains, 6000 ft. (Mr. G. Mann).

10. *C. delicata*, Flk. (K + C-).

Britain:—Holt Wood (Sir W. J. Hooker).

Europe:—Germany (Dr. Schwaegrichen), Switzerland (Dr. Schrader, M. Schleicher), Gryphiæ, Jurançon, Pyrenees (Mr. R. Spruce).

Tropical America:—Carissi, Pará (Mr. R. Spruce).

Var. *subsquamosa*, Nyl. (K + C-).

Britain:—Ireland (Miss Hutchins, Dr. Stokes).

Europe:—Spitzbergen (Parry).

North America:—Esquimault (Dr. Lyall), Vancouver's Land (Dr. Lyall), N. 49th par. lat. Oregon B. C. (Dr. Lyall).

South America:—Juan Fernandez Island (Mr. Cuming), Cape Horn (Dr. J. D. Hooker).

India:—Kamkolo, 15,000 ft., and Lachen, 13,000 ft., Sikkim reg. alp. (Dr. J. D. Hooker).

11. *C. ustulata*, Tayl. (K + C-).

South America:—Falkland Islands (Dr. J. D. Hooker).

Dr. Nylander (Syn. i. 196) refers this to *C. fimbriata* (K- C-), but, as the Kew specimen appears to be an authentic one,

labelled in Dr. Taylor's own handwriting, incorrectly so, as the different reaction will separate them.

**** Reaction (K - C +).

12. *C. alcicornis*, Flk. (K - C +).

Britain:—near Hengrave, Suffolk; Aldborough (Sir T. Gage).

***** Reaction (K - C -).

13. *C. pyxidata*, Fr. (K - C -).

Britain:—White Hill and Kinnordy, Scotland (Mr. W. Gardner).

Europe:—Col de Louvre, Pyrenees (Mr. R. Spruce), Berne, Switzerland (Sir W. J. Hooker), Gryphiæ, Walden Island (Capt. Parry).

India:—Pindari Glacier, Kumaon, Himalaya, 12,000 feet (Strachey & Winterbottom), Chongtam, reg. temp. 5000-8000 feet, Sikkim; Lachen, reg. alp. 12,000 feet, Sikkim (Dr. J. D. Hooker), Sumatra (Dr. Arnold).

North America:—Hunde Island and Arctic Greenland (Dr. Sutherland), Saute River, Minnesota (J. A. Lapham), Franklin's First Journey.

South America:—Cordillera de Ranco, Chili (Lechler).

Australasia:—Melbourne (Dr. Müller), Victoria (Dr. F. Müller), Swan River (Mr. James Drummond).

Var. *pityrea* (Ach.) (K - C -).

Britain:—Forfar and Glen Minch (A. Croall), Ireland (Miss Hutchins).

Europe:—Switzerland (Seringe), Gryphiæ.

India:—Chenab Valley, N. W. Himalaya, reg. temp. 8000 ft. (Dr. Thos. Thomson), Chongtam, Sikkim, reg. temp. 5000-8000 ft., Lachen, Sikkim, reg. alp. 12,000 ft. (Dr. J. D. Hooker).

North America:—United States (Greene, Franklin's First Journey), British North America (Drummond), Ohio (Lee), Labrador (?), Saskatchewan (E. Bourgeau), Awatscha Bay (Dr. B. Seemann).

Tropical America:—Peak of Orizaba, Mexico, 9000-12,000 ft. (H. Galeotti), Nova Granada (Mr. Blagborne), Peru (hb. Ruiz and Pavon).

South America:—Magellan's Straits (Capt. King), top of Mount Foster, Cape Horn (Dr. J. D. Hooker), Falkland Islands (Dr. J. D. Hooker).

Africa:—Teneriffe (E. Bourgeau), Algeria (Bové), Uitenhag (Taylor).

Australasia:—Port Kennedy (Dr. Walker), Asbestos Hills (Mr. Gunn), Van Diemen's Land (Mr. Gunn and Mr. Oldfield), Otago (Dr. Hector).

Forma *acuta*, Tayl. (K—C—).

Tristan d'Acunha (Milne), Pacific (Nightingale), Forfarshire (A. Croall), Killarney (hb. Dawson Turner).

This appears to be a subulate form of *pitirea*.

Forma *carneo-pallida* (K—C—).

Vosges (Dr. Mougeot), Kambachen, Sikkim, reg. alp. 11,000 ft. (Dr. J. D. Hooker);

Var. *chlorophæa*, Flk. (K—C—).

Europe:—Transoubet, Pyrenees (Mr. R. Spruce, Dr. Esper in hb. Dr. Turner).

Africa:—Canaries (Dr. Leman).

North America:—Ohio (Peck and Lee), Boston (B. D. G.), Observation Island (Scouler).

Tropical America:—Piedade (Milne), Guyana (Mr. C. S. Parker), St. Vincent (L. Guilding).

South America:—Caracas (Brischell), Juan Fernandez Island (Mr. Cuming), Falkland Islands (Dr. J. D. Hooker).

Australasia:—Tasmania (Mr. Oldfield).

Var. *fimbriata*, Hoffm. (K—C—).

Forma *tubæformis* (K—C—).

Britain:—Forfar (A. Croall, hb. D. Turner).

Europe:—Moscow (Karelin and Kiriloff).

India:—Ootacamund, Nilgiri Mountains, in woods (Rev. Foulkes), Kankola, Sikkim, reg. alp. 12,000 ft. (Dr. J. D. Hooker).

North America:—British North America (Mr. Drummond).

Tropical America:—Quito (Dr. Jameson), Xalapa (Mr. Harris).

South Atlantic:—Tristan d'Acunha (Milne).

Australasia:—Lord Howe's Island (Milne), New Zealand (Raoul and Colenso), Victoria, Lake King (Dr. F. Müller), Back River, Tasmania (Mr. Oldfield).

Forma *cornuto-radiata* (K—C—).

Britain:—Killarney (hb. D. Turner), Forfarshire (A. Croall); England (Hudson hb.).

Europe:—Vosges (Dr. Mougeot), Switzerland, Gryphiaë.

Africa:—Natal (Gueinzus).

North America:—Awatscha Bay (Dr. B. Seemann).

Tropical America:—Piedade (Milne), West Indies (Lambert).

Australasia:—New Zealand (Dr. Joliffe and Milne), Van Die-

men's Land (Gunn and Mr. Oldfield), Victoria (Adamson and Wilhelmi), prov. Canterbury, New Zealand (Dr. Haast).

India:—Kankola, reg. alp. 12,000 feet, and Chongtam, Sikkim (Dr. J. D. Hooker).

South Atlantic and South Indian Oceans:—St. Paul's Island and Tristan d'Acunha (Milne and Macgillivray),

Var. *decorticata* (Flk.) (K—C—).

Africa:—Mauritius (Telfair), Tristan d'Acunha (Macgillivray).

India:—Tonglo, Sikkim, reg. temp. 10,000 feet (Dr. J. D. Hooker).

North America:—Ohio (Peck).

Tropical America:—St. Vincent's (Rev. L. Guilding).

South America:—Rio (Mrs. Graham).

Australasia:—Tasmania (Mr. Oldfield), New Zealand (Dr. Joliffe), Otago (Hector).

Var. *cæspititia*, Flk. (K—C—).

Ireland (Miss Hutchins and Sir T. Gage).

14. *C. conchata*, Nyl. (K—C—).

Victoria (Dr. F. Müller).

According to the typical specimen of Dr. Nylander, in hb. Kew, this seems referable to *pityrea*.

15. *C. ceratophylla*, Eschw. (K—C—).

Tropical America:—Jamaica (M'Fadyen?), Peak of Orizaba, 10,000 ft. (H. Galeotti).

North America:—Near 49th par. lat. Oregon B. C. (Dr. Lyall).

South America:—Rio (Milne).

Africa:—Tristan d'Acunha (Milne).

There would appear to be two forms of *ceratophylla*—one (of which the localities and reaction are as above) with the thalline leaves flat and of a green colour, and apparently approaching *pyxidata*; the other, from Brazil (Tweedie), has a reaction K f + C +, quite similar to the reaction in Wright's Cuba, 25, and the thalline leaves are of a yellower colour and considerably recurved.

16. *C. verticillaris*, Mnt. (K—C—).

Tropical America:—Brazils (Prof. Raddi), Organ Mountains and summit of Redra Bonita Igaca, and in the Diamond District (Gardner).

The specimens from the above localities had a smooth unbroken cortex, and the verticilli were large and dilated, entire, the edges only lacinate. Other specimens, from the following

places, appeared transitional, having the base of the podetia albomaculate, and the verticilli much more deeply divided:— Minas Geraes, Brazil (P. Claussen), Organ Mountains and Diamond District (Gardner).

17. *C. calycantha*, Dél. (K—C—).

Tropical America:—Loja, Ecuador (Dr. B. Seemann), Pic d'Orizaba, Mexico (J. Linden), Peru (hb. Mus. Paris), Brazils (Burchell), Diamond District (Gardner), Tequendama (J. F. Hotton), Pillzhum, Columbia (Dr. Jameson).

There was also a smaller form (in size like the *verticillata*, Flk., but with the base of the podetia more or less albomaculate, and the verticilli much diminished in size and laciniation), from the following localities:—

Asia:—China (Fortune), Hongkong (Wilford), Nepal (Wallich), Madras (Wight), Kollong Khasia, reg. temp. 5000 feet (Hook. fil. and Thoms.).

Tropical America:—Nova Granada (Mrs. Blagborne), Organ Mountains, Brazil (Gardner), Guadaloupe, West Indies (?), S^a Martha (Purdie).

We may therefore, I think, safely conclude that *verticillaris* and *calycantha* are varieties of each other.

18. *C. gracilis*, Hoffm. (K—C—).

Britain:—Glen Callater, Lion's-Face and Sidlaw Hills, Scotland (W. Gardner), Morne (A. Croall), Ben Lawers (Mr. D. Turner), Forfarshire (J. Drummond), Ireland (Miss Hutchins.).

Europe:—Switzerland, Stockholm, Susten (Seringe), Vosges (Dr. Mougeot).

North America:—Franklin's First Voyage, east coast of America (Mr. D. Douglas), Arctic Greenland (Dr. Lyall), California (Beechey), White Hills, United States (Greene), Lake Winnipeg (Sir J. Richardson), British North America (Drummond), Lake Superior, Wisconsin (J. A. Lapham), Ohio (Lee), Vancouver's Island (Dr. Lyall), Saskatchewan (E. Bourgeau), near 49th par. lat. Oregon B. C. (Dr. Lyall), Whalefish Island (Dr. Lyall), Disco (Dr. Lyall).

South America:—Juan Fernandez Island (Cuming).

Australasia:—Australian Alps (Dr. Müller), Melbourne (F. M. Adamson), New Zealand (Dr. Knight).

Forma *macroceras*, Flk. (K—C—).

North America:—British North America (Mr. J. Drummond), Newfoundland (Miss Brenton), Vancouver's Land (Garry), Northwest America (Scouler), Kotzebue Sound (Dr. B. Seemann).

Forma *aspera*, Flk. (K—C—) = Flk. Clad. Exs. 15 ;
Anzi, Clad. Cisalp. 10 G.

India :—Wallanchoon, 12,000–13,000 feet, and Kongra Lama, 14,000 ft., Sikkim, reg. alp. (Dr. J. D. Hooker).

Forma *divulsa*, Dél. (K—C—) (in Dub. Bot. Gall. 625).

India :—Singalelah, 11,000 feet, Kankola, 15,000 ft., Yeumtong, 12,000 ft., Sikkim, reg. alp. (Dr. J. D. Hooker).

Forma *abortiva* (K—C—), = Schær. Exs. 69 ; Mudd,
Brit. Clad. 36.

Europe :—Serra di Gerez, Portugal (Welwitsch, Lusit. 119).

Var. *cornuta* (Fr.) (K—C—).

Britain :—Ireland (Miss Hutchins).

North America :—Great Bear Lake (Sir J. Richardson), Kamtschatka (Beechey), Newfoundland (Cormack).

India :—Yeumtong, Sikkim, reg. alp. 12,000 feet (Dr. J. D. Hooker).

19. *C. verticillata*, Flk. (K—C—).

Europe :—Vosges (Dr. Mougeot).

North America :—Boston (Dr. B. D. Greene), Lexington, Kentucky (Dr. Short), British North America (Drummond), United States (Greene), Labrador (Mrs. Brenton).

Australasia :—Mount Wellington, Tasmania (Dr. J. D. Hooker).

Var. *sobolifera*, Dél. (K—C—).

Britain :—Lound (Mr. D. Turner).

Europe :—Switzerland (Sir W. J. Hooker).

North America :—Franklin's First Voyage.

Tropical America :—Guyana (Mr. C. S. Parker).

Africa :—San Diego del Monte, Teneriffe (Bourgeau), Ascension Island (Dr. J. D. Hooker).

India :—Nepal (Dr. Wallich).

20. *C. decorticata* (Fr.) (K—C—).

Europe :—Susten, Switzerland.

21. *C. degenerans*, Flk. (K—C—).

Europe :—Bruyères (Dr. Mougeot), Switzerland (Thomas), Gryphiæ (Dr. Swartz in hb. D. Turner).

North America :—British North America (Mr. J. Drummond).

Australasia :—Wilson's Promontory, Victoria (Dr. F. Müller), Cheshunt (Archer).

India:—Kankola, Sikkim, reg. alp. 15,000 feet (Dr. J. D. Hooker).

22. *C. furcata*, Hoffm. (K—C—).

Britain:—Lound Heath (Mr. D. Turner), Suffolk (Sir W. J. Hooker), Whitley Reed, Cheshire (Mr. W. Wilson), Balmerino, Falls of the Garrawalt, Cairn-a-Drochel, White Hill, Scotland (Mr. W. Gardner), Morne (A. Croall), Forfarshire (Mr. T. Drummond).

Europe:—Bois de Boulogne (hb. E. I. C.).

Forma *recurva* (K—C—).

Britain:—Near Beddgelert, North Wales (Mr. D. Turner).

Europe:—Pau, Pyrenees (Mr. R. Spruce), Volterra, Italy (?), Gryphiæ.

North America:—Roch of the Hudson, New York (Douglas).

Var. *racemosa*, Flk. (K—C—).

Britain:—Ben Cruachan (Mr. Borrer).

Europe:—Switzerland (Sir W. J. Hooker), Pyrenees (hb. E. I. C.).

North America:—East coast of America (Douglas), North-west America (Scouler), North-west coast of America (Douglas), Kentucky (Dr. Short), Ohio (Lee), Vancouver's Island (Dr. Lyall), Rocky Mountains (Bourgeau).

Tropical America:—Pic d'Orizaba, Mexico (H. Galeotti).

South America:—Chiloe (Cuming).

India:—Kambachen, 12,000 feet, and Singalelah, 11,000 feet, Sikkim, reg. alp. (Dr. J. D. Hooker).

Australasia:—Victoria (Dr. F. Müller), Brown's River, Tasmania (Mr. Oldfield), Tasmania (Lawrence, Gunn, and Dr. J. D. Hooker), New Holland (A. Cunningham and Fraser), New Zealand (Dr. Jolliffe, Colenso, Gunn, and Dr. J. D. Hooker), Otago (Hector).

Forma *adspersa*, Flk. (K—C—).

India:—Moolee-il, Moulmein (Rev. C. Parish), Chongtam, 8000 feet, Lachoong, 9000 feet, Sikkim, reg. temp. (Dr. J. D. Hooker).

Var. *crispata*, Flk. (K—C—).

Europe:—Gryphiæ.

North America:—Newfoundland (Miss Brenton, Franklin's First Voyage), British North America (Drummond), Boston (Dr. B. D. Greene), Cascade Mountains (Dr. Lyall).

South America:—Magellan's Straits (King), Port Famine (King).

India:—Kina Okosima, Japan (Oldham).

23. *C. squamosa*, Hoffm. (K — C —).

Britain :—Sidlaw Hills, Scotland (Mr. W. Gardner), Killarney, Ireland (Mr. Drummond ?).

Europe :—Bithère and V. de Gazos, Pyrenees (Mr. R. Spruce), Vosges (Dr. Mougeot), Switzerland (D. Esper in hb. D. Turner), Spitzbergen (Parry).

North America :—North-west coast (Dr. Scouler), United States (Greene), Vancouver's Island (Garry) ; Russian America (Beechey's Voyage), Boston (Dr. B. D. Greene).

South America :—Rio (Milne).

Africa :—Cape of Good Hope (Milne), Mauritius (Gardner ?).

India :—Nintung, near Ningpo, China (Fortune), Nagasaki, Japan (Oldham), Tsu-Sima (Wilford).

Australasia :—Lord Auckland's group (Dr. J. D. Hooker and Dr. Lyall), Van Diemen's Land (Lyall and Gunn), New Zealand (Dr. J. D. Hooker), Wilson Promontory (Dr. F. Müller).

24. *C. cenotea*, Schær. (K — C —).

Europe :—Mahourat, Pyrenees (Mr. R. Spruce), Gryphiæ.

25. *C. pileata*, Mont. (K — C —).

Africa :—On the summit of the Pouce, Mauritius (Dr. Ayres).

26. *C. botrytes*, Hoffm. (K — C —).

This is only represented by the Acharian specimen.

27. *C. substraminea*, Nyl. (K — C —).

North America :—Wisconsin (J. A. Lapham).

28. *C. athelia*, Nyl. (K — C —).

Tropical America :—Bluefield Mountains, Jamaica (W. Purdie).

B. *Erythrocarpæ*.

* Reaction (K f + C +.)

29. *C. cornucopioides*, Fr. (K f + C +).

This has no yellow reaction with K, or only one slightly observable; but C gives a full yellow.

Britain :—Mangerton Mountain and Killarney (Sir T. Gage), Sidlaw Hills and White Hill, Scotland (Mr. W. Gardner), Cawdor Wood, Nairn (A. Croall), Schehallion (Sir W. J. Hooker), Shot-over Wood, Bagley Wood, Berks (Mr. Baxter).

Europe :—Vosges (Dr. Mougeot), Switzerland (Sir W. J. Hooker), Gryphiæ, Spitzbergen (Parry).

North America :—Davis's Straits (Dr. Lyall ?), Arctic coast between Cape Barrow and Mackenzie River (Capt.

Pullen), North-west America (Scouler), British North America (J. Drummond, Franklin's First Voyage), Halifax (?), Newfoundland (Miss Brenton), Boston (B. D. Greene), Quebec (Morrison), between York Factory and Chindell (Wrey), United States (Greene), Labrador (Mr. Morrison), Canada (Pursh), Whalefish Islands (Dr. Lyall), Fort Vancouver (Garry), Chamisso Island (Dr. Seemann), North Pole Voyage (Parry), Kotzebue Sound (Dr. Seemann).

South America:—Juan Fernandez Island (Mr. Cuming), Surinam (Hostmann?), Falkland Islands (Dr. J. D. Hooker), Magellan's Strait (King), Port Famine (King), Cape Horn (Dr. J. D. Hooker).

India:—Wallanchoon, 10,000–12,000 ft.; Yeumtong, 12,000 ft.; Jongri, 13,000 ft.; Lachen, 12,000 ft., reg. alp., Sikkim (Dr. J. D. Hooker).

Australasia:—Van Diemen's Land (Gunn and Lawrence), Melbourne (Mr. F. M. Adamson), Van Diemen's Land, St. Patrick's River (Mr. Gunn), New Zealand (Colenso), Otago (Hector).

30. *C. vestita*, Ach. (K f + C +).

North America:—Vancouver's Island (Dr. Lyall), near 49th par. lat. (Oregon Bound. Com., Dr. Lyall), Ohio (Peck), Arctic Greenland (Dr. Lyall), Newfoundland (Miss Brenton), east coast of America (Mr. D. Douglas).

The different reaction compels us to separate this from *bellidiflora*.

31. *C. deformis*, Hoffm. (K f + C +).

Britain:—Ben Ferrog (Mr. Borrer), Glen Callater (Mr. W. Gardner), Ben-na-Bourd and Braemar (A. Croall).

Europe:—Vosges (Dr. Mougeot), Grimsel, Switzerland, Valley of Guttanen (Sir W. J. Hooker), Hammerfest (Sir J. Ross).

North America:—Labrador (Mr. Morrison), Newfoundland (Miss Brenton, Franklin's First Voyage), Port Bowen, Murray Bay (Shepherd), Whalefish Islands (Dr. B. Seemann), Davis's Straits (Dr. Lyall?), Kotzebue Sound (Dr. B. Seemann), Cape Osborne (Dr. Lyall), United States (?).

South America:—Cape Horn and Falkland Islands (Dr. J. D. Hooker).

India:—Lachen, Sikkim, reg. alp. 14,000 ft. (Dr. J. D. Hooker).

Australasia:—Tasmania (Mr. Oldfield), prov. Canterbury, New Zealand (Sinclair and Haast).

** Reaction (K + C -).

32. *C. digitata*, Hoffm. (K + C -).

Europe:—Vosges (Dr. Mougeot), Gryphiae, Switzerland (Schleicher).

North America:—Arctic coast between Cape Barrow and Mackenzie River (Capt. Pullen).

Australasia:—Cheshunt, Tasmania (Archer).

Var. **macilenta*, Hoffm.

Britain:—Edgefield (Sir W. J. Hooker), Scotland (Mr. D. Turner).

Europe:—Vosges (Dr. Mougeot), Ins. Smellandia.

Africa:—“Forest of Grootvadersborth” (Mund).

Australasia:—Norfolk Island (Milne).

Forma *polydactyla*, Flk.

Britain:—Scotland (hb. D. Turner), Ireland (Miss Hutchins), Carr Hill (Mr. W. Gardner), Loch Minch, Aberdeen (A. Croall).

Europe:—Switzerland (Sir W. J. Hooker), Gryphiæ.

North America:—California (Beechey).

Australasia:—Cheshunt, Tasmania (Archer).

33. *C. rigida*, Tayl. (K + C—).

Australasia:—Victoria (Dr. Müller), Lord Auckland's Islands (Dr. J. D. Hooker; the authentic specimen, labelled by Dr. Taylor himself).

South America, Chiloe (Cuming?).

*** Reaction (K—C—).

34. *C. sanguinea*, Flk.

Tropical America:—Serra de Jaquari; summit of Organ Mountains (Mr. Gardner), Brazil (hb. Mus. Paris).

35. *C. bellidiflora*, Schær. (K—C—).

Britain:—Lochnagar, Aberdeen, and Cawdor Woods, Nairn, and Braemar (A. Croall), Cruachan (Mr. Borrer), Ben Nevis (Mr. D. Turner), Craig Chailleach (Mr. D. Turner), Cairn Gorum (Sir W. J. Hooker).

Europe:—Grimsel, Valley of Guttanen, and Switzerland (Sir W. J. Hooker), Pico de Arvas (Durieu), Hammerfest (Ross).

North America:—Sumass, Brit. Columbia (Dr. Lyall), Fort Vancouver (Garry), Whalefish Island (Dr. Lyall), North-west coast (Barclay), Observatory Island (Scouler).

36. *C. Flörkeana*, Fr. (K—C—).

North America:—Wisconsin (J. A. Lapham).

Australasia:—New Zealand (Colenso).

Var. **bacillaris*, Ach. & auct.

Britain:—Aberdeen and Ben-na-Bourd (A. Croall), Sidlaw

Hills and Cairn-a-Drochel (Mr. W. Gardner), Ireland (Miss Hutchins and Sir T. Gage).

Europe :—Mont Gaillard, Pyrenees (Mr. R. Spruce), Cabo da Rocca, Portugal (Welwitsch).

North America :—Ohio (Lee).

Tropical America :—Demerara (Mr. Harris), Jamaica (Purdie), Mexico (Galeotti), Guyana (C. S. Parker).

South America :—Rio (Milne).

India :—Java (?).

Australasia :—New Zealand (Dr. J. D. Hooker and Dr. Jolliffe), Otago (Hector), Middle Island (Haast).

Forma *seductrix*, Nyl.

Australasia :—Brown's River, Tasmania (Mr. Oldfield).

Dr. Nylander informs me (*in litt.*) that *C. seductrix*, Dél., has reaction K+. This was not the case with the specimen so named by Dr. Nylander himself in herb. Kew.

III. CLADINA, Nyl.

A. *Phaeocarpæ*.

* Reaction (K f+ C+).

The application of both the reactives enables us to distinguish more accurately and readily the different species which have been heretofore comprehended under the name *rangiferina*. The true or typical *rangiferina* has the reaction K+ C-. The *sylvatica* has a faint yellow reaction with K, which, on the application of C, becomes of a fuller and more decided yellow (K f+ C+). *Pycnoclada* has the double negative reaction (K- C-). *Peltasta* has the negative reaction with K, but the yellow reaction on C being subsequently applied (K- C+). *Candelabrum* has the double negative reaction (K- C-).

37. *C. sylvatica*, Hoffm. = Schær. L. H. 78.

Britain :—Pentland Hills (?).

Europe :—Sweden and Norway (?), Vosges (Dr. Mougeot), Switzerland (Sir W. J. Hooker), Coria Transtag., Portugal (Welwitsch).

North America :—Newfoundland (Miss Brenton), Arctic Greenland (Dr. Lyall & Dr. Sutherland), Hunde Islands (Dr. Sutherland), Cascade Mountains, British Colombia, 7500 feet (Dr. Lyall), Disco (Dr. Lyall), Halifax (Kendal), Sitka (Barclay).

South America :—Magellan's Straits (King).

India :—Jongri, reg. alp. 12,000; Lachong, reg. temp. 4000-7000 feet; Kambachen, reg. alp. ? Sikkim (Dr. J. D. Hooker);

Lachen, 14,000 ft., reg. alp.; Sikkim, 7000 ft., reg. temp.; Yangma Valley, East Nepal (Dr. J. D. Hooker).

Australasia:—Prov. Canterbury, New Zealand (Sinclair and Haast).

Var. *alpestris* (Schær.) (K f + C +).

North America:—Franklin's First Voyage; New Brunswick.

South America:—Chiloe (Cuming and Capt. King), Juan Fernandez Island (Cuming), Port Famine (Capt. King).

Tropical America:—Rio de Janeiro (Mr. Gardner), Diamond District (Mr. Gardner), Jamaica (Purdie).

Australasia:—Middle Island, New Zealand (Haast).

Forma *pumila*, Dél. (K f + C +).

North America:—Vancouver's Island (Dr. Lyall).

South America:—Falkland Islands, Cape Horn (Dr. J. D. Hooker and Capt. Black), Strait of Magellan (Macwhinnie).

Africa:—Summit of Table Mountain, Cape of Good Hope (Milne).

Polynesia:—Sandwich Islands (Tolmie), Owhyhee (Capt. Harris).

Australasia:—New Zealand (Dr. J. D. Hooker, Jolliffe, and Colenso), Van Diemen's Land (Mr. Gunn), Chatham Island (W. Travers).

38. *C. amaurocræa*, Schær. (K f + C +) = Schær. L. H. 70.

Europe:—Chateau d'Or, Switzerland.

North America:—Saskatchewan (Bourgeau); Arctic Greenland, Leively (Franklin's First Voyage), United States (Greene), Kotzebue Sound (Beechey), Vancouver's Island (Dr. Lyall), Cape Krusenstern (Beechey), Great Bear Lake (Mr. J. Drummond), Observation Island (Scouler).

Australasia:—Asbestos Hills, Tasmania (Gunn); Arthur's Lakes, Tasmania (Mr. Gunn); New Zealand (Dr. Jolliffe), Swan River (Mr. J. Drummond).

Forma *capitellata*, Tayl. (Bab. N. Z.)

Australasia:—New Zealand (Dr. J. D. Hooker), Victoria (Dr. F. Müller), Middle Island (J. Haast).

The different reaction separates *amaurocræa* and *uncialis*, to say nothing of the different external characters.

** Reaction (K + C +).

39. *C. medusina*, Bory (K + C +).

Tropical America:—Jamaica (?).

40. *C. retipora*, Flk. (K + C +).

Australasia :—Chatham Island (Mr. W. Travers), New Zealand (Colenso, Allan Cunningham, and Dr. J. D. Hooker), Bay of Plenty, New Zealand (Dr. Jolliffe), Tasmania (Dr. J. D. Hooker and Fraser), Asbestos Hill, Tasmania (Gunn), New South Wales (hb. E. I. C.), New Holland (M. Labillardière and Baxter), Botany Bay (?), Swan River (Mr. Drummond), Victoria (Dr. F. Müller), Grampians (Wilhelmi), Kangaroo Island, South Australia (Whittaker), Otago (Hector).

In all the specimens of *C. retipora*, K gave a yellow reaction, which was increased by C, but subsequently destroyed by it. This reaction was especially observable on the paler specimens.

*** Reaction (K + C -).

41. *C. rangiferina*, Hoffm.

Forma *grandis* = Schær. L. H. 77.

Britain :—Craig Koynach (A. Croall).

Europe :—Tyrol Alps (hb. E. I. C.), Gryphiae.

North America :—Wisconsin (J. A. Lapham), Kamtschatka (Beechey), Canāda (Pursh), New Brunswick (?), Troy (?).

Africa :—Madagascar (Dr. Meller).

India :—Wallanchoon, Sikkim, reg. alp. 13,000 feet (Dr. J. D. Hooker).

Forma *gracilis* = Schær. L. H. 76.

Britain :—Sands of Barrie and Summit of the Lion's Face, Scotland (Mr. W. Gardner).

Europe :—S. de Cintra, Portugal (Welwitsch), Spain (?), Gryphiae.

Asia :—Black Sea (Fischer).

South America :—Rio (Milne), summit of the Corcovado (Gardner), Juan Fernandez Island (Mr. Cuming).

42. *C. candelabrum*, Bory (K + C -).

Tropical America :—Brazil (hb. Mus. Paris), Diamond District (Gardner).

**** Reaction (K - C +).

43. *C. peltasta*, Spr. (K - C +).

North America :—Kotzebue Sound (Beechey, Franklin's First Voyage); Cascade Mountains, British Columbia, 7500 ft. (Dr. Lyall), Lively and Whalefish Island (Capt. Ross).

Tropical America :—Jamaica (Mr. Wilson), Carapi, Peru (Mr. Matthews), Cotopaxi (Dr. Jameson).

Forma alpestris (K - C +), = Schær. L. H. 79.

Europe:—Vosges (Dr. Mougeot); Gryphiæ; Hammerfest (Parry).

North America:—Lexington, Kentucky (Dr. Short), Lake Winnipeg (Bourgeau).

Tropical America:—Jamaica (Wilson).

South America:—Port Famine (Capt. King), Straits of Magellan (Macwhinnie and Capt. Collinsson).

Forma pumila.

South America:—Berkeley Sound, Falkland Islands (Mr. C. Darwin), Falkland Islands (Edmonstone and Dr. Lyall).

Africa:—Mauritius (Bojer).

Australasia:—New Holland (Allan Cunningham), New Zealand (Dr. F. Müller), Hummock Island, Bass Straits (Milne).

44. *C. uncialis*, Hoffm. (K - C +).

Britain:—Glen Callater and Rossie Moor, Forfar (A. Croall), Appin (Capt. Carmichael), Ben Lawers (Mr. D. Turner), White Hill and summit of the Bassies, Clova (Mr. W. Gardner), near Yarmouth (Mr. D. Turner), near Brandon Mountain, Ireland (Miss Hutchins), Lound (Mr. D. Turner).

Europe:—Bretagne (hb. E. I. C.), Vosges (Dr. Mougeot),
? (Dr. Esper), Switzerland (?), ?
(Dr. Nohden); Gryphiæ.

North America:—Labrador (Mr. Morrison), Whalefish Island (Dr. Lyall), North-west America (Capt. Back), Kotzebue Sound (Dr. Seemann), Vancouver's Land (Dr. Lyall), New Brunswick (Mr. Kendal).

***** Reaction (K - C -).

45. *C. pycnoclada* (Dél.) (K - C -).

This I assume on the authority of a specimen (in herb. Kew) from Brazil, so named by Dr. Nylander.

Britain:— ? (Mr. Pitchford).

North America:—North-west America (Scouler), Fort Vancouver (Mr. D. Douglas).

Tropical America:—Sachapata, Peru (Lechler).

South America:—Cape Horn (Dr. J. D. Hooker), Port St. Antonio, East Patagonia (Capt. King).

India:—Nepal (Dr. Wallich).

Asia:—Tartary (Hemse).

Australasia:—Hummock Island, Bass Straits (Milne), New Holland (Allan Cunningham), Port Arthur, Tasmania (Mr. Oldfield).

46. *C. aggregata*, Eschw. (K—C—).

North America:—Pilzhum, Columbia (Dr. Jameson), Staten Island (Mr. Menzies).

South America:—Mendoza (Gillies), Juan Fernandez Island (Mr. Cuming), Falkland Islands and Cape Horn (Dr. J. D. Hooker), south part of Terra del Fuego (Mr. C. Darwin).

Polynesia:—Norfolk Island (F. Thomson), Island of Pines, near summit of Peak (M^cGillivray and Milne), Sandwich Isles (Mr. D. Douglas).

Africa:—Cape (Drège).

Australasia:—Campbell Island (Dr. J. D. Hooker), Lord Auckland's Islands (Dr. J. D. Hooker), New Zealand (Dr. C. Knight, Allan Cunningham, Colenso, Dr. J. D. Hooher, and Dr. Müller), Van Diemen's Land (Gunn), New Norfolk, Brown's River, Mount Wellington, Tasmania (Mr. Oldfield), Swan River (Mr. J. Drummond), Gipps Land and Victoria (Dr. F. Müller), New Holland (?), Turkey Creek, Victoria (Mr. Robertson), Melbourne (F. M. Adamson), Sealers' Cove (Dr. Müller), Otago (Hector).

B. *Erythrocarpæ*.

* Reaction (K f + C +).

47. *C. leporina*, Fr.

North America:—Galveston Bay, Texas (Mr. J. Drummond).

The following species do not at present exist in the Kew Herbarium:—

Dilleniana, Flk. (K f + C—); *carneola*, Fr. (K f + C+); *dactylota*, Tuck. (K + C+); *mitrula*, Tuck. (K—C—); *corymbescens*, Nyl. (K+); *Santensis*, Tuck. (K+); *subdelicata*, Nyl. (K—); *grypea*, Tuck. (K—); *insignis*, Nyl. (K—); *muscigena*, Eschw. (K—C—); *gracilentia*, Tuck. (K f + C+); *cetrarioides*, Schwein. (K—C—); *gorgonea*, Eschw. (K + C—); *Salzmanni* (Dél.) (K—); *divaricata*, Nyl. (K—); *schizopora*, Nyl. (K—); *stenophylla*, Nyl. (K—); *Caroliniana*, Tuck. (K—); *leptopoda*, Nyl. (K—); *areolata*, Nyl. (K—); *angustata*, Nyl. (K—); *cris-tatella*, Tuck.

IV. PILOPHORON, Tuck.

1. *P. aciculare*, Tuck. (K + C+).

North America:—Sumass, British Columbia (Dr. Lyall), North-west America (Mr. D. Douglas), west coast of North America (Mr. D. Douglas), east coast of North America (?).

Africa:—Cape of Good Hope (?).

Australasia:—Botany Bay (Dr. J. D. Hooker).

The other species of *Pilophoron* are not represented in the Kew Herbarium.

V. HETERODEA, Nyl.

1. *H. Mülleri*, Nyl.

Of this there is no specimen in herb. Kew; but in a specimen from New Caledonia, given me by Dr. Nylander, the reaction is K—C—.

VI. THYSANOTHECIUM, Berk. & Mont.

1. *T. hyalinum*, Tayl. (K + C—).

Australasia:—Swan River (Mr. J. Drummond).

2. *T. Drummondii*, Hook. hb. (K + C+).

? (Mr. J. Drummond).

XXII.—*Description of a new Genus and one new Species of Satyridæ.* By ARTHUR G. BUTLER, F.Z.S., Assistant, Zoological Department, British Museum.

[Plate III.]

THE four species upon which I propose to form the present genus have hitherto been confounded with *Lasiommata* of Westwood (fig. 4), a genus from which they differ in almost every structural detail, but which the male sex somewhat resembles in coloration. They are more nearly allied to (*Satyrus*) *Hipparchia* of Fabricius (fig. 5), from which they may be readily distinguished by the form of the discoidal cell in the hind wings; the several parts, however, when seen under a high magnifying-power, show that this group is widely distinct from both the above-named genera.

The antennæ of *Hipparchia* (fig. 11) are much flattened and expanded at the tip, and present the appearance of a shovel, the shank being very slender: in *Lasiommata** a modification of this form exists (fig. 10); but here the club more nearly resembles a pear-shaped gauge †; in the third form (fig. 9) the club is entire, merely showing an indistinct dorsal line. The plumules on the males of *Hipparchia* (fig. 14) and *Lasiommata* (fig. 13) are much elongated, and somewhat resemble the scales on species of *Erebia*; in the present genus they are oblong,

* Since writing this, I have determined that this is not the true type of *Lasiommata*.

† This form can only be seen by turning the antenna round, the position of the club in relation to the shank not being the same as in *Hipparchia*.

with a terminal fringe (fig. 12). This form is so unlike the last two that I think it impossible for it to be very closely allied to them.

HIPPARCHIOIDES, gen. nov. Pl. III.

Alæ magnæ, latæ, anticæ maris elongatæ, subtrigonatæ, angulis rotundatis, costa anticarum minime undulata; anticæ feminæ majores, latiores, margine postico minus obliquo et undulato: posticæ magnæ, rotundatæ, margine externo undulato: corpus robustum, lanare; palpis elongatis, articulo apicali prorsum porrecto; oculis exstantibus, minime hirsutis; antennis clava gradatim formata, vix costæ medium anticarum attingentibus.

Alæ anticæ vena costali costæ medium attingente, nervulis subcostalibus regularibus; vena disco-cellulari prima brevissima, secunda subobliqua et minime undata, tertia directa, longitudine secundæ; nervulis medianis subparallelis, directis; vena submediana paulum undata; venis ad basin tumidis.

Alæ posticæ vena costali subangulata, cella simplici; venis regularibus, pene æquidistantibus.

Wings large, expanded; front wings of male more elongated, subtriangular, the angles rounded off; anterior margin of front wings somewhat waved; front wings of female larger and wider, the outer margin straighter and waved; the hind wings alike in both sexes, rounded and large, the outer margin waved: body large, hairy, with elongate palpi (fig. 6), the apical joint extended forwards; eyes slightly hairy; the antennæ with gradually formed club (fig. 9), and nearly half the length of the front wings; prolegs of male (fig. 7) more hairy and smaller than those of female (fig. 8).

Front wings (fig. 3) with the costal nervure extending to the middle of the anterior margin; the subcostals regular, as in *Lasiommata*; the first disco-cellular very short, the second much longer, nearly oblique and slightly waved, the third equal to the second in length, but transverse; the median nervules nearly parallel, straight; the submedian vein slightly waved; the costal, median, and submedian veins much swollen at the base: hind wings with the costal nervure somewhat angular; the cell simple; the nervules regular and placed at almost equal distances from each other.

This genus should be placed near *Epinephele*, which it somewhat resembles in the colouring of the underside of the wings*. The four species contained in it are nearly allied; they stand as follows:—

* I have examined the plumules on several genera of *Satyridæ* (see fig. 15), but can find none at all like those on *Hipparchioides*.

1. *Hipparchioides Merope**.

- ♀, *Papilio Merope*, Fabricius, Ent. Syst. iii. 1. p. 99. n. 306 (1793); Donovan, Insects of New Holland, pl. 28. f. 2 (1805).
Satyryus Merope, Godart, Enc. Méth. ix. p. 500. n. 80 (1819); Boisduval, Voy. de l'Astrolabe, pt. 1. p. 146 (1832-35).
Lasiommata Merope, E. Doubleday, List. Lep. Brit. Mus. i. p. 134 (1844); Westwood and Hewitson, Gen. Diurn. Lepid. p. 387. n. 18 (1851).
♂, ♀. *Oreas nubila Œnomais*, Hübner, Samml. exot. Schmett. i. pl. 94. figs. 1-4 (1806).
♂, *Satyryus Archemor*, Godart, Enc. Méth. ix. p. 500. n. 82 (1819).

Hab. Australia (B.M.) Var. Tasmania (♂, ♀, B.M.).

2. *Hipparchioides Philerope*. Pl. III. fig. 2, ♀.

- ♂. *Satyryus Philerope* (part.), Boisduval, Voy. de l'Astrolabe, Entom. pt. 1. p. 147 (1832-35); Guérin, Voy. de la Favorite, Suppl. pl. 3. f. 2, & p. 16 (1839).
Lasiommata Philerope (part.), Westwood †, in Gen. Diurn. Lepid. p. 387. no. 19 (1851).

♀. Coloribus fere *Meropes*, alæ autem magis elongatæ, anticæ costa magis convexa, area apicali nigro-fusca, maculis flavis minoribus, nec cum colore basali confusis; macula subocellari nivea; ocello subapicali indistincto: alæ subtus area apicali magis fulvescente, litura discoidea distincta; area apicali nigrescente; posticæ magis fuscæ, costæ medio paulum elevato et nigrescente.

Hab. Australia (♀, B.M.).

This species † is closely allied to *Merope*, but differs from it in many important particulars. Mr. Doubleday, however, placed it first in his enumeration of the specimens of *Merope* in the National Collection. It is stated, in his List, to have been presented by General Hardwicke.

3. *Hipparchioides Banksia*.

- Hipparchia Banksia*, Leach, Zool. Miscell. i. t. 10 (1814).
Lasiommata Banksia, E. Doubleday, List. Lep. Brit. Mus. i. p. 134 (1847); Westwood & Hewitson, Gen. Diurn. Lepid. p. 387. n. 29 (1851).
Satyryus Gelanor, Godart, Enc. Méth. ix. p. 498. n. 73 (1819); Boisduval, Voy. de l'Astrolabe, pt. 1. p. 145 (1832-35).

Hab. New Holland (♂, B.M.).

Lasiommata Satricus of Mr. Doubleday's 'Genera,' although it bears a general resemblance, on the upperside, to the males of

* The type is in the Banksian Collection.

† Dr. Boisduval, Guérin, and Westwood have agreed in considering this to be the female of *Klugii* (which belongs to another genus). I have lately seen specimens of *Philerope* in Mr. Bates's collection, and have no doubt that they are males of the insect in the British Museum collection.

‡ See Ann. & Mag. Nat. Hist. xvii. p. 287 (1866).

H. Merope, has a very distinct structure, and, I think, may be more nearly allied to the genus *Melanagria* (Arge).

4. *Hipparchioides mirifica*. Pl. III. fig. 1.

♀, *Lasiomata mirifica*, Butler, Ann. & Mag. Nat. Hist. vol. xvii. p. 286 (1866).

Hab. —? B.M.

Two wings and part of the body of this insect are in the National Collection. It is evidently a beautiful insect when perfect.

XXIII.—*On some points in the Muscular Anatomy of the Marsupials*. By the Rev. SAMUEL HAUGHTON, M.D., F.R.S., Fellow of Trinity College, Dublin.

THE following observations were suggested to me by the dissection of several Kangaroos, Phalangeroos, and Opossums, which were placed at my disposal by the Council of the Royal Zoological Society of Ireland. Several points of much interest turned up in the course of my dissections; but I shall confine myself at present to a few observations on the cremaster and quadratus femoris muscles, which seem to have escaped the notice of other observers:—

I. *The Cremaster Muscle in the Marsupials*.

Professor Owen thus describes the cremaster muscle:—

“The cremaster in the Phalanger and Opossum is not a fasciculus of fibres simply detached from the lower margin of the internal oblique or transversalis, but arises by a narrow though strong aponeurosis from the ilium, within and a little above the lower boundary of the internal oblique, with the fibres of which the course of the cremaster is not parallel; it might be considered as a part of the transversalis, but is separated by the fascia above mentioned from the carneous part of that muscle. Having emerged from beneath the margin of the internal oblique, the cremaster escapes by the large elliptic abdominal ring, bends round the marsupial bone near its free extremity, and expands upon the tunica vaginalis testis. In the female it has the same origin, course, and size, but spreads over the mammary glands at the back of the pouch. If the anterior fascicles of the diverging and embracing fibres be dissected from the posterior ones, the appearance of the cremaster dividing into two layers is produced”*.

* Cyclopædia of Anatomy and Physiology, vol. iii. p. 288.

The cremaster muscle was found by me to have the following weights:—

Giant Kangaroo (female)	0·38 oz. av.
Wallaby (male)	0·09 „
Opossum (female)	0·01 „
„ (male)	0·02 „

In the male Wallaby the muscle was 6 inches in length, and must be shortened to 2 inches during coition, which is, I believe, a greater amount of contraction than is recorded of any other muscle in the animal kingdom. The cremaster muscle, in all the Marsupials I have examined, forms the lower border of the transversalis muscle, taking its origin from the edge of the ilium directly. The transversalis itself is only four and a half times the mass of the cremaster, and takes its origin from the superior anterior edge of the ilium, from the lumbar fascia, and from the last two ribs, and is inserted into the fascia of the internal oblique.

It seems very strange that a muscle having so definite an object as the cremaster should in the female Marsupials be diverted to fulfil a purpose essentially distinct from its function in the male. I think, however, that a little reflection and an application of the doctrine of final causes will enable us to explain with ease this apparent anomaly.

The placental Mammals, which are higher in organization and intelligence than the Marsupials, are not entrusted with the responsibility of feeding their young, by voluntary efforts, during foetal life; and yet we find the young of the non-placental Marsupials transferred from the uterus to the marsupium long before they can exert the power of suction, and apparently abandoned to the voluntary efforts of the mother, who supplies them with milk by compressing the mammary gland from time to time by means of the contraction of the cremaster muscle, which spreads itself out over the back of the gland in a fan-shaped form.

As it was not possible for me to believe that so stupid a mother as a kangaroo or opossum should be entrusted with a duty withheld from a tigress, or even a woman, I examined carefully the mechanism of suckling a young kangaroo, with the view of discovering some self-acting cause of irritation to provoke the cremaster muscle to contract, without the necessity of supposing the volition of the mother to intervene; and I believe that I have discovered such a cause, quite adequate to produce the effect required.

The cremaster muscle, in the female Marsupials, winds round the marsupial bone to the back of the mammary gland placed

above it, so as to form an acute angle, and is liable to be stretched by every *depression* of that bone.

The marsupial bone, as is well known, turns upon a long hinge coinciding nearly with the pectineal line of the ilium, and is raised and depressed by the following muscles, which tend to turn it round that hinge:—

1. *Levators of the Marsupial Bones.*

1. The external oblique takes its origin from the lumbar fascia and from all the ribs except the first, and is inserted into the whole length of the marsupial bone, as well as into the inner edge of the pubes and edge of the ilium. This muscle is continuous with the pectoral at the extremity of the sternum, and weighs in the Giant Kangaroo 5·35 oz. Its exerts little, if any, action on the marsupial bone in its usual position in the wall of the abdomen; but when this bone is depressed by the weight of the young in the marsupium, the external oblique is capable of acting as a powerful levator ossis marsupii.

2. The rectus abdominis takes its origin from the first rib and middle line of the sternum and abdomen, and is inserted into the anterior surface and inner edge of the marsupial bone only, of which it is the proper levator. In the Giant Kangaroo it measures 27 inches in length, and weighs 3·43 oz.

2. *Depressors of the Marsupial Bones.*

1. The pectineus takes its origin from the pectineal line and base of the marsupial bone behind the spine of the pubes, and acts as one of the depressors. It is inserted into the second fourth of the linea aspera. It weighs in

The Giant Kangaroo	0·36 oz.
The Wallaby	0·25 „

2. The adductor brevis takes its origin from the anterior line of the pubes, inside the adductor magnus, and is inserted into the upper fourth of the linea aspera. It acts as a depressor of the marsupial bone, and weighs in

The Giant Kangaroo	0·25 oz.
The Wallaby	0·21 „

3. The adductor magnus takes origin from the anterior edge of the pubes, from the base of the marsupial bone, from the symphysis pubis, and from the top of the pubic arch, and is inserted into the whole length of the linea aspera. It is a depressor ossis marsupii, and weighs in

The Giant Kangaroo	5·22 oz.
The Wallaby	2·96 „

It is evident from the foregoing that the marsupial bones, supporting as they do occasionally a considerable weight, are held in equilibrium by the opposing action of two levators and three depressors; so that, in active motions of the mother, the bone vibrates, balancing itself backwards and forwards as it is impelled by the inertia of the guts and of the young in the pouch, and by the opposing actions of the muscles, and thus perpetually "tips" the cremaster muscle that winds round it, exciting it to contract upon the mammary gland, and so feed the helpless young one suspended, by an almost organic union, from the nipple of the gland inside the pouch.

By means of this self-acting mechanism the young is perpetually fed, and the mother marsupial relieved from a care that would infallibly prove too great for her little modicum of brains.

I may mention that I have confirmed the foregoing explanation by the careful dissection of the male Marsupials, in which I find that the cremaster muscle passes from the abdominal ring to the testis in such a manner as to clear the marsupial bone; so that the cremaster in the male is not *tipped* by the marsupial bone at every motion of the body, as it must be in the case of the female marsupial, carrying her young permanently in her pouch.

II. *The Quadratus femoris Muscle in the Marsupials.*

This seems to me to be one of the most remarkable muscles found in the Kangaroos, and is intended to assist in the support of these animals while resting in their favourite attitude, sitting on the tail and hind legs. It takes its origin from a large triangular surface on the ischium, and thence converging in a pyramidal mass to a point, is inserted into a special trochanter or tubercle developed for its reception in the middle of the posterior surface of the shaft of the femur. Fully two-thirds of this pyramidal mass are composed of tendinous fibres, the remaining third being muscular; so that the whole may be regarded as forming an elastic tendon. When the animal sits upon its tail and legs in the manner above described, it sometimes places its feet so far forward, and its tail so far back, that a mechanical observer is at once struck by the apparent want of strength in the arch on which the weight of the body is supported, and feels disposed to come to the conclusion that the act of sitting on its tail must be a fatiguing one to the kangaroo. Observation of their habits, however, abundantly proves the contrary, and shows that the animal prefers this attitude to any other.

The explanation of this difficulty is to be found in the semi-tendinous condition as well as great size of the quadratus femoris,

which acts as a “*tie-beam*” to a portion of the arch, and without much expenditure of force supports the weight of the body placed on the vertex of the straddling arch formed by the tail and hind feet.

I do not know of any other animal in which the quadratus femoris is inserted so low down on the femur, nor of any in which, as in the kangaroo, a special trochanter is provided for the insertion of this muscle. Its weight is

In the Giant Kangaroo	1.47 oz.
In the Wallaby	0.91 ,,

The relative *moment* of the quadratus femoris in man, the Quadrumana, and the kangaroos may be seen from the following comparison: in all cases the total weights of the hip-joint muscles being called 100, the quadratus femoris forms of the hip-joint muscles

In Man	1.25 per cent.
In the Chacma	3.01 ,,
,, Green Monkey	3.00 ,,
,, Macaque	4.01 ,,
,, Wallaby Kangaroo	5.06 ,,
,, Giant Kangaroo	3.77 ,,

XXIV.—On the *Freshwater Fishes of Algeria*.

By PAUL GERVAIS*.

IN a memoir published as long ago as the year 1853†, I gave some descriptive details of the fishes which had then been collected in Algeria in the different streams and in some lakes of that country, and showed how little they varied specifically. Including *Coptodus* and *Tellia*, both differing generically from European fishes, the number amounted only to seven, namely, *Coptodus Zillii*, a species of *Tilapia*; *Zillia apoda*, of the family of *Cyprinodontes*; a Bleak (*Leuciscus callensis*, Guichenot); three Barbels, one of which even is contestable (*Barbus callensis*, Val., *B. setivimensis*, Val., and *B. longiceps*?, Val.); lastly, an Eel, to which M. Guichenot also thought it necessary to give a specific name (*Anguilla callensis*). This list has since been increased only by two interesting species, a Trout (*Salar macrostigma*, A. Duméril ‡) and a *Cyprinodon* (*C. dohiatus* and *cyanogaster*,

* Translated by W. S. Dallas, F.L.S., &c., from the ‘Comptes Rendus,’ 17th December 1866, pp. 1051–1058.

† Bull. Soc. d’Agric. de l’Hérault, xl. p. 76; Ann. des Sci. Nat. 3^e série, xix.

‡ Revue et Magasin de Zoologie, 1858, p. 396, pl. 10.

Guichenot *). This latter exists also in various localities of the Mediterranean region ; every one knows the geographical distribution of the preceding species.

Having more recently received from M. Paul Marès, a naturalist whose labours with relation to Algeria are appreciated by the Academy, some fishes from that country, with the request that I would examine them, I have been led to revise the results of my former investigation, and can make some additions to it which are not without interest.

The fishes collected by M. P. Marès enable me to add two genera to the above list. I shall avail myself of the opportunity which they present to make some new observations with regard to the *Cyprinodontes*, and to establish more accurately than I could formerly the synonymy of *Coptodus*.

The first of the two genera, new as Algerian, which I shall indicate from the fishes sent to me by M. P. Marès is the genus *Gobius*, the species of which are chiefly marine, but which, nevertheless, furnishes a few to the fresh waters of the south of Europe. Bonelli and Cuvier have mentioned such as occurring in Piedmont and about Bologna ; there are also some in eastern Europe, especially in Austria and the south of Russia. Pallas indicated one ; and others have been described by MM. Heckel and Nordmann. *Gobius lacteus*, Nordmann, is from the Dniester.

The Algerian *Gobii* were taken in the rivulets of the environs of Guelma ; I have been unable to compare them with those previously described, and consequently cannot affirm that they differ specifically from them.

A second genus which had not been observed in Algeria is *Gasterosteus*, well known by its European species. It occurs also in North America, but has not previously been indicated in any part of Africa. Specimens have been taken near Algiers, in the rivulets in the vicinity of the *Maison-Carrée*. They belong to the group of Sticklebacks with three dorsal spines ; and their principal characters approximate them to the species or variety common in the environs of Paris, of which Cuvier has made his *Gasterosteus leiurus* ; nevertheless some secondary differences allow of their separation, and they seem to constitute a distinct species.

M. P. Marès has also sent me some Cyprinodons. They came, like the Gobies, from the torrents of the environs of Guelma, and do not appear to be specifically distinct from the specimens previously received by M. Guichenot from Biskra. They are likewise very similar to those which Captain Zickel saw issuing with the water from the artesian well bored under his

* Revue et Magasin de Zoologie, 1859, p. 377.

care at Aïn-Tala, as cited by M. Desor in his note on the Algerian Sahara*. Lastly, it is no less difficult to distinguish them from fishes of the same genus which are found in Portugal, Spain, Sardinia, and even in the neighbourhood of the Dead Sea, as well as in other circum-Mediterranean localities. It seems to me that it would be useful to make a careful comparison of the Cyprinodons of these different localities before admitting that they constitute so many distinct species as ichthyologists have supposed. Nevertheless I shall not include in this synonymy, even generically, the *Tellia*, which certainly belongs to the same family as the Cyprinodons, but differs from them by the absence of the ventral fins. The *Tellia* has the mouth clearly different from that of the Cyprinodons, having its aperture more raised; and it is an error to attribute its apodal character to the wearing of its ventrals, as supposed by M. Desor †, since not only the rays of these fins are wanting, but also the pelvic bones which support them in other fishes. This is easily ascertained by the examination of the specimens of *Tellia* deposited by M. Guyon in the Paris Museum, as has been done by M. Valenciennes ‡.

The number of genera of Fish observed in Algeria is thus raised to nine, namely:—

Of the Acanthopterygii, the genera *Coptodus* or *Tilapia*, *Gobius*, and *Gasterosteus*.

Of the Malacopterygii abdominales, the genera *Cyprinodon*, *Tellia*, *Barbus*, *Leuciscus*, and *Salar*.

Of the Malacopterygii apodes, the genus *Anguilla*.

These nine genera only present as yet eleven species, even including *Barbus longiceps*. It has been supposed that Pikes exist in Algeria, and the lake Fetzara has been indicated as containing them; but hitherto this assertion has not been confirmed.

Of the nine genera ascertained, only one, *Tilapia*, to which I have given the name of *Coptodus*, belongs to a family not represented in the fresh waters of Europe. With regard to this I have made some new observations which deserve to be recorded.

This fish has already been found in Algeria at several points in the Sahara-region, at Biskra, Tuggurth, and Tmacin, and in the lake of Farfar. I owe the specimen formerly described by me to M. Zill, a very distinguished naturalist, who sent it to me during my journey to Constantine in 1848; he had brought it from Tuggurth several years before. M. Guyon also

* Bull. Soc. Sci. Nat. de Neuchâtel, 1864.

† *Loc. cit.*

‡ Comptes Rendus, lvi. p. 713 (1858).

possessed specimens of *Coptodus*, which he has deposited in the Museum.

The Coptodon is an Acanthopterygian fish, resembling the Percoids, and especially the Ruffe, in some of its peculiar characters; but it is pharyngognathous, which necessitates its removal into another group; and its maxillary teeth are trenchant and notched, like those of the Glyphisodons, which Cuvier arranges in the family of the Sciænoidei. Moreover its scales are destitute of those numerous little points on the free margin which are observed in those called *ctenoid*; and thus it would be a fish of the great division of the Cycloidei of Agassiz, which forbids its being placed in the same genus as the Glyphisodons, as was proposed by M. Valenciennes*. The scales of *Coptodus* have their margin of insertion festooned, an arrangement which does not occur in all the Cycloidei, but is found in some of them, among which I may cite the *Cyprinodontes*. Moreover the Coptodon is not the only Acanthopterygian in which similar scales may be indicated. M. Agassiz has already pointed out that certain genera of that order present them; and among these he cites various Labroidei, including the *Bolti* of the Nile, associated by Cuvier, in his genus *Chromis*, with several marine species, which are, on the contrary, Ctenoids. The Coracin, or Little Castagneau, represents in the Mediterranean the marine *Chromides*—fishes very different from the Bolti, and which must, indeed, be placed in a different genus, not only on account of the form of their scales, but because their teeth are villiform instead of being trenchant and incised like those of the Bolti, the Coptodon, and the Glyphisodons. Some authors even think that the marine *Chromides* should be referred to the genus *Helias*, established by Cuvier and associated by him with the Sciænoidei. This is the opinion adopted by Charles Bonaparte in his Catalogue of the Fishes of Europe; and I believe it may very well be sustained.

Thus the Bolti, or *Chromis niloticus*, which M. Peters met with in Mozambique, becomes the type of a small distinct group, characterized by its fluviatile habitat, its trenchant and incised teeth, and its cycloid scales. In Africa (that is to say, on the same continent with it) we find some analogous Fishes.

At a short distance from the Orange River, in some small lakes which are dry during the hottest season, Dr. Andrew Smith discovered an Acanthopterygian very similar to the Bolti, and regarded both by Peters and J. Müller as only differing from it specifically; this is his *Tilapia Sparmanni*†. The natives believe that this fish buries itself in the mud like the Tortoises,

* *Loc. cit.*

† Illustr. Zool. S. Africa, Pisces, pl. 5 (1849).

and thus waits until the excavations in the soil in which it remains during the dry season are inundated afresh. Dr. Smith was unable to verify this statement.

Other fishes having the form of the Bolti live in the Gaboon and in the Senegal. M. A. Duméril* has described nine species of them as distinct, calling them *Tilapia*, this name being adopted by him as that of the genus of which the Bolti is the oldest known form.

It is also in the same division that must be placed *Haligenes Tristrami*, Günther†, taken, like M. Zill's Coptodons, at Tuggurth. Between this fish and the Bolti, or Coptodon, the only difference that I can see is that of the pharyngeal teeth, indicated as cardiform in the specimen brought by Mr. Tristram, which cannot be applied to these teeth taken singly in the Bolti, but becomes conformable to the reality if the author intended, as I suppose, to speak of the bone supporting these teeth.

M. Peters was the first to demonstrate the resemblance which exists between the Bolti, *Tilapia*, and *Coptodon*. Having lately had the opportunity of comparing the Bolti of the Nile with the Coptodon from Tuggurth sent me by M. Zill, I have been able to judge of the correctness of this approximation indicated to me by the learned naturalist of Berlin, and to assure myself that these fishes are certainly of the same species. The similarity of their characters is complete; there is nothing, even to their pharyngeal teeth, both superior and inferior, that does not present the same details of form and arrangement. In both cases we find the same distribution of these teeth, the same inequalities in their size, their villiform appearance, and in some the division of the apex into two or three small, short, unequal points, slightly recurved, and arranged in a linear series. A certain number of them also have the apex tinged with red, nearly of the same shade as the teeth of some Shrews.

There can be no doubt that the Acanthopterygian with cycloid scales which is found in certain springs, both fresh and salt, of the Algerian Sahara, and which, in several places, has been seen issuing with the waters of these springs, or those of artesian wells, in the same way as the Cyprinodons already mentioned, is the same fish as the Bolti of the Nile; it enters, therefore, with this into the genus *Tilapia*. The *Tilapia Sparmanni* is itself a Bolti; and it is not certain that the analogous fishes which have been indicated in the Gaboon and Senegal under other names are all specifically distinct from it. In any case they must be associated with it generically, as also apparently must *Haligenes Tristrami*.

* Archives du Muséum, tome x. p. 251.

† Proc. Zool. Soc. London, 1859, p. 451, pl 9. fig. B.

In describing his *Haligenes Tristrami*, Dr. Günther has called the attention of naturalists to a fish, of the Mediterranean region of Africa, with regard to which science still possesses but few details, namely the *Sparus Desfontainii* of Lacépède*, which Cuvier and Valenciennes have placed among the *Chromides* under the name of *Chromis Desfontainii*. It would be the more interesting to know what relations this supposed *Sparus* or *Chromis* may have with the Bolti, as, like the latter, it is not found in the sea. Lacépède tells us that it was discovered by the celebrated botanist whose name it bears in the hot waters (+ 30° R.) of the town of Cafsa in Tunisia; this water is potable when allowed to cool. Lacépède adds that Desfontaines also met with fishes of this species in the rivulets of cold and brackish water which irrigate the date-plantations at Tozzer, likewise in the district of Tunis. Under the name of *Chromis Desfontainii* the museum possesses some fishes which come precisely from the thermal waters of Cafsa; and M. Duméril, with his usual complaisance, has been kind enough to afford me facilities for examining them, as well as many other rare species which I required to study in order to confirm the conclusions of this investigation.

Sparus Desfontainii is neither a *Sparus* nor a *Tilapia*, that is to say, a Chromide of the same genus as the Bolti. In fact, although it has the jaws furnished with teeth of nearly the same form as in the latter, which distinguishes it from the *Spari*, it is clearly separated from the Bolti by the ctenoid form of most of its scales, and in this respect presents the ordinary condition of the Acanthopterygii. Its teeth and its scaling, therefore, approximate it more to *Glyphisodon* than to any other genus; and it is with the Pharyngognathi of this genus that it must be classed, unless we prefer to regard it, especially on account of its habitat, as forming a separate genus; for the *Glyphisodons* are marine fishes. I do not, however, consider myself authorized, by the comparisons which I have hitherto been able to make, to separate *Sparus Desfontainii* from *Glyphisodon*; and I do not doubt that M. Valenciennes, who wished to make the *Coptodon* a species of this genus†, notwithstanding its cycloid scales, would have expressed the same opinion with regard to the fish from Cafsa.

Independent of the data which it may furnish for the nomenclature of ichthyology, this little discussion leads us to the remark, certainly worthy of being brought forward, that the continental waters of the Mediterranean region of Africa contain a fish evidently nearly allied by its principal characters to the

* Histoire des Poissons, iv. pp. 161 & 162.

† *Glyphisodon Zillii*, Valenciennes, *loc. cit.*

marine species to which the generic name *Glyphisodon* has been given; and yet there are no species of *Glyphisodon* in the Mediterranean sea. This species must finally be compared with the numerous Pharyngognathi, often taken for *Chromides*, which MM. Natterer and De Castelnau* have brought from the great rivers of intertropical America, although we may be sure, by the knowledge of its maxillary teeth, and the comparison of its pharyngeal teeth with those of the species taken by M. Heckel† as the types of his different genera, that *Sparus Desfontainii* has more analogy with the *Glyphisodonts* than with the best-known American species.

In the reflections with which Mr. Tristram has accompanied the description of the species, probably identical with the Bolti, to which Dr. Günther has given his name, this naturalist inquires whether the fish which he brought from Tuggurth is not to be regarded as a last living vestige of the fauna which peopled the Saharan sea during the Tertiary epoch, "before," as he says, "the elevation of the soil of North Africa poured into the Mediterranean the waters of this vanished ocean." I do not know whether the *Sparus Desfontainii*, a fish which approaches marine species of fishes still more closely than the Bolti, *Tilapia*, *Coptodus*, or *Haligene*, can serve as an argument in favour of this opinion. Before according any credit to such an hypothesis as this, I should like to know that the same species of Fish had been observed in the marine strata deposited during the period to which this supposition would make it ascend; and this has not been done; but, as regards *Haligenes Tristrami* and its companion in its habitat (and, no doubt, synonym), *Coptodus Zillii*, I cannot avoid remarking how much their identification with the Bolti or *Chromis* of the Nile and other fresh waters of Africa, is opposed to this supposition.

Nor do I think we have any more reason for adopting the opinion which has sometimes been put forward with regard to Cyprinodonts thrown out, like the Coptodons, by artesian wells of the Sahara, namely, that they are derived from a sea extending beneath this region—since, wherever they are met with, the Cyprinodonts, like the Boltis themselves, are non-marine fishes, whether they have been taken in Algeria, Portugal, Spain, Syria, Egypt, Abyssinia, or even in America.

If we wished to find in geological time an equivalent to the ichthyological fauna of Algeria, which is related to the fluviatile faunas of Southern Europe or of the rest of Africa by the whole of its known genera, it is in the lacustrine deposits of the

* Animaux nouveaux ou rares de l'Amérique du Sud.

† Annales du Musée de Vienne, tome ii.

pliocene and miocene Tertiary epochs that we must seek for it. Independently of the Cyprinoidei which are chiefly characteristic of the fresh waters of our hemisphere, we find, in the gypseous beds of Montmartre, in the marls of Puy-en-Velay, in those of the Limogne d'Auvergne, and elsewhere, Cyprinodons (which have also received the generic name of *Lebias*) which have nowhere been observed in beds of marine origin.

XXV.—*Additional Notes on Euplectella speciosa.*

By Dr. J. E. GRAY, F.R.S., V.P.Z.S. &c.

THE great interest which the importation of more specimens of Venus's Flower-basket (*Euplectella speciosa*) has excited induces me to send you some further observations on this beautiful Sponge.

All the forty-eight or fifty specimens of the *Euplectella* that I have seen are bent on one side, as in Professor Owen's figure of *E. aspergillum*; there is one short, stouter specimen, which came with the others from Zebu, that is nearly erect, which induces me to believe that probably the *E. cucumer* of Owen is only a shorter, broader, and erect specimen of the same species.

Probably this curved form arises from the sponge growing on the perpendicular face of the cliffs in the sea; but all the specimens which I have been able to examine seem to have been attached to earth intermixed with fragments of shells, corals, &c., indicating that they most probably live on mud-banks.

It has occurred to me that this form may be produced by the crab that inhabits them. From several indications in the different specimens, there can be no doubt that the sponge when growing in the sea is rather more flexible than in the dry state in which we receive it. The crab, which is of considerable size, the thorax being about an inch and a half wide and an inch long when the tail is contracted, must enter the cavity of the sponge while it is growing, when it is more flexible, and before the netted lid is placed on the end of the central cavity, and probably when the crab itself is of a smaller size. As the crab becomes imprisoned in the cavity, it will be constantly walking up and down the tube, to procure food; and by so doing it will most likely bend the tube on one side, so that the free end of the tube may become bent down nearly to the level of the base. Most of the specimens which are brought to this country have been more or less cleaned and bleached; but there are two or three in the British Museum which appear to be in their natural state; and these seem to be more covered with the external layer of short spicules on the convex side of the curve, which would be the upper side of the sponge if it grows in this

position in the sea. Sometimes more than one crab is found in the cavity of the same sponge; and I think I can determine, through the network of the sponge, that they belong to different species, or even genera: one looks much like a *Pagurus*.

I am by no means sure that this is a correct explanation of the form; for it is exceedingly difficult to reason *à priori* on such subjects; and I only throw it out as a probable explanation of the peculiarities of the form.

A specimen in Mrs. Gray's cabinet is interesting as showing that the sponge has the power of repairing an injury. There has evidently been a hole made in one of the sides, about the middle of the distance between the base and the apex; and the animal has repaired the injury by forming a new network of bundles of fibres very like the original structure.

The specimens vary considerably in the convexity of the network that closes the cavity, and also in the size of the spaces between the network: in some the interlaced bundles of fibres are broad, and the interspaces large; in others the spaces are small, and the interlaced bundles of fibres narrower and more numerous.

Mr. Wright has just informed me that there is a block of timber in Germany which has ten specimens attached. This is interesting as showing how they probably grow under the sea; and if they grow so grouped together, this explains why they have come to Europe in such comparative abundance.

The first specimen that Mr. Cuming had he sold for £30; he bought it back for the same sum, and it came with his collection to the British Museum. The first new specimens that arrived sold for £10 or £15 each; they are now selling at from £3 to £4 each.

The specimens that first arrived were in their natural state as taken out of the sea, and are of a pale brownish colour; but those that are now in the market have been cleaned and bleached, which makes them more attractive to the unscientific purchaser.

I have seen one specimen which is nearly cylindrical, being scarcely broader at the upper end than a little above the base.

Two specimens which have lately arrived are almost entirely destitute of any frill round the upper end of the sponge: one has a nearly regular, almost circular end, covered with very fine reticulations without any apparent centre; the other has an oblong aperture to the tube, which is produced at the edge on the convex side of the curve of the tube, and it is covered with very fine reticulations which seem to converge to many points. This specimen is short, stumpy, and only slightly curved; whereas the other is very much curved, so that the whole sponge forms rather more than half of a circle.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

December 20, 1866.—Dr. William Allen Miller, Treasurer and Vice-President, in the Chair.

“On the Formation of ‘Cells’ in Animal Bodies.” By E. Montgomery, M.D.

I. *Observations.*

So called organic “cells,” chiefly those of various cancerous tumours, were seen, on the addition of water, to expand to several times their original size, and at last to vanish altogether into the surrounding medium.

The “nucleus” did not always participate in this change, but at times remained unaltered, whilst the outer constituents of the “cell” were undergoing this process of expansion.

This curious phenomenon of extreme dilatation is intelligible only on the supposition that the spherical bodies in question are in reality globules of a uniformly viscid material, which by imbibition swells out till at last its viscosity is overcome by the increasing liquefaction.

In embryonic tissues and in various tumours, single “nuclei” were seen, each surrounded by a shred of granular matter. On the addition of water there would bulge from one of the margins of the granular mass a segment of a clear globule, which continued growing until it had become a full sphere, which ultimately detached itself, and was carried away by the currents. At other times no such separate globule would be emitted, but the entire granular shred would itself gradually assume the spherical shape, ultimately encompassing the “nucleus,” and constituting with the same the most perfect typical “cell.”

Not only single “nuclei” were found, each surrounded by a shred, but also clusters of two, four, or more were seen similarly enclosed by a proportionately large granular mass. Under these circumstances it sometimes occurred that, on the addition of water, the whole granular mass of such a cluster became transformed into a large sphere containing two, four or more “nuclei.” The resulting body was to all appearance identical with shapes well known under the name of “mother cells.” In all these cases the granular shred must have partly consisted of a viscid material, which, on imbibition, naturally assumed the spherical shape.

Primary globules were surrounded by a secondary globule, and thus the typical “cell” was completed under the observer’s eye.

In some instances the globules resulting from the transformation of the granular mass were at first bright and transparent, the granules having completely disappeared. They, however, gradually re-formed, showing at first molecular motion, then crowding more and more, till at last the whole mass seemed to undergo coagulation.

Alternate liquefaction and coagulation of the same material was found to play an important part in the development of “cells.”

Masses of certain viscid materials do not, on imbibition, expand

uniformly throughout their entire bulk, but globules of a definite size are emitted, as many as the mass will yield.

The crystalline lens of many young animals affords, when treated with water, a beautiful illustration of this fact. Its homogeneous material is transformed, under the influence of imbibition, into a vast number of globules of nearly equal size.

Hyaline embryonic tissues display, under similar conditions, the same phenomenon.

Certain inferences lead one to suspect that this size-limiting property is due to the crystallizing propensity of some ingredient of these viscid substances.

Blood-corpuscles (human blood-corpuscles at least) are evidently tiny lumps of a uniformly viscid material.

When broken up into fragments, each fragment assumes the spherical shape.

On slow imbibition, they often emit a clear sphere, or a segment of one.

In various specimens of foetal blood, each blood-corpuscle was seen to emit as many as two or even three equal-sized globules, the original corpuscle being at last no longer distinguishable from its descendants. This is sufficient proof of the uniformly viscous nature of the blood-corpuscles.

In many cancers the most recently formed part consists of mere fibres. These after a time become "nucleated." The "nuclei" are at first very elongated, this being due to the lateral pressure of the still fibrous texture. But as the mass gradually softens, the ovals expand more and more into spheres, forming the primary globules, round which, as has already been shown, a secondary globule is often seen to shape itself.

Chemical differentiation transforms first one portion of the fibrous mass into viscid material. This at once strives, by imbibition, to assume the globular shape. The remaining portion may or may not ultimately undergo similar transformation.

Inflamed serous membranes become often densely "nucleated." In the deeper layers, the "nuclei" are very elongated. At the surface they are perfectly globular, and are detached as minute opaque balls. These balls are the granulation- or the pus-corpuscles. On imbibition, one portion of their soft material swells out, encompassing the rest, which, when forming a single uniform globule, goes under the name of granulation-corpuscle—when, on the other hand, broken up into several granules, constitutes the famous pus-"cell." This is an example of a second mode of "cell"-formation. Here the secondary globule is shaped from a portion of the primary mass.

In some instances these "nuclei" or balls will, when still enclosed within the surrounding texture, undergo the above-mentioned change on imbibition; and thus whole rows of granulation- or pus-corpuscles are seen to form.

This second mode of "cell"-formation is still more strikingly manifested in epithelial textures. In the mucous membrane of the

nose, for instance, the faint oval "nuclei" of the large scales become during disintegration more and more distinct and globular. The surrounding material of the scale gradually liquefies, and the minute balls, thus liberated, expand by imbibition into mucus- or pus-corpuscles. It often succeeds in causing them to form in all perfection whilst they are still contained within the scale.

In abscesses of the skin the pus-corpuscles are formed in exactly the same manner. They can often be watched, fully shaped, still enclosed within the scale. Here, it would seem, are "cells" not the result of life, but rather of death.

The multiple "nuclei" of pus-corpuscles are not the result of over-fecundity, but are simply due to the disintegration of the non-imbibing portion of those oval or spherical sharply defined bodies which are themselves so well known under the name of "nuclei."

The disintegration of this non-imbibing portion can be traced through all possible stages, down to the cluster of most irregularly shaped granules (which, notwithstanding, have been looked upon as the result of fissiparous division), and has been made to represent the crowning feature of the cell theory.

The same minute balls found swimming in the serum of a blister were seen, when treated with water, to disclose single bright sharply defined "nuclei;" when treated with acetic acid, to reveal the most typical multiple nuclei of pus-cells.

II. *Experimental Verification.*

In all the above-cited observations the existence of a viscid imbibing material was proved with almost conclusive evidence,—a viscid material which is capable of forming globules of a definite size, and which in the living organism actually forms such globules—shapes, the nature of which has been hitherto mistaken.

After a long search, the substance known under the name of myeline was found to be the desired material.

When to myeline in its dry amorphous state water is added, slender tubes are seen to shoot forth from all free margins. These are sometimes wonderfully like nerve-tubes in appearance. They are most flexible and plastic. From this curious tendency of shooting forth in a rectilinear direction, it was inferred that a crystallizing force must be at work.

To counteract this tendency, and to oblige the substance to crystallize into globules, it was intimately mixed with white of egg. The result was most perfect. Instead of tubes, splendid clear globules, layer after layer, were formed, resembling closely those of the crystalline lens formed under similar conditions.

Here was actually found a viscid substance which, on imbibition, formed globules of a definite size.

The remaining task was comparatively an easy one. By mixing the myeline with blood-serum, globules were obtained showing the most lively molecular motion.

When the serum somewhat preponderated, the whole of the globules

seemed, after a while, to undergo coagulation, and appeared often as beautifully and finely granulated as any real "cell."

When this mixture of myeline and serum was spread very thinly over the glass slide, there often started into existence, on the addition of water, small primary globules, round each of which an irregular mass of granular material became gradually detached from the glass slide. It at last shaped itself into a secondary globule, enclosing the primary one, and constituting with it, down to the minutest details, the most perfect typical "cell." In many instances the nucleolus did not fail; and the narrow white margin, so often mistaken for a cell-wall, was always present. Beautiful "mother cells" were formed in the same manner.

The next endeavour was to form "cells" according to the second mode.

If the amorphous myeline be very thinly spread on the glass slide, instead of tubes there will form bodies looking like rings. They are actually double globules, the inner globule being more transparent than the outer. They correspond to the inner and outer substance of the above-mentioned tubes. When these are left to dry, and then again acted upon with water, one portion will swell out into a clear globule, enclosing the rest as "nucleus." These "nuclei" are either large and single, like those of granulation-corpuscles, or they are multiple, exactly like those of pus-cells. Whole layers of perfect pus-corpuscles are thus formed. But, of course, more complicated shapes occur as well—among these, for instance, many such pus-cell-like bodies enclosed within one large sphere.

If, instead of water, serum be added to the thinly spread myeline, biconcave disks will form, only generally much larger than blood-corpuscles.

"Cells" being thus merely the physical result of chemical changes, they can no longer afford a last retreat to those specific forces called vital. Physiology must aim at being something more than the study of the functions of a variety of ultimate organic units; and pathology will gain new hope in considering that it is not really condemned to be the interpreter of the many abnormalities to which the mysterious life of myriads of microscopical individuals seemed to be liable.

MISCELLANEOUS.

THE LATE MR. JOSHUA ALDER.

WE regret to announce the death, on the 21st of January, of Mr. Joshua Alder, of Newcastle-on-Tyne, at a somewhat advanced age. He was a true naturalist—working diligently and carefully himself in the field of marine zoology, and encouraging his fellow-labourers (by all of whom he was much beloved), without any petty feeling of jealousy or affectation of superiority. Mr. Alder was frequently a contributor to this periodical. His departure from the ranks of British naturalists was not long preceded by that of a still

greater veteran, Mr. William Bean, of Scarborough, who was a zealous and kind-hearted collector of shells, fossils, and plants.

Hatching of the Mantis in England.

By HENRY DENNY.

Not being aware if there is an instance on record of the hatching of any species of *Mantis* in England, I beg to inform you that, on the 12th of December last, I was much gratified by the sight of a very lively little specimen in a tumbler glass, up and down the sides of which it was rapidly pacing in pursuit of small flies, and every now and then elevating its prothorax and anterior pair of feet, in the well-known attitude of these insects when searching for food. A young friend of mine, Mr. H. L. Watson, of Leeds, detached a cluster of eggs from a post, about a mile out of the town of Melbourne, Australia, where he had observed it for a month previously, towards the end of August; these were placed in a small box. After his arrival in England, he examined the box, and found about twenty specimens hatched, and all dead; on the 10th of December, however, another, the one above alluded to, made its appearance, and fed readily upon small flies for about fifteen days, when, owing to the supply failing, the little *Mantis* became too weak to kill larger flies, though it still made efforts to do so, and at last died. Had it occurred earlier in the season, there is little doubt that by keeping the specimen in a greenhouse, with a good supply of food, it would have arrived at maturity and lived many weeks. My friend tells me the species is very plentiful in the neighbourhood of Melbourne, where it is a common practice to place specimens of the *Mantis* on the window-blinds, where they keep the room clear of flies by their incessant watchfulness for food.

On some points in the Structure of the Xiphosura, having reference to their Relationship with the Eurypterida. By HENRY WOODWARD, Esq., F.G.S., F.Z.S., of the British Museum.

The author pointed out that Prof. M'Coy's tribe *Pæcilopoda* was intended to include the *Limuli*, with *Eurypterus*, *Pterygotus*, and *Belinurus*. Prof. Huxley had already shown (in 1859) that this classification was founded upon an erroneous interpretation of the fossils, then (1849) only known in England by extremely fragmentary remains.

The object of this communication was to demonstrate that although Prof. M'Coy's classification was based on conjecture rather than upon a minute acquaintance with the anatomy of these extinct forms, yet the subsequent researches of Profs. Agassiz and Hall in America, Prof. Nieszkowski in Russia, and the independent investigations of Mr. J. W. Salter and the author in this country have shown that a close relationship actually does exist between the *Xiphosura* and the *Eurypterida*.

The author then gave a detailed comparison of the structure of

these two divisions, which he proposed to call suborders of Dr. Dana's order *Merostomata*. He also pointed out that the *Xiphosura* were divisible into three genera:—1st, *Belinurus*, Baily, having 5 freely articulated thoracic segments, and 3 anchylosed abdominal ones and a telson; 2nd, *Prestwichia*, a new genus, having the thoracic and abdominal segments anchylosed together; and 3rd, *Limulus*, Müller, having a head composed of 7 cephalic and 1 thoracic segments, followed by 5 coalesced thoracic somites bearing branchiæ, and 1 or more coalesced apodal abdominal somites, to which is articulated the telson. Although so great a dissimilarity exists between *Pterygotus* and *Limulus*, yet in the genera *Hemiaspis*, *Exapinurus*, and *Pseudoniscus* we have forms which, in the number of body-rings, are intermediate.

The order *Merostomata* offers a parallel group to the *Decapoda*, the *Eurypterida* representing the *Macrura*, and the *Xiphosura* the *Brachyura*. The author did not, however, intend by this comparison to indicate that *Limulus* was higher in the Crustacean scale than *Pterygotus*, but rather that the former was one of those low but persistent types (like the Brachiopoda) which have remained unchanged through long geological ages, whilst forms capable of further development, like *Pterygotus*, have been modified and swept away.—*Proc. Geol. Soc.* Nov. 21, 1866.

On the Structure of the Skin in Stellio caucasicus.

By Professor F. DE FILIPPI.

In his travels in Georgia and Persia, M. de Filippi observed the *Stellio caucasicus* in great abundance and at the most various elevations. Contrary to Duméril and Wilson's account of the habits of *Stellio vulgaris*, he ascertained, by the dissection of a great number of individuals, that this animal feeds chiefly upon vegetable materials, and that insects form but a small portion of its nourishment. This fact is not without interest, as the known herbivorous Saurians (*Iguana*, *Amblyrhynchus*, *Cyclura*, *Sauromalus*) are peculiar to America.

But the most remarkable peculiarity of this species consists in a change of colour under the influence of light, perfectly similar to that of the Chameleons. An analogous phenomenon has certainly been mentioned as occurring in other Saurians, especially in certain species of *Agama*, *Anolis*, and *Polychrus*; but nothing of the kind had previously been suspected in any *Stellio*. The scale of variation of colour, indeed, is greater in the Chameleons than in *Stellio caucasicus*; but, on the other hand, the latter seems to present a greater distance between its maximum paleness and its most complete darkening; in other words, the phenomenon is more varied in the Chameleon, and more striking in the *Stellio*. Moreover these changes of colour occur only in the adults, the young being exempt from them, contrary to what is observed in the Chameleons. The change is particularly distinct on the lower part of the body, and diminishes towards the back. The Chameleon becomes dark when it is exposed

to a bright light, and in direct proportion to the intensity of the light. The opposite is the case with the *Stellio*, which becomes paler when exposed to the light of the sun. From this M. de Filippi concludes that the passive state of the skin is that which corresponds to the paleness, because M. Brücke has demonstrated, by the aid of irritation by galvanism, that in the Chameleon the active state of the skin corresponds to the pale, and the passive state to the darkened condition. But this hypothesis of the author needs confirmation.

However, the causes of the change of colour do not appear to be identical in the Chameleons and the *Stellio*. In the former M. Brücke discovered beneath the epidermis a layer of polyhedric cells, which, when seen under the microscope without the addition of any liquid, present the most vivid colours of interference; these colours disappear in liquids—that is to say, in substances of which the index of refraction differs less from that of the layer in question than the index of refraction of the air. M. Brücke consequently calls this layer the *stratum of interference*, and he thinks that the effects of coloration produced by it are due to the same causes as the luminous effects in their laminæ, in consequence of the interposition of an extremely thin layer of air between the cells of this stratum. This layer would concur with the combination of two sorts of pigment in the change of colour of the Chameleon. M. de Filippi does not think that phenomena of interference play any part in the changes of colour of *Stellio*. The scale of colours is besides so restricted in those animals, that the change may be sufficiently explained by the combination of two pigments of which he has detected the existence in the skin—one yellowish white, occupying the superficial regions of the dermis, the other dark, more deeply seated, but capable of covering the former more or less abundantly. If the changes of colour do not occur in young individuals, this is because the black pigment is deficient in them.

As regards the mechanism of the change of colour, it cannot be compared with that of the chromatophores of the Cephalopoda; for no muscular fibres are to be found in the layer of the dermis which contains the pigment-cells. It is by the same consideration that Leydig was led to explain the changes of colour of the Tree-Frogs and Tadpoles by the amœboid contractions of the protoplasm of the pigment-cells.

In the case of the *Stellio*, M. de Filippi has recourse to a somewhat different explanation. The papillæ of the dermis contain in their deeper layers a network of black pigment-cells, which emit processes to the surface of the dermis, above the whitish pigment. The black pigment may be injected by means of these processes through the superficial whitish pigment, and cause the change of colour. This injection of the black pigment is ascribed by the author, rather hypothetically indeed, to the turgescence of a vascular glomerule which occurs in each dermal papilla.—*Mem. della R. Accad. di Torino*, 1865; *Bibl. Univ.* 25th October, 1866, *Bull. Sci.* pp. 198–200.

On the Developmental History and Reproductive Power of the Orthoptera. By VITUS GRÜBER.

In this memoir the Orthoptera are first of all divided into two groups, in accordance with the different development of the wings in their various stages: the insects belonging to the first section (*Forficulinæ*, *Blattinæ*, *Mantidæ*, and *Phasmidæ*) show in all their stages more or less developed rudiments of wings horizontally amalgamated with the mesonotum and metanotum (horizontal-fixed-wing development); those of the second group (including the *Gryllidæ*, *Locustidæ*, and *Acridiidæ*), which are subjected to a more detailed examination, in their first stages are either destitute of wing-rudiments or have them united only vertically with the sides of the meso- and metanotum (*Stadium lobulare* i., ii., &c.), and in their last phases of development possess distinct, free wing-sheaths placed upon the back (*Stadium vaginale* i., ii., or *ultimum*, &c.).

In the *Gryllidæ* the first three stages (usually) present vertical-attached wing-rudiments, the last two horizontal free wing-sheaths.

The *Locustidæ* characterized by complete development of the wings present a similar condition, whilst in the *Acridiidæ* there occur (probably) only two stages, with merely lobular lateral wing-rudiments; and the last two stages correspond with those of the *Gryllidæ* and *Locustidæ*.

The wing-sheaths in the last stage but one (*vaginale* i.) are more separated from each other, reach in (most) *Gryllidæ* only a little beyond the metanotum, in the *Acridiidæ* scarcely beyond the first, and in the *Locustidæ* not beyond the third dorsal plate, and never show distinct transverse veins; whilst in the last stage (*vaginale* ii.) they accurately represent on a small scale the venation of the perfectly developed wings, and close together by their inner margins over the middle line of the back like a roof, the elytra being for the most part concealed by the wing-sheaths.

In those forms which, when fully developed, never possess wings, and sometimes have only rudimentary elytra, the rudiments of the flying-apparatus are proportionally smaller in the last stage and the last but one; but in all cases distinct wing-sheaths are to be detected besides the elytra (*Platyphyma*, *Pezotettix*, *Chrysochroon* ♀, *Thamnotrizon*, &c.).

Lastly, the author calls attention to the sexual differences of the *Locustidæ* and *Acridiidæ* in their first stage, this being distinctly expressed in the form of the last ventral (genital) plate. In the male this is simple and more or less oval; in the female, on the contrary, composed either of four (*Acridiidæ*) or six (*Locustidæ*) lamellæ. From the comparison and dissection of the external sexual apparatus of the female in the succeeding stages, it appears that the ovipositor of a female Locustide is composed of six laminæ (or more properly three pairs of laminæ), three of which unite to form a lateral half. The previously quite unknown median lamellæ are very narrow, and setiform, and apply themselves very closely to the inferior laminæ.

In the second part of his memoir the author records one or two experiments upon the reproductive power of the Orthoptera, from which it appears that antennæ which were almost entirely cut away in the first stages of development certainly again acquired their normal length during the succeeding moults, but assumed a peculiar geniculate form; and that a piece cut out of the side of a wing-sheath, (in the last stage but one, for example) was almost entirely replaced at the next moult, although the wing thus treated was finally smaller, and especially shorter, than the corresponding uninjured one.—*Bericht der Akad. der Wiss. in Wien*, 3rd January, 1866, pp. 6-8.

On two Hydrozoa of the Mediterranean.

By Prof. DE FILIPPI.

In the marine aquaria of the Zoological Museum of Turin, M. de Filippi has met with two Hydrozoa, one of which appears to be new, and the author proposes for it the name of *Halybothys*; the other belongs to the genus *Eleutheria* of Quatrefages. The latter genus, which has been carefully investigated of late years by different observers, has not always furnished the same results; and this, according to M. de Filippi, arises from the observations having been made upon different species. Of these, he distinguishes at least three: (1) the original species of M. de Quatrefages, (2) that of M. Claparède, and (3) that of M. Krohn and Mr. Hincks. To the latter the individuals observed at Turin appear to belong. The first is characterized by a terminal knob of nematocysts at the extremity of each of the two branches of its six arms; the second by the normal existence of eight arms and four gastrovascular canals. M. Claparède, indeed, observed some *Eleutheria* having eight arms and six gastrovascular canals, and others with six arms and six canals. M. de Filippi thinks that these anomalies may be explained by a confusion of two species radiated in accordance with different numbers. Finally, the last species, which was observed by the author to the number of several thousands, possesses, like the second, knobs of nematocysts only at one of the extremities of its bifurcate arms; and the number of radiating gastrovascular canals is normally six. Nevertheless fifteen per cent. of the individuals observed presented seven arms and six gastrovascular canals—a variation not very well fitted to confirm the hypothesis that M. Claparède had two species before him.

Whatever may be thought of these specific differences, it is certain that the *Eleutheria* present great differences in their mode of reproduction. Whilst the *Eleutheria* of Normandy observed by M. Claparède always bore their germs in the cavity of the subumbrella, M. de Filippi, like M. Krohn, has seen those of the Mediterranean constantly bearing buds on the outer surface of the umbrella, and these buds themselves frequently producing new buds before detaching themselves from their parent. In this case we find three generations attached to each other, the oldest of which may at the same time contain ova.

M. de Filippi has not been more fortunate than his predecessors in his search for the males of the *Eleutheriæ*. M. Krohn still remains the only naturalist who has observed one. The ova are developed rapidly, not, as M. Krohn thinks, between the ectoderm and the endoderm, but in a cavity everywhere bounded by the endoderm. This cavity is at once an ovary and an incubatory pouch, from which the embryos appear to issue only by the laceration of the body and the consequent death of their parent. The sexual organs do not exist throughout the year; from the middle of April (when his observations commenced) to the end of the first half of May the author could not detect a trace of them. From this period all the individuals, without exception, were provided with them. Towards the beginning of June the *Eleutheriæ*, which had previously swarmed in the aquaria, all disappeared. The ova, after undergoing a complete segmentation, become transformed into embryos belonging to the form of the ciliated *Planulæ*.

The author cannot, as MM. Krohn and Gegenbaur have done, find in the division of the arms of the *Eleutheriæ* a sufficient character for the approximation of these Medusæ to *Cladonema* in the family Oceanidæ. The differences in the structure of the umbrella, in the mode of locomotion, and in the position of the sexual organs (which in *Cladonema*, as in the other Oceanidæ, originate from the wall of the gastric cavity) appear to be more important than the analogies. The author therefore proposes the formation for the *Eleutheriæ* of a separate family—that of the Creeping Medusæ.—*Memorie della R. Accad. d. Sci. di Torino*, serie 2. tom. xxiii.; *Bibl. Univ.* October 25, 1866, *Bull. Sci.* pp. 196–198.

On the Anatomical Arrangement of the Lymphatics in the Torpedos, compared with that presented by those in the other Plagiostomi.
By C. ROBIN.

Although the arrangement of the lymphatics in Fishes is of great simplicity compared with that in other Vertebrata, it nevertheless leaves several important points to be elucidated*. It has been investigated by several eminent anatomists; but the want of clearness in the descriptions of them in dogmatic works on comparative anatomy shows that more than one of the questions relating to them requires solution.

The organs furnished with lymphatics in these animals are:—
1, the *digestive tube*, from the end of the œsophagus to the cloaca;
2, the *pancreas* and its duct (the spleen is destitute of them);
3, the *hepatic ducts*, the gall-bladder, and the *ductus choledochus*;

* “In the class of Fishes the lymphatic system is still only very imperfectly known” (Milne-Edwards, *Leçons sur la Physiol. et l’Anat. Comp.* tom. iv. p. 471). Milne-Edwards divides the lymphatics into deep-seated, or visceral, and superficial. The vessels which he, like Monro and other authors, describes among the latter, are cutaneous venous networks and their median, lateral, and subperitoneal collective sinuses.

4, the *oviducts*, the *deferent canals*, and the *cloaca*, but the ovary and testicle have none; 5, the *peritoneum*, which passes in front of the kidney, is furnished with them, and they cease upon the outer sides of this organ, but its proper substance is destitute of them; 6, the *heart*, the intrapericardial portion of the branchial artery, and the pericardium possess lymphatics, which unite with those of the end of the œsophagus by trunks existing on the inner surface of the pericardio-peritoneal duct. The surface of the suprahepatic venous sinuses, that of the *vena cava* and its dilatations and sinuses, and that of the branches of the *vena porta* and the corresponding arteries are also provided with them.

The lymphatics of the different regions of the body above enumerated discharge themselves, in the *Torpedos*, by one or several orifices into two prismatic triangular reservoirs, with their inner surface smooth and of serous aspect, and their cavity often traversed by delicate fibrous bundles. These reservoirs open into the dilatations which the *venæ cavæ* present in all the *Plagiostomi* before their arrival in *Monro's sinuses*.

The precise point of this opening cannot be absolutely ascertained, as it varies a little, not only in different species, but even in different individuals. In *Torpedo* and *Acanthias* it is in the posterior third of the venous dilatation that the lymphatic reservoirs open, by one or two apertures, of which the anterior is almost always smaller than the other. There is no valve at these orifices, nor above them; but they are oval, elongated, narrower in front than behind, and cut obliquely in the thickness of the venous wall, like that of the ureter in the mucous membrane of the bladder. Hence the posterior part of the orifice represents a sort of fold with a delicate, concave, transparent margin, which, under the pressure of the blood distending the *vena cava*, applies itself against the opposite wall, and prevents reflux into the lymphatic reservoirs.

In the species of *Plagiostomi* in which the dilatations of the two *venæ cavæ* communicate with each other by numerous orifices of their common partition (*Torpedo*, *Squatina*, *Galeus*), it is at the lower margin of the common perforated partition that this opening of the lymphatic reservoirs takes place. In *Torpedos* of ordinary dimensions the orifices are from one to three millimetres in diameter.

The networks forming the origin of the lymphatics in the *Plagiostomi* are directly applied against the capillary blood-vessels. If we imagine the section of a capillary, the primary lymphatic always forms upon the sides of this vessel a canal which embraces one-half, two-thirds, or sometimes three-quarters of the circumference of the vessel. The lymphatic represents a canal which has a proper wall only on one side; for the rest of its extent it is bounded by the capillary; or at least, to be more exact, the proper coat of the lymphatic adheres intimately at this point to the outer coat of the capillary, on a part of the circumference of the latter, without losing its continuity with the other portion. The lymphatic vessels are thus applied to the sides of the capillaries. But this arrangement is also observed in voluminous vessels, especially arterial ones.

In Fishes, Batrachia, and even Reptiles, this arrangement occurs even round the aorta. In them the lymphatics are applied to the arterial vessels, of which they embrace one-half, three-quarters, or even the whole. The true capillaries, and even some small arteries, which diverge from the principal blood-vessels, traverse these lymphatics transversely, and are thus completely immersed in the lymph for a short portion of their course; sometimes even a branch of the lymphatic accompanies them. This arrangement merits notice, because something analogous to it is met with about the capillaries of the encephalon and spiral marrow of the Mammalia*.

From the whole of these facts, it seems to result that the chief use of the lymphatics is to charge themselves with the excess of that portion of the blood-plasma which arrives in the capillaries, and issues from them at each systole of the ventricles. In fact we know that the quantity of lymph flowing is much greater when there is a considerable afflux of blood to an organ than when the latter is in a state of repose.

Moreover I have ascertained, by the examination of living Rays in M. Coste's laboratory at Concarneau, that the great lymphatic vessels contain only a few drops of lymph when they are opened several minutes after the removal of the fish from the water. This fact coincides with the paleness of the intestine and the state of comparative vacuity of the vessels. This lymph is more abundant when the animal is opened immediately on its removal from the water, and when at the same time the intestine still contains food in course of digestion; then also the blood-vessels contain more blood.

There is reason to think that under certain conditions of the life of these fishes, which live at a great depth, these large ducts are full, or nearly so, when certain modifications of the circulation, of the kind just indicated, occur.

In the cavity of the lymphatic, between the concave inner surface of its free wall and the convex outer surface of the capillary to which the other portion of its wall is applied, the following phenomena may be detected by the microscope:—In the living animal a hyaline lymph holding leucocytes in suspension is seen circulating. The movement of the leucocytes is oscillatory, but with a slow progression in a direction opposite to that followed by the blood in the contiguous artery. The leucocytes of the blood are carried along by the blood-corpuses, but more slowly than the latter, and they may be seen momentarily arrested against the inner concave surface of the capillary and separated from the lymph by its wall. The leucocytes of the lymph are the only elements perceptible in that liquid; and no red globules are found in it. These leucocytes (in the mesentery of the lizards which were the subjects of my observations) are about one-third smaller than those of the blood; they float in the liquid for the most part, and only a few are applied to the inner surface of the lymphatic. They are also rather less granulated than those of the blood. Their outline is darker, like that of the leucocytes

* C. Robin, *Journal de la Physiologie*, 1859, pp. 537 & 719.

which have become smaller when transported from a comparatively thin liquid into a denser one.

It is well known, however, that E. H. Weber long since ascertained, in the mesentery of living frogs, the presence of lymphatics surrounding the capillary blood-vessels. Under the microscope he saw the rapid currents of the blood surrounded on all sides by the current of the lymph, which was from ten to twenty times as slow, these currents being separated from each other by the arterial coat in such a manner that there was no mixture of the globules of the lymph with those of the blood.

As I have neither time nor space for the exposition of the historical investigations which I have made upon this subject, they will find a place in the fourth volume of the 'Journal d'Anatomie et de Physiologie,' where this memoir will be published entire.

To sum up. From the numerous observations and experiments which I have made, it consequently follows that the cutaneous and subcutaneous vessels described by Monro, Hewson, &c. as lymphatics are veins; some in the condition of true veins, others in that of venous sinuses. Beyond these veins it is impossible to inject any vessel, either by means of mercury or otherwise. The division of the lymphatics of fishes into *superficial* and *deep-seated* or *visceral*, still adopted by some modern authors, must, consequently, be abandoned, the former kind of vessels not existing in this class of Vertebrata.—*Comptes Rendus*, January 7, 1866, pp. 20–24.

On *Xenacanthus Dechenii*. By Prof. KNER.

Professor Kner has investigated the fossils referred to *Xenacanthus Dechenii* (Beyr.) in the Museums at Vienna, Dresden, Berlin, and Breslau, and states the results of his examination as follows:—

1. From the structure of its fins, it cannot be approximated either to *Squatina* or to any other genus of Plagiostomi or Cartilaginous Fishes; nor, notwithstanding its peculiarly formed and frequently united ventral fins, can it be placed in the vicinity of the *Discoboli*. It rather represents a genus singularly intermediate between the Placoids (Selachii) and Malacopterygii, one of the transitional forms characterized by Agassiz as "prophetic types," and, in Professor Kner's opinion, can only find its nearest allies among living fishes in the great group of the Siluroidei, although still very distant from these.

2. It is certain that *Diplodus* (Agass.), *Orthacanthus* (Goldf.), and *Xenacanthus* (Beyr.) are generically identical; and this statement probably applies also to *Pleuracanthus* (Agass.).

3. On the other hand, however, it seems very probable that *Xenacanthus Dechenii* will have to be divided into at least two species, which might be characterized as *laevidens* and *ptychodus*, unless the remarkable differences are merely sexual.—*Bericht der Akad. d. Wiss. in Wien*, January 3, 1867, p. 6.

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XXVI.—On *Hyalonema*. By Professor MAX SCHULTZE.

THE singular *Hyalonema* (Glass Rope) from Japan, as to the nature of which the opinions of naturalists differ in many respects, has lately been discussed at considerable length in this journal (No. 106, October, 1866, p. 287). Dr. J. E. Gray, the celebrated zoologist of the British Museum, seeks to prove, in the paper just cited, that the opinion of several naturalists who refer *Hyalonema* to the Sponges is erroneous. In opposition to it, he maintains the opinion long since expressed by him (1835) that the "Glass Rope" constitutes the axis and the product of a polype. In accordance with the views expressed in the monograph of Professor Brandt of St. Petersburg, he classifies *Hyalonema* with the Polypes, and regards a sponge observed at the lower extremity of many specimens of *Hyalonema* as a parasite; whilst his opponents maintain that the sponge and the "Glass Rope" belong to each other, and that the undoubted polype which usually coats the latter is the parasite.

As I have very carefully examined a great number of *Hyalonemata* in the Leyden Museum, and published the results in a detailed monograph (*Die Hyalonemen, ein Beitrag zur Naturgeschichte der Spongien*: Bonn, 1860), and have subsequently had many others through my hands, and, indeed, myself possess some very fine ones, I venture to contribute a word or two to the dispute, in the hope that they may assist in the determination of the truth.

Thus there is at any rate *one parasite* in the case, and this causes the difference of opinion. The only question is, whether the polype is the parasite on the sponge, or the sponge the parasite on the polype. *A priori* no decision can be arrived at upon this point; for both the organisms in question live as parasites, inasmuch as they attach themselves to various foreign bodies in the sea. We must therefore bring together the reasons for and against each of these modes of parasitism.

The main argument of my colleague Dr. Gray is evidently the apparently constant union of a polype with the *Hyalonema*, in such a manner that the polype covers a greater or less portion of the "Glass Rope" like a bark, and stands in the same relation to it as the polypes of *Gorgonia* to the solid axis. In the dry specimens in our collections the polype-bark generally adheres very firmly and closely to the siliceous threads, so that nothing can appear more natural than that the polype formed the threads, or, in other words, that the "Glass Rope" represents the solid axis of the polype-tube. I will lay no stress upon the fact that in nearly all the specimens which I have seen in Leyden, London, Paris, and Berlin, and also in those in my own possession, the total number of which, including those figured by Brandt, is at least fifty, the polype forms only an *imperfect* coat upon the "Glass Rope," because it is evident that, in some of these specimens, a part of the polype-coat has been removed artificially or by accidental injury. Nor will I attach any importance to the circumstance that hitherto no other polype is known the axis of which consists, as in *Hyalonema*, of loosely united long threads, the incombustible constituent of which is formed almost exclusively of *silica*, whilst as yet only lime salts are known in the skeletons of polypes. For, as Dr. Gray indicates, why should not an exception to the rule occur? Moreover I may add, might not the allied forms have disappeared during an earlier geological period? So far, therefore, we have evidently nothing essential to oppose to Dr. Gray's opinion.

On the contrary, a very decisive significance belongs to the following point, to which I have already called attention in my monograph, and which, I regret, has been passed over in silence by Dr. Gray. On microscopic examination the long threads of the "Glass Rope" show a structure which is perfectly characteristic of sponge-spicules. To all acquainted with the subject it is sufficient to state that the threads possess a regular, fine, concentric stratification and contain a fine central canal in their axis, exactly such as distinguish the sponge-spicules from all other natural products and exclude all confusion with other skeletal structures of lower or higher organisms. As a witness in favour of my view, I may here cite the most experienced of living micrographers, Ehrenberg, who never doubted for a moment that the long siliceous threads were sponge-spicules. Dr. Bowerbank also, the celebrated student of Sponges, immediately recognized the threads of *Hyalonema* as sponge-spicules. Here no escape is possible, the microscope decides inexorably: the siliceous threads are sponge-spicules; and therefore a polype cannot have formed them. If, notwithstanding, they are coated by a polype, this must be a parasite.

I have ranged the polypes under the genus *Palythoa*, and think that in so doing I was nearly right. According to Professor Oscar Schmidt, there occurs in the Adriatic a perfectly similar polype, which he likewise refers to the genus *Palythoa*, and which also occurs only as a parasite upon a sponge. Two species of the genus *Axinella* are *always* covered with this parasite, which, moreover, was found upon no other sponge, nor upon any other foreign body in the Adriatic Sea (O. Schmidt, *Die Spongien des Adriatischen Meeres*: Leipzig, 1862, p. 61, taf. vi. figs. 2, 3). In this we have the most perfect analogy to the parasitism of *Palythoa fatua* upon *Hyalonema*; and it is well known that many such examples of exclusive parasitism upon a particular host occur in nature.

If, therefore, it is indubitably established that the long threads of the "Glass Rope" are sponge-spicules, the occurrence of a sponge-body at one of its ends, as already mentioned, acquires peculiar significance. This sponge, in the specimens in which it is completely retained (as, for example, in several of those figured by me from the Leyden Museum), presents a pyriform body, which so completely envelopes the lower extremity of the "Glass Rope" that nothing can be seen of the latter. The broad base of the sponge is directed downwards, the cord of long siliceous threads projecting freely from the middle of the superior narrowed extremity. The sponge itself consists of an elegant tissue of dense masses of very short siliceous spicules.

If the sponge be opened by breaking through the dense felt of fine siliceous spicules, the long siliceous threads are found to terminate in extremely fine ends in the axis of the sponge, and to be united in a very characteristic manner with the tissue of the latter (see taf. ii. fig. 1 of my monograph). No one who has performed such a dissection can doubt that the most intimate organic union exists between the porous sponge and the "Glass Rope," and that both, therefore, form an organic whole.

But in many specimens in collections the sponge is wanting, and the siliceous threads terminate freely at both ends. I have submitted a great number of such specimens, in which the sponge was deficient, to a careful examination, and found that whenever the lower attenuated extremities of the siliceous threads were preserved *these were always united to each other by distinct remains of a sponge-tissue*. The microscopic examination of this always revealed a complete agreement of its spicules with those of the sponge-body of the perfect specimens above described. Thus, as I could almost always detect very characteristic traces of the sponge even in my imperfect specimens, injured in many ways by mechanical violence, and, indeed, in those which had been wedged with stones into the borings of *Pholades*, I do not hesitate

to regard the sponge at the lower extremity of the "Glass Rope" as something *perfectly constant*.

I now come to the last, but very important, point, the microscopic examination of the spicules of the sponge. Dr. Gray says (*l. c.* p. 292), "Prof. Max Schultze enters into a long description of the spicula of the sponge, and figures several of them; but I cannot see what bearing that has on the subject; for he does not show that any spicula of a true sponge are like the spicula that form the axis of the coral. They certainly have little affinity to the elongated siliceous spicula of the genus *Alcyoncellum* or *Euplectella*, with which they have been compared." But in reality my "long" description of the spicules of the sponge included the incontrovertible proof of the mutual relation of the latter and the "Glass Rope," and places it beyond a doubt that the nearest allies of *Hyalonema* are the *Euplectellæ* (*Alcyoncellum* Quoy & Gaim.) from the Philippines, which are to a certain extent similar even in external form.

The proof lies in the form and intimate structure of the spicules of the inferior sponge. Notwithstanding great external differences, all these spicules have something in common which is wanting in the spicules of other sponges, and therefore sharply characterizes the *Hyalonema*-sponge. This is the peculiarity that the longitudinal canal presented by the spicules possesses one or two perpendicularly placed *transverse canals* almost exactly in the middle. Very frequently the spicules, at the point where these short transverse canals are situated internally, show externally perceptible thickenings, which may grow out into longer lateral branches; and by this means are produced the numerous cruciform spicules figured by me, and so characteristic of the *Hyalonema*-sponge as to furnish a diagnostic character even for the inconsiderable traces of the sponge which often alone remain in imperfectly preserved specimens. In other cases the external dilatations or lateral branches at the locality of the transverse canals are entirely wanting; but by careful examination the transverse canals themselves may always be found, even in the perfectly smooth awl-shaped spicules (see taf. iii. fig. 1 of my monograph).

But if this structure be characteristic of the whole of the spicules of the sponge of *Hyalonema*, it might be expected that, if the long threads (as can no longer be doubted) be parts of this sponge, it will also occur in these long threads of the "Glass Rope." On account of the difficulty of finding any fine transverse canals that might be present about the middle of the longest spicules, which measure from one foot to a foot and a half in length, I looked out the shortest threads of the "Glass Rope." They occur in the inferior extremity, which is enveloped

by the sponge, of not more than a few millimetres in length. That, nevertheless, they are related to the long threads is shown by their great thickness, in which they agree precisely with the thinnest of the long threads. These are indubitable intermediate structures between the short spicules of the sponge and the long ones of the "Glass Rope." These short, thick spicules are rare; but the few examples of them which I found were quite sufficient to establish the correctness of my supposition. About the middle of the space between the two pointed ends they possess the characteristic fine transverse canals of the axial canal quite distinctly, although externally not the slightest dilatation of the spicules is to be observed at the spot in question (see taf. ii. fig. 6 of my book). After this favourable result I also examined the longer spicules, and had the good fortune to discover the short transverse canals in fragments of the middle of these mounted in Canada balsam.

Thus, therefore, we have every imaginable proof of the mutual relation of the "Glass Rope" and the sponge, which may be briefly recapitulated as follows:—

1. The long siliceous threads are in structure indubitable sponge-spicules. They must therefore have been produced in a sponge.

2. Such a sponge, likewise with siliceous spicules, occurs constantly at the lower extremity of the "Glass Rope" in organic connexion therewith. Even when the "Glass Rope" is injured and smeared with cement ("Kitt") the traces of the sponge may be detected if only a portion of the inferior finely pointed ends of the long siliceous threads is preserved.

3. The sponge at the lower extremity of the long threads has very characteristically constructed spicules, inasmuch as their axial canal always possesses one or two perpendicular transverse canals. The same characteristic structure is also displayed by the longer and shorter threads of the "Glass Rope."

The following important circumstance must still be mentioned. Of all known Sponges only the rare and extraordinarily elegant *Euplectella* (Owen) from the Philippines is somewhat allied to *Hyalonema* in external form. These *Euplectella* consist of a sponge-body composed of beautifully interlaced siliceous spicules, and cylindrical in form, from the upper end of which projects a tuft (a cord) of long, silky, thin siliceous spicules, in which Bowerbank has found threads of 3 inches in length. I have examined perfect specimens of *Euplectella* in Leyden, and I found that even in the intimate structure of its spicules it very closely agrees with *Hyalonema*. In fact the most important character of the spicules of *Hyalonema*, namely the single or double transverse canal of the axial canal, is reproduced in *Eu-*

plectella. By this, notwithstanding many differences in other respects in the form of the spicules, the affinity of the two genera is proved; for, as far as our present investigations reach, this character is met with in no other sponge. Dr. Gray had lately the very great kindness of his own accord to send me a few spicules from a *Euplectella* from the Philippines, recently received at the British Museum. The microscopic examination of these furnished precisely the same result as my previous examinations in Leyden. These spicules, also, all possess the transverse canal, and among the cruciform the three-armed specimens (taf. iii. fig. 18 of my book) predominate.

Thus, therefore, I believe, the mystery of the nature of *Hyalonema* is solved; and at the same time we have found a near relative of the remarkable organism, so that we must take into consideration its systematic arrangement. In *Hyalonema* and *Euplectella* we have to do with siliceous sponges (*Halichondriæ*) without horny fibres, distinguished by a tuft (cord) of long siliceous spicules, which projects from one extremity of the sponge-body. I give these the name of "Crested Sponges" (*ΛΟΦΟΣΠΟΝΓΙÆ**), and they form a family with two genera—(1) *Hyalonema* (Gray), from Japan, and (2) *Euplectella* (Owen), from the Philippines.

Dr. Gray, in his memoir already repeatedly cited, mentions a specimen of *Hyalonema* particularly favourable to his opinion, which was received by Professor Barboza du Bocage of Lisbon from a friend, to whom it was brought by a Portuguese sailor, who professed to have fished it up off that coast. I must admit that the study of the memoir by Professor Barboza in the 'Proceedings of the Zoological Society of London' (June 1864) has not impressed me with the notion that this Portuguese specimen can in the least alter the position of the question as to the nature of *Hyalonema*. For similar specimens of *Hyalonema*, in which the inferior sponge is wanting, are plentiful enough in collections, and a careful examination of them shows that they have been injured. But that the Portuguese specimen was *not* injured, we have not the least evidence. Whether, from the statements of Professor Barboza du Bocage we are to ascribe to the *Hyalonemata* a wider geographical range than the sea around Japan, is another question, which I will not decide. In any case I should have preferred waiting for further information as to the occurrence of *Hyalonema* on the Portuguese coast before venturing to cite Lusitania side by side with Japan as a certain habitat of these singular sponges.

Addendum.—I see from the November part of the 'Annals,' which has just reached me, that Dr. Bowerbank, in a reply to

* From *λόφος*, a crest, or tuft of feathers.

Dr. Gray, printed at p. 397, has maintained, in accordance with my view, that *Hyalonema* is not a coral, but a sponge. As I think that he has not defended his conviction of the mutual relation of the "Glass Rope" and the sponge adhering to its lower extremity with such striking arguments as, in my opinion, have been put forward in the preceding article, I do not regard the publication of my remarks as superfluous. Dr. Bowerbank promises a complete monograph upon *Hyalonema*, in which he intends to prove that the polype-coat of the "Glass Rope" is not a polype, but also a *portion of the sponge* ("a cloacal system"). Here, therefore, we have a third view as to the nature of *Hyalonema*, according to which the concurrence of a parasite is entirely excluded.

Dr. Bowerbank supports his opinion upon the fact that the same cruciform spicules which are characteristic of the sponge of *Hyalonema* occur also in the supposed polype-coat. I admit that this circumstance is very likely to lead one to agree with Dr. Bowerbank in opinion. I also admit that, after my first microscopic examination of the specimens at Leyden, I favoured the same opinion that Dr. Bowerbank expresses (see 'Comptes Rendus,' 23rd April, 1860, p. 792). But the careful examination of the cortical layer in question proves incontrovertibly that it consists of polypes and is no part of the sponge. When the bark of well-preserved specimens is softened in water, or especially in dilute solution of potash, not only do the tentacles of the polypes make their appearance in their characteristic form (see taf. v. fig. 4 of my monograph), but the higher powers of the microscope even show that the tentacles and many other parts of the polypes are beset with unmistakable urticating organs. These are in part of comparatively large size, and present an internal rolled thread like the fresh urticating organs of the polypes and medusæ, leaving not the smallest doubt that we have to do here with true Polypes. All this I have already described in detail and illustrated with figures in my monograph (1860) above quoted. Dr. Bowerbank has made no mention of these circumstances; and also in his memoirs published in the 'Philosophical Transactions' (vol. clii. part 2, 1862, pp. 747 & 1087, plate 31. figs 3-6), in which he figures the siliceous spicules of *Hyalonema*, there is no intimation that several years previously I had already described these spicules, in my opinion, much more perfectly.

After the preceding statements, the circumstance that scattered siliceous spicules are imbedded in the skin of the polype can no longer furnish evidence that in these polypes we have only a "cloacal system" of the sponge, as Dr. Bowerbank thinks; for we know that *Palythoa* and other *Zoanthidæ* take up foreign

bodies into their substance. And the siliceous spicules of *Palythoa fatua* upon *Hyalonema* are evidently foreign bodies of this sort, since, as I have described, they occur mixed with sand, shells of Polythalamia, and other structures.

I have still a word to say upon nomenclature. Dr. Bowerbank names the sponge *Hyalonema mirabilis*. Of course there is nothing to object to in this name; but Dr. Gray had already (1835) named the same structure *Hyalonema Sieboldi*. The first specimens were sent to Europe, so far as we know, by the celebrated Japanese traveller Von Siebold. This name is therefore also certainly quite suitable; and as it has the priority, I think it would be well to retain it. From my observations there does not appear to be the least reason for the establishment of two distinct species.

Bonn, January 1867.

XXVII.—Description of a new Freshwater Bivalve found in Trinidad. By R. J. LECHMERE GUPPY, Esq., F.G.S.

Cyclas punctifera, Guppy.

Shell somewhat subquadrately oval, thin, diaphanous, close, finely striate concentrically, whitish horny, or slightly tinted with fuscous patches near the umbones, and covered with numerous granular points, which are finer and more crowded on the umbones, where the concentric striation is less evident; anteriorly rather short and subangulate, posteriorly a little truncate; hinge with well-developed lateral teeth in both valves, $\frac{1-1}{1-1}$; cardinal teeth $\frac{2}{2}$, small.



This curious little shell varies somewhat, and specimens are sometimes more oval and compressed than the one figured. Occasionally they are higher and shorter, with a steeper posterior slope. The granular points are more easily seen in dead shells, which are opaque. In living examples they seem, under a strong lens, to bear short hairs. The length of a large example is 4 millimetres, height $3\frac{1}{2}$ millims., thickness $2\frac{1}{2}$ millims. Of an average example the length is 3 millims., height $2\frac{1}{2}$ millims., thickness 2 millims.

Among species of the genus *Cyclas* the shell now described would appear to resemble most *C. argentina*, D'Orb., and *C. calyculata*, Drap. It is usually more equilateral than either of those species. The epidermis is thin and colourless, so that the striate gills may be seen through the shell. The umbones are not so prominent as those of *C. calyculata*, but they are occa-

sionally flattened or otherwise distorted. The foot is whitish translucent, and may be extruded to a length more than equaling that of the shell, the body being brought up to it with a jerk, as in allied species. Full-grown examples are slightly more equilateral and more angulate than young ones.

The first example was found by Mr. Prestoe, the colonial botanist, when we were examining the weeds in a pond at St. Ann, near Port of Spain, for Mollusca.

Port of Spain, Trinidad.

January 8, 1867.

XXVIII.—*Descriptions of five new Genera and some new Species of Satyride Lepidoptera.* By ARTHUR G. BUTLER, F.Z.S., Assistant, Zoological Department, British Museum.

[Plate IV.]

THE genus *Lasiommata* of Westwood has hitherto contained Satyridæ which differ in size, colouring, and structure. The type of this genus appears to be the well-known *L. Aegeria* of Linnaeus*; this insect, however, does not possess all the requisite characters, nor, indeed, can I find any species that entirely answers to the description of the genus. *Megara* certainly possesses a pear-shaped club to the antennæ: these are not, however, distinctly annulated with white; moreover the apical joint of the palpi is somewhat elongate, and unlike that of *Aegeria*.

I propose in the present paper to separate the different structural forms under generic heads; and as the characters of *Lasiommata* have necessarily been made very general, so as to include very widely distinct species †, I shall redescribe the genus, and thereby, I hope, make it more defined.

Genus LASIOMMATA (*Pararge*, Hübn.)‡.

Lasiommata, part., Westwood.

Alæ anticæ elongato-triangulares, costa plus minusve arcuata; apice vix angulari; margine postico apud apicem plerumque paulum angulato; margine interiore subrecto; venis velut in *Debe* (nec *Arge*) positis.

* See Westwood & Humphrey's 'British Butterflies,' p. 65 (1840).

† See Gen. Diurn. Lepid. p. 385. "Antennæ straight, distinctly annulated with white, not quite half the length of the fore wings, terminated by a distinct, compressed, pear-shaped club, the tip bent outwards; the club, however, varies considerably in shape, being elongated and very gradually formed in some of the exotic species' (*L. Aegeria*?).

‡ I am not quite satisfied that the genus *Pararge* of Hübnér's 'Verzeichniss' should not supersede *Lasiommata*; though not sufficiently characterized, it certainly possesses the advantage of priority.

Alæ posticæ pyriformes, costa paulum arcuata; margine postico distincto denticulato; margine interiore undato, rarius ad angulum ani inciso.

Corpus pedibus anticis distinctis, lanaribus; antennis (fig. 2^a) aliquando albo annulatis nec costæ medium anticarum attingentibus, clava gradatim formata; palpis lanaribus, articulo apicali brevi (fig. 2).

1. *Lasiommata Ægeria*.

Papilio Ægeria, Linnæus, Syst. Nat. i. p. 473 (1758).

Hab. England and South Europe. B.M.

2. *Lasiommata Tircis* (*Ægeria*, ♀, var.?).

Satyrus Tircis, Godart, Léop. de France, i. p. 163, pl. viii. a. f. 1 (1821).

Hab. France.

3. *Lasiommata Meone*.

Papilio Meone, Cramer, Pap. Exot. 4. pl. 314. figs. E, F (1782).

Hab. South Europe. B.M.

4. *Lasiommata Xiphia*.

Papilio Xiphia, Fabricius, Ent. Syst. iii. 1. p. 492. n. 215 (1793).

Hab. Teneriffe; Portugal. B.M.

5. *Lasiommata Roxelana*.

Papilio Roxelana, Fabricius, Ent. Syst. iii. 1. p. 227. n. 712 (1793).

Hab. Smyrna and Mount Hermon (Syria). B.M.

6. *Lasiommata Clymene*.

Papilio Clymene, Fabricius, Ent. Syst. iii. pt. 1. p. 242. n. 753 (1793).

Hab. Russia? B.M.

7. *Lasiommata Dejanira*.

Papilio Dejanira, Linnæus, Syst. Nat. ii. p. 774. n. 154 (1766).

Hab. Central Europe. B.M.

∴ Cum nonnullis aliis.

AMECERA, gen. nov.*

Lasiommata, part., Westwood.

Alæ anticæ margine postico minime undato nec apud apicem angulato; posticæ valde elongatæ, margine postico vix sinuato; aliter

* The genus *Dira* of Hübner cannot be adopted, as it includes several distinct forms, the type species, moreover, being a true *Lasiommata*. Herr Ström, in the 'Naturhistorisk Tidsskrift' for 1866, has briefly characterized Hübner's *Pararge* (*Pararga*), taking for his type the *Megara* of Linnæus; this species, however, was referred by Hübner to his genus *Dira*, and if placed in *Pararge* would displace the original type.

velut in *Lasiommata*; venis velut in *Lasiommata*, cella autem posticarum brevior.

Corpus antennis magis elongatis et tenuioribus, clava pyriformi compressa; palpis (fig. 1^a) articulo apicali magis elongato (fig. 1).

1. *Amecera Megæra*.

Papilio Megæra, Linnæus, Syst. Nat. ii. p. 771. n. 142 (1766).

Hab. England; Europe. B.M.

2. *Amecera Lyssa* (*Megæra*, var.).

Satyris Lyssa, Hübner, Europ. Schmett. 1. n. 114-117 (1805).

Hab. Dalmatia. B.M.

3. *Amecera Tigelius*.

Papilio Tigelius, Bonelli in Mem. Accad. Torino, xxx. t. 1. f. 2 (1826).

Hab. Sardinia; Corsica. B.M.

4. *Amecera Mæra*.

Papilio Mæra, Linnæus, Syst. Nat. ii. p. 771. n. 141 (1766).

Hab. South Europe. B.M.

5. *Amecera Eversmanni*.

Hipparchia Eversmanni, Eversmann in Bull. Soc. Imp. Nat. Mosc. pl. 2. f. 3-6 (1847).

Hab. Dauria?

6. *Amecera Hiera*.

Papilio Hiera, Hübner, Europ. Schmett. i. n. 176 (1815).

Hab. Helvetia. B.M.

7. *Amecera Shakra*.

Satyris Shakra, Kollar in Hügel's Kaschmir, p. 446, tab. 15. figs. 3, 4 (1848).

Hab. Himalayas. B.M.

8. *Amecera Menava*.

Lasiommata Menava, F. Moore, Proc. Zool. Soc. p. 499. n. 83, pl. 30. f. 3 (1865).

Hab. Middle Kunawur; Germany. B.M.

9. *Amecera Baldiva*.

Lasiommata Baldiva, F. Moore, Proc. Zool. Soc. p. 499. n. 84, pl. 30. f. 4 (1865).

Hab. Spiti and Tibet.

Cum nonnullis aliis.

RHAPHICERA, gen. nov.

Alæ anticæ elongato-triangulares, costa subconvexa; margine postico brevi, convexo; margine interiore subrecto; venis ad basim vix tumidis, velut in *Lasiommata* positis; venis disco-cellularibus obliquis: posticæ pyriformes, costa subrecta; margine postico denticulato; margine interiore subintegro: alæ supra velut in *Satyro* ♀, subtus velut in *Arge* magis scriptæ.

Caput antennis alarum medium attingentibus, elongatis, tenuibus, clava gradatim formata (fig. 4^a); palpis elongatis, lanaribus, articulo apicali distincto brevi.

1. *Rhaphicera Satricus*. Pl. IV. fig. 3.

♀. *Lasiommata Satricus*, Hewitson & Westwood, Gen. Diurn. Lepid. p. 387. n. 14, pl. 64. f. 4 (1851).

Hab. Eastern Himalayas. ♀, B.M.

2. *Rhaphicera Moorei*, n. sp. Pl. IV. fig. 4.

Lasiommata Satricus, Moore, Proc. Zool. Soc. p. 499. n. 82 (1865).

♀. Alæ supra flavo-ferrugineæ, pallidæ, eis præcedentis simillimæ sed minores: anticæ venis omnibus fuscis; basi fuscescente; fasciis latioribus nigris; fascia discali ad marginem interiorem continuata; puncto minuto medio discali nigro: alæ posticæ magis denticulatae; area interna olivaceo-fuscescente; serie ocellorum sex, pupillis griseis; margine externo fuscescente.

Alæ anticæ subtus fascia discali tenuiore, ocellis minoribus; margine postico paulum fuscescente: posticæ pallidiores, ocellis approximantibus; lineis mediis continuis, magis irregularibus; lineis submarginalibus magis undulatis.

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

Hab. North-western Himalayas. Coll. F. Moore.

This insect has been very kindly lent to me by my friend Mr. Moore; and, as it proves to be distinct from *Satricus*, I have great pleasure in naming it after him. The genus *Rhaphicera* must be placed after *Arge*.

The two following genera are in part represented by the subgenus *Xenica* of Westwood; they may be readily distinguished from the other insects with which they have hitherto been associated by the elongate compressed form of the hind-wing cell, and also by the different character of the markings.

Lasiommata Abeona, which was also included in *Xenica*, and its ally of our plate (fig. 8), appear, from the construction of their palpi, to be more nearly allied to *Epinephele* or *Satyris*.

GEITONEURA, gen. nov.

Alæ magnitudine mediocres: anticæ subtrigonatæ, costa subrecta; margine postico integro subconvexo; margine interiore recto; venis ad basim tumidis; venis disco-cellularibus linea undata oblique

currentibus; nervulo primo mediano post venæ medianæ medium emisso; venis aliis velut in *Lasiommata* positis.

Alæ posticæ pyriformes, cella elongata de medio abrupte attenuata et apice oblique truncato (fig. 5).

Caput palpis elongatis, cirratis, articulo apicali brevi; antennis brevibus, clava gradatim formata (fig. 5^a); oculis exstantibus, nudis.

1. *Geitoneura Klugii*.

♀. *Satyrus Klugii*, Guérin, Voy. Coquille, Atlas, Ins. pl. 17. f. 2 (1826).

♂. *Satyrus Singa*, Boisduval, Voy. de l'Astrolabe, Entom. pt. 1. p. 144 (1832-33).

Hab. King George's Sound, New Holland. B.M.

2. *Geitoneura Achanta*.

Papilio Achanta, Donovan, Ins. New Holland, pl. 22. f. 2 (1805).

Hab. New Holland. B.M.

L. Cordace may belong to this genus; but, as I have only seen the figure, which represents this species with a simple hind-wing cell, I am unwilling to include it. *Geitoneura* will come next to *Rhaphicera*.

The two following insects, though somewhat like the species of *Geitoneura*, cannot be included, on account of the compressed pear-shaped club of their antennæ and the different form of their palpi. I therefore propose to give them the generic name of *Argynnina*.

ARGYNNINA, gen. nov.

Xenica, part., Westwood.

Alæ parvæ: anticæ elongatæ, subtrigonatæ, marginibus subrectis; angulo anali convexo; venis ad basim tumidis; cella elongata, post alarum medium extendente; venis disco-cellularibus linea obliqua undata currentibus; nervulo primo mediano ad venæ medianæ medium emisso.

Alæ posticæ pyriformes, cella elongata de medio gradatim attenuata, et apice subconvexo (fig. 6).

Caput palpis brevioribus lanaribus; antennis brevibus undatis, clava compressa pyriformi, apice reflecto (fig. 6^a); oculis exstantibus, cirratis.

1. *Argynnina Hobartia*.

Lasiommata Hobartia, Westwood, Gen. Diurn. Lepid. p. 387. n. 21. desc. footnote (1851).

Hab. Van Diemen's Land. B.M.

2. *Argynnina Lathoniella*.

Lasiommata Lathoniella, Westwood, Gen. Diurn. Lepid. p. 387. n. 25. desc. footnote (1851).

Hab. Van Diemen's Land. B.M.

The genus *Argynnina* must be placed between *Geitoneura* and *Satyrus*.

NEOPE, gen. nov.

Enope, F. Moore, Cat. Lep. Mus. E. I. C. p. 228 (1857).

Neope, F. Moore, Proc. Zool. Soc. p. 770 (1865).

Alæ magnæ : anticæ elongatæ, subtrigonatæ, costa paulum convexa ; margine postico denticulato ; margine interiore convexiusculo, rarius recto ; venis ad basim vix tumidis, velut in *Debe* positis ; maculis ocellisque ut in *Lasiommata*.

Alæ posticæ forma venisque *Debis*, *Samionis*, *Syrgidisve*.

Alæ subtus ocellis submarginalibus ; area basali striis fasciisque irregularibus scripta. Antennæ clava gradatim formata (fig. 7^a).

The species composing this genus seem very closely allied to some of the species of *Debis* ; and I almost question the propriety of separating them from that genus. Although somewhat similar in markings and coloration to some of the species of *Lasiommata*, they differ entirely in structure.

1. *Neope Bhadra*.

Lasiommata? *Bhadra*, Moore, Cat. Lep. Mus. E. I. C. p. 227. n. 478 (1857).

Hab. Darjeeling, East Indies. B.M.

2. *Neope Pulaha*.

Lasiommata? *Pulaha*, Moore, Cat. Lep. Mus. E. I. C. p. 227. n. 477 (1857).

Hab. Bootan, India. B.M.

3. *Neope Moorei*, n. sp. Pl. IV. fig. 7.

♂. *Enope Pulaha*, ♀, F. Moore, Brit. Mus. Coll.

Alæ supra flavo-olivaceæ, venis ochraceis : anticæ maculis septem elongatis ovalibus ochraceis, prima et secunda a fasciola fusca interruptis, tertia, quinta et sexta maculas magnas nigro-fuscas, et septima maculam parvam, includentibus.

Alæ posticæ maculis septem submarginalibus ochraceis, prima et septima minimis, de septima ad secundam longitudine crescentibus, omnibus maculas fuscas includentibus ; linea marginali et margine ipso post medium griseo-fuscis. Corpus ochraceum.

Alæ subtus ochraceæ pallidæ, cella anticarum et area basali posticarum a lineis striisque irregularibus variegatis ; fascia valde irregulari media continua, lineis duabus marginalibus et margine ipso fuscis.

Anticæ apice fuscescente, maculis quatuor submarginalibus, prima ocellari nigra ochreo cincta et albo pupillata, secunda ochracea, tertia et quarta nigris : posticæ ocellis septem nigris albo pupillatis, flavo cinctis et fusco circumcinctis, septima geminata, tertia et quarta minimis. Corpus pallido-ochraceum.

Exp. alar. unc. $3\frac{1}{8}$.

Hab. East Indies. ♂, B.M.

4. *Neope Japonica*, n. sp.

♂ ♀. *Neope Pulaha*, ♀, Butler, Proc. Linn. Soc. vol. ix. p. 56. n. 21 (1866).

Alæ supra eis præcedentis simillimæ, sed minores, medio marginis postici posticarum vix producto; margine minus sinuato; area apicali magis fuscescente.

Alæ subtus ocellis omnibus multo minoribus; fasciis striisque magis fuscescentibus; posticæ et apex anticarum pallide cinerascens.

Exp. alar. unc. $2\frac{7}{8}$.

Hab. ♂, Japan; ♂ ♀, Hakodadi. B.M.

This is probably a local form of the preceding species; it chiefly differs in its smaller size, less angular hind wings, smaller ocelli, and dark basal markings.

The following new species has just arrived from Western Australia:—

Hipparchioides Duboulayi, n. sp.

♂. Coloribus fere *Meropes*, ocellis autem anticarum supra valde minoribus, fasciisque discoideis minus obliquis; fascia discali posticarum magis regulari, nigrescente nec ad costam currente; fascia submarginali continua; ocello subanali multo majore.

Alæ subtus magis rufescentes, ocello subapicali anticarum parvo nec fusco circumcincto, pupilla minima; fasciis transversis tenuioribus: posticæ fasciis rufescentibus, multo magis regularibus; ocello subanali parvo vix pupillato; ocellis subapicalibus obsolete.

Alæ multo angustiores et elongatæ.

Exp. alar. unc. $2\frac{5}{8}$.

Hab. Champion Bay. B.M.

This species is closely allied to *Merope*, but differs entirely in the form of its wings, the position of the bands and lines, the small ocellus of the front and the large ocellus of the hind wings, also in having only one ocellate spot in the hind wings on the underside. I have named it after its captor.

XXIX.—*List of Coleoptera received from Old Calabar, on the West Coast of Africa.* By ANDREW MURRAY, F.L.S.

[Continued from vol. iv. p. 358*.]

NITIDULIDÆ (continued).

3. *Brachypeplus (Liparopeplus) colastoides*, Murr. in Monog. of Nitid. in Linn. Soc. Trans. vol. xxiv. p. 307.

Not very scarce.

* These papers have been interrupted for some time by pressure of more engrossing occupations. It is with pleasure that I find myself now able to resume them.

PROMETOPIA, Er.

The species belonging to this and some of the following genera are of special interest from their geographical distribution, several of them being closely allied to forms characteristic of the opposite part of the continent of America, and others showing an affinity with the Indo-Malayan region.

There are only two species of *Prometopia* as yet described, viz. *sexmaculata* and *confluenta*, Er.,—the former from North America, the latter from Columbia.

I have species of the genus from the following countries, viz. :—

One species	from North America	(<i>sexmaculata</i> , Er.).
Two	„	Mexico.
One	„	Columbia (<i>confluenta</i> , Er.)
One	„	the Amazons (Santarem).
One	„	Ega.
One	„	Old Calabar (<i>binotata</i> , infrà).
One	„	the East Indies.
Five	„	Borneo, the Philippine Islands, Morty, Flores, Cambodia, &c.

That from Old Calabar is more like the species from the Indo-Malayan district than those from America, being smaller and rounder, but in facies and all the essential characters of the genus corresponds with them.

Prometopia binotata.

Rotundato-ovalis, nitida, leviter punctata, brunnea; elytris singulis disco prope suturam leviter rufo-notatis.

Long. $1\frac{3}{4}$ lin., lat. 1 lin.

Roundish-oval, shining, finely punctate, dark chestnut-brown, with the margins translucent and reddish, and a pale, rather large, ill-defined, oblong reddish spot on the disk of each elytron reaching nearly to the suture; head not so shining, and rather more roughly punctate than the rest. Mandibles bidentate. Labrum slightly emarginate in the centre, and with two slight, rounded denticulations on each side. Head rather broad. Prothorax deeply emarginate in front; anterior angles acute; sides rounded, with a flat expanded margin very slightly reflexed; base with the posterior angles extending back rather further than the middle; disk smooth and without depressions. Scutellum rather small and transverse. Elytra about twice the length of the thorax; sides slightly expanded, and most so at the



base, and with the margins very slightly reflexed, the expansion and reflected margin not extending further than two-thirds from the base; sutural apical angle slightly rounded; the spot on the elytra placed near the suture and scutellum, and extending somewhat obliquely outwards. Pygidium slightly visible. Under-side moderately shining; metasternum finely irregularly punctate. Segments of abdomen longitudinally finely rugose, and with a luteous narrow margin. Legs lighter brown than the body; the middle and posterior thighs obliquely finely aciculary scratched.

Scarce, only two or three specimens having been received, which I owe to the Rev. W. C. Thomson.

This genus, so far as I know, has never been figured: I have therefore given a rough woodcut outline to give a general idea of the facies of the above species.

AXYRA, Er.

1. *Axyra perforata* (*Galaor perforatus*), Thomson, Archiv. Entom. ii. p. 43.

M. Thomson, apparently not having known Erichson's genus *Axyra* nor his species *Axyra brunnea*, from Guinea, which is almost identical with this, has described it as the type of a new genus, under the name of *Galaor*. He says that it differs from the genus *Lordites* by its tarsi not being dilated, and by the second article of its antennæ being small. The latter of these characters is not sound, there being scarcely any difference in the size of the second article of the antennæ in *Lordites* and *Axyra*, and there being (so far as I can remember) not a single insect in the whole family which has not the second article of the antennæ small. The former character is one of those on the strength of which Erichson placed *Lordites* among the Strongyliini, and *Axyra* among the Nitidulinæ. Lacordaire has thought that it is not a sufficient character for this purpose; for he has disregarded it, and combined *Lordites* and other similar genera along with *Axyra* as part of one general section of what he considers typical Nitidulinæ. But the main character by which he does distinguish the true Strongyliini (or Cychramidæ, as he calls them) seems to me no better, indeed scarcely so good, viz. that in the Nitidulinæ the thorax is only applied to the base of the elytra, while in the Cychramidæ it laps over them. In some, such as *Lobiopa* and *Æthina*, it is scarcely possible to say whether the thorax laps over or is only applied to the elytra. On the whole, weighing these characters singly, I should prefer to rest the separation of the sections on the dilatation of the tarsi; but probably the better plan would be to have three sec-

tions of this group of the Nitidulidæ instead of two—the Nitidulinæ, the Lorditinæ, and the Cychraminæ. At any rate, it is clear that M. Thomson, in contrasting *Axyra* with *Lordites*, has not selected the most kindred form. It lies in affinity, as it does in geographical position, between the South-American *Psilotus* and the Indian *Ischæna*. There are, however, one or two undescribed South-American insects identical in form and facies with *Axyra*, differing only (so far as facies is concerned) in being more shining and less rough. There are some trifling differences in the parts of the mouth, such as the labrum being only slightly emarginate instead of deeply bilobed, which may perhaps warrant us in erecting them into a separate genus or subgenus (which I call *Axyrodes*); but they are to all intents and purposes true South-American representatives of the African genus *Axyra*.

The geographical distribution of that genus is:—

1. *Axyra brunnea*, Er. Guinea.
2. ——— *picea* (*Nitidula picea*, Boh.). Natal.
3. ——— (*Galaor*) *perforata*, Thoms. Gaboon and Old Calabar.
4. A more convex species, with conspicuous rows of white bristles, which I have received with the simple locality "Africa" attached to it, but which I have also seen in the Marquis de Laferté's collection, standing under the name *albosticta*, from India. In the discrepancy of localities, I prefer Africa; and I prefer my own provisional name of *setosa* to *albosticta* of Laferté; as there are no white dots upon it, only white bristles.
- 5 & 6. The two following, *elongata* and *papillosa*, from Old Calabar.

The two species of *Axyrodes* which I have seen are, one found at Ega by Mr. Bates, the other sent from Merida by M. Pilate.

The genus *Axyra* is figured by Lacordaire in the plates of his 'Genera des Coléoptères.' As I have alluded to a certain degree of affinity between *Axyra* and *Psilotus*, I may take this opportunity to point out an error in Lacordaire's figure of the dissections of the parts of the mouth of *Psilotus carbonicus*, Erich., which at first puzzled me, and may lead to a wrong appreciation of the affinities of that genus, especially when it has crept into a work of such importance and accuracy as Lacordaire's 'Genera.' The representation of the maxilla is quite right; but by some unhappy mischance the ligula of a *Colastus* has got substituted for that of *Psilotus*. The paraglossæ or appendages of the ligula of *Colastus* are very remarkable. No other beetle, so far as my experience goes, has anything like them. They have something of the form of the flourish of a cow's horn.

Fig. A, which is a copy of Lacordaire's ligula of *Psilotus carbonicus*, is a correct representation of that of a *Colastus*. Fig. B



is that of *Psilotus*. I ought to say that I have not dissected the mouth of *Psilotus carbonicus*. I have only one specimen, and do not choose to risk it, especially as I have dissected *Psilotus cornutus* and *Psilotus ventralis*, both of which have the ligula of one type (viz. that above shown) and are as close as can be to *Ps. carbonicus* in other characters. *Axyra* has the same type of ligula as *Psilotus*, only the appendages are a little straighter in front.

Axyra brunnea and *perforata* are so very close to each other that I have great hesitation in keeping them distinct. Still, if a number of specimens were mixed together, they could be distinguished, and I therefore allow the species to stand.

Axyra brunnea has a tinge of brown in its black, while *A. perforata* is coal-black: the former has the thorax a little wider, especially in front; and the latter has the punctures on the elytra a little more regular and better defined, they producing in the former more the effect of papillæ than of punctures.

Not scarce, a good many specimens having been received.

2. *Axyra elongata*.

Nigra, fortiter punctata, *A. perforatæ* valde affinis, parum angustior, magis plana.

Long. $3\frac{3}{4}$ lin., lat. $1\frac{1}{2}$ lin.

Perhaps only a variety of the preceding species; narrower, comparatively not so broad in front, and rather flatter, especially the disk of the prothorax. The little longitudinal prominence or ridge on each side at the base of the thorax almost effaced.

Three specimens are all that I have seen.

3. *Axyra papillosa*.

Affinis præcedentibus, sed minor; brunneo-nigra, fortiter punctata; clytris subpapillois; thorace latiore pone medium, et angulis posticis abrupte inflexis.

Long. $2\frac{3}{4}$ lin., lat. $1\frac{1}{2}$ lin.

Easily distinguished from the preceding by the form of the thorax. In all the other species the posterior halves of the sides

of the thorax are nearly straight and parallel; in this species they are suddenly turned in near the posterior angles, not unlike those of some of the *Epureæ*. It is flatter, comparatively broader, and has less than the other species of the typical straight parallel character of the genus, and more of the ordinary facies of the genus *Nitidula*, and is about the size of *Soronia punctatissima*. It has the roughened rasp-like texture of the other *Axyræ*, and has short pale brownish bristles or stiff hairs scattered over it. The thorax is narrower in front than behind; the short basal ridges on each side are nearly effaced, although a slight, rough, raised line may be traced; between it and the posterior angles is a deep round fovea; on the inner side of it there is a smooth, shining line, and between those on each side the basal central space is almost impunctate. The disk of the prothorax is very faintly punctate, with two or three irregular rows of larger punctures and setæ; the sides are explanate and rough, with coarse punctuations, in some lights looking like longitudinal rugosities; the base is nearly straight. Scutellum rounded at the apex, glabrous and impunctate. Elytra roughened like a rasp from punctures appearing as if made from behind; they are very close, but are in something like rows; the margins are deeply channelled, and have a series of larger punctures. The setæ are in four rows, some of them double towards the apex. The disk of the elytra equably convex, instead of being flattish as in the preceding species. In other respects similar to them.

Only one specimen received.

TARACTA, nov. gen. (from *ταράκτης*, a disturber).

I have given this new genus the above name in allusion to the difficulty of placing it, and the disturbance it occasions to the harmony of previous arrangements. It is founded on a single specimen of a small brown insect which my friend Mr. Fry had received from Old Calabar, and which, with his usual liberality, he insisted on sacrificing to me, as it belonged to the family of my predilection.

Mentum broad and almost covering the inferior parts of the mouth, with a large tooth in the middle. Labrum almost entire, very slightly emarginate. Mandibles bidentate; both maxillary and labial palpi slender, the last lobe of each elongate-ovate. Head short, broad, and transverse. Antennal grooves converging. Antennæ slender, except the club, longer than the head; first article rather large, second small and roundish, third longer than the rest, fourth and fifth nearly equal, sixth, seventh, and eighth progressively smaller—all minute; the club rather large,

and the first article of it rather long. Thorax transverse; apex deeply emarginate; base nearly straight, with the lateral margins slightly reflexed. Elytra about twice and a half the length of the thorax, truncate at the apex, leaving the pygidium and the extremity of the penultimate segment of the abdomen exposed. Legs short; tarsi short; first three articles in all the feet dilated; claws simple. No prosternal keel, although a slight thickening between the coxæ of the two anterior legs.

It will depend upon the weight which is given to the dilated tarsi as a sectional character whether we should place this species among the Nitidulinæ or Strongyliini. I do not think that the species composing these two sections can be definitely separated by any characters which can be devised. The two extremes (*Nitidula* and *Strongylus*) are distinct enough, but they pass into each other by imperceptible degrees; indeed, as already said, there is actually a middle group, intermediate between them, which, I think, is entitled to a distinct place, and which passes by degrees into the two sections on each hand of it. The types of that middle group are *Stelidota* and *Lordites*; and it passes into the group of which *Nitidula* proper is the type through the present species and *Axyra*, to which this is certainly allied; while, on the other hand, *Lordites* passes into the group of Strongyliini, of which *Camptodes* may be taken as the type, through *Gaulodes*, *Æthina*, and *Amphicrossus*.

I have great faith in facies as a guide to affinities; but I have scarcely less faith in the texture of the integument. Take the most anomalous creature that the mind of man could conceive or the vagaries of nature produce, and according to the texture of its integument will its affinities be found to be. When the *Archæopteryx macrura* was first found, and the question was whether it was a bird or a reptile, and before Owen had pronounced it a bird, I remember saying, on the strength of the permanence of the characters of the epidermis, that from the feathers alone I was sure it must be a bird. The epidermis seems to retain its character longer than any other part of the body; the stripes remarked on by Darwin in horses, tigers, and other apparently most unkindred quadrupeds are long persistent evidence of community of descent. The same thing is very apparent in *Coleoptera*. Give any entomologist a microscopic fragment of the elytron of a *Cicindela*, and he will tell that it belongs to that group. Try him with a bit of a *Colymbetes*, and he will tell its place with equal certainty. In this new genus of uncertain seat, *Taracta*, which has the dilated tarsi of *Lordites*, I interrogate the chitinous texture of its covering, and I find a certain resemblance to *Axyra*. The insect undoubtedly stands near that genus.

Taracta Fryi.

Brunneus, subnitidus, punctatus; thorace disco fere lævi; elytris punctato-striatis, prope suturam fere lævibus.

Long. $1\frac{1}{2}$ lin., lat. $\frac{3}{4}$ lin.

Madder-brown; club of the antennæ and tarsi fawn-coloured. Slightly shining, somewhat obscured by the punctuation and a slight pubescence; the punctuation deepest and roughest on the sides, very fine on the disk of the thorax and near the suture of the elytra. Prothorax with sides gently rounded, widest a little before the middle; posterior angles obtuse, anterior somewhat acute, with the point rounded. Scutellum with the apex rounded, smooth. Elytra punctate-striate, the striæ fading off towards the suture, but under the glass very coarse towards the sides; a series of fine stiff pale hairs along the striæ and on the pygidium. Underside of head finely papillose, rest of body finely punctate. Legs with tibiæ simple; tarsi very short.

Named after the well-known entomologist Mr. Alexander Fry. One specimen is all that I have seen.



PLATYCHORA, Er.

(Subgenus *Pherocopsis*, Thomson, Arch. Ent. ii. 42.)

M. Thomson, in describing the genus *Pherocopsis*, which he made for the following species, says it ought to be placed next to *Lordites*. If it were a good genus, however, it is further removed from *Lordites* than even *Axyra* is. But in truth at most it is only a subgenus of *Platychora*. The only respects in which it differs from any of the characters of that genus are, the form of the emargination of the labrum and the mentum. In the African species the latter has not a tooth in the middle, while in the South-American species it is bisinuate and has a central projection. That is the only difference; and the points of agreement are of the more importance inasmuch as both forms differ from those which come nearest to them. The antennæ are peculiar in having all the articles from the third to the club not minute, and of uniform size and thickness. The tarsi are of medium size, but in both the fourth article is nearly as large as the third—a remarkable deviation from the usual proportions in the Nitidulidæ, of which an almost invariable character is that the fourth article is minute, often almost invisible. The maxillæ and the ligula and palpi of both are identical, and the flatness of the body and the general appearance and facies are also the same.

I consider them two sections or subgenera of one genus.

There are two species known in South America which compose the typical subgenus—*Platychora polita* and *P. Lebasii*.

And two from Africa, viz. *P. deplanata*, Boh., from Natal, and the following species. These compose the subgenus *Pherocopsis*.

P. ebena, Thoms. Arch. Ent. ii. 42.

Three or four specimens have been received.

LORDITES, Er.

The genus *Lordites* has never been figured, and I therefore give an outline of the species described below. Only two species have been described by Erichson in Germar's 'Zeitschrift,' iv., and six by Boheman, under the generic name *Soronia*, in his 'Insecta Caffraria.' Erichson's two are *Lordites procerus*, which is the *Lasiodactylus brunneus* of Perty (a rare large Brazilian species of a different facies and belonging to a different genus from the remaining *Lordites*), and the other *Lordites inquinatus*, described from a specimen whose country is unknown. The best-known species is yet undescribed: it is from the Malayan region, and stands in French cabinets under the name *Nitidula maculipes*. It is, however, the *Silpha limbata* of Fabricius—at least stands under that name in the Fabrician collection.

The geographical distribution of the genus is—

Six from South Africa (generally long and narrow; those described by Boheman).

Two from Madagascar (coming nearest to the South-African species).

One or two from Mauritius.

One from Old Calabar (described below).

One from Senegambia (exceedingly like the Indian species).

One, or perhaps two, from the East Indies and Philippine Islands.

Five or six from the Celebes and New Guinea group of islands.

Lordites circumflexus.

Magnus, ovatus, brunneus, subopacus, crebre punctatus, griseo pubescens; clytris luride ochraceis, singulis maculis brunneis, una basali utrinque prope scutellum, altera suturali pone scutellum, tertia laterali ante medium, medio fascia vel macula irregulari, et pone medium brunneo circumflexis; pygidio testaceo, punctato.

Long. 4 lin., lat. $2\frac{1}{4}$ lin.



Large, ovate, thickly punctate, griseo-pubescent, subopaque,

ochreous brown, the elytra ochreous clay-coloured, with brown markings. Head with a well-marked transversely curved fovea on each side in front. Antennæ and parts of the mouth yellowish brown. Thorax with the sides finely margined, widest at the posterior angles, which are nearly right angles and contain a slight rounded prominence, around which on the inner side and along the sides to the anterior angle there is a slight depression; anterior angles obtuse and equal; the disk smooth, convex. Scutellum triangular, punctate. Elytra closely punctate, the punctures in rows, and with griseous pubescence in rows; also with a series of longitudinal slight ridges on which the pubescence is more prominent; the sides are subparallel for two-thirds of their length, and with a reflexed margin. The colour of the elytra is dirty ochreous yellow, with dark markings of the colour of the thorax, viz. a spot on the base midway between the scutellum and the outer margin, and touching the shoulder, which is slightly prominent, a spot on the suture immediately behind the apex of the scutellum, another on the outer margin a little before the middle, but this is connected by a narrow neck with a broader marginal band which goes round the rest of the elytra to the apex; from the anterior part of this proceeds a transverse irregular band into the middle of the elytron, in the centre of which one or two ochreous spots are enclosed. The apex of the elytra is pointed, but the point is rounded. A part of the pygidium is exposed; it is pubescent and punctate, paler than the thorax and darker than the elytra. The underside is of the same colour as the thorax, and more finely punctate than the upper. The abdominal segments have a rather broad, impunctate, shiny, smooth margin. The legs are stout, and the tibiæ fold in upon the thighs, but not so much so as in the flatter-legged true *Strongyli*. Tarsi dilated and broadly ciliated.

Only one specimen has come under my notice.

ÆTHINA, Er.

As this genus has never been figured, I give a rough outline of the form of the following species. Indeed, although the *genus* has been described by Erichson in Germar's 'Zeitschrift,' vol. iv. p. 306, no *species* has yet been described. The species from which Erichson took the generic characters was *Æthina pubescens* (Klug, inedit.), which is very closely allied to the preceding, from which it differs in being brown and pubescent above, while the Old Calabar species is black and has no pubescence above. The Old Calabar species, too, is a trifle broader, and more tumid and convex, and has the sides of the elytra rounded in behind, while in *Æ. pubescens* they are more nearly straight to the truncate apex.

Æthina tumida.

Nigra, subrotundata, punctatissima, subnitida, lateribus ciliatis, supra haud pubescens, infra velutino pubescens.

Long. $3\frac{1}{4}$ lin., lat. 2 lin.

Black, very convex, broad oval or roundish, very closely punctate, so as to give a little dullness to the surface, still somewhat shining; the punctuation on the elytra so close as to seem irregular; but on closer examination it is seen to be arranged longitudinally, and, in certain lights, streaks, as of striæ, are visible. The lateral margins of thorax, elytra, and pygidium are ciliated with a fringe of close, short, bright tawny-coloured hairs; the disk of the thorax convex, and the convexity prolonged backwards, something like a raised lobe, to the middle of the base, descending rapidly so as to make a hollow on each side; the base deeply bisinuate, the posterior angles prolonged backward, overlapping the elytra, and acute, but with the points rounded; the apices of the elytra broadly truncate and rounded both at the sutural and external angles. The pygidium large and broad, punctate. The underside very faintly punctate, clothed with a thick coating of velvety pubescence of a tawny colour, longest along the margins of the segments of the abdomen. The legs are broad and flat, the tibiæ folding within the femora, as in the Strongyliini, and the tarsi short, dilated, and villose.



It may be that the absence of pubescence above in my species is due to its having been rubbed off; but I think not. If it had been so, some traces would have been left of it, while none exist, except below, where it is sufficiently abundant.

I have only received two specimens, both from the Rev. W. C. Thomson.

. AMPHICROSSUS, Er.

1. *Amphicrossus concolor.*

Late ovatus, convexus, subnitidus, pubescens, lævissime punctatus, castaneus, lateribus parum rufo ciliatis.

Long. 3 lin., lat. $2\frac{1}{4}$ lin.

Broadish oval, convex, very finely and irregularly punctate, finely pubescent, the sides ciliated, with a very narrow fringe. Head with scarcely any impressions. Prothorax emarginate in front; anterior angles broadly projecting; posterior angles rounded; base bisinuate; sides slightly explanate, the depressed portion narrowest in front. Scutellum triangular. Elytra with the sides explanate and the margin reflexed and broadly inflexed on the underside; shoulders large, elongate, roundish, and promi-

ment; apices truncate, slightly rounded, and with the angles, both external and sutural, rounded, the exterior angles most so. Pygidium and part of penultimate segment of abdomen visible from above. Underside finely punctate and pubescent. Legs moderately broad; tibiæ ciliated; four anterior tarsi dilated and villose, the posterior two not so much dilated.

One specimen only received.

2. *Amphicrossus fuscus*.

Capite et thorace ignotis, ceteris nigro-fuscus, ovatus, subnitidus, punctatus, breviter pubescens, lateribus dense griseo ciliatis. Long. —? lin., lat. $1\frac{1}{2}$ lin.

Head not known. Thorax not known. In other respects brownish black, ovate, more elongate than the other species, very finely punctate, clothed with a very short pubescence; the margins ciliated with a fringe of long, close, griseous hairs. Scutellum triangular, apex not very acute, less punctate than the elytra. Elytra finely punctate, sides not explanate, but the margin briefly reflexed, and not very broadly inflexed below; shoulders not prominent, almost absent; apex truncate, external angles rounded, sutural angles obtuse. Pygidium and part of penultimate segment of abdomen visible from above. Underside finely punctate and pubescent. Legs moderate.

Only the posterior half of a single specimen received; but I have thought it worth while to describe it as probably sufficient to enable it to be recognized in future when an entire specimen may be found.

In addition to the above two, there are three species of *Amphicrossus* known, which have been described by Erichson:—

One from North America (*ciliatus*).

One from South America (*lateralis*).

One from the Indo-Malayan district (*discolor*).

Mr. Wallace also brought at least one other species from the New Guinea Islands.

Ipidæ.

CRYPTARCHA, Shuck.

Subgenus *Arhina* (from α and $\rho\acute{\iota}\nu$, *noseless*).

At first sight I took this for a convex *Prometopia*: looking more carefully, its resemblance to *Camptodes* led me to suppose it an African representative form of the South-American genus *Camptodes* (a thing not hitherto met with); but on examining the mouth, I found that it was nothing but a *Cryptarcha*. As the facies, however, is aberrant, and differs from the usual character of the genus in being glabrous and brilliantly shining, as well

as more rounded, I think it will be as well to make a subgenus for it.

Characters the same as those of *Cryptarcha*, with the following exceptions:—Head and epistome, instead of being rounded, transverse and broadly trigonal; body very convex and rounded in form, glabrous and very shining; underside concave.

Arhina strongyloides,

Creberrime læviter punctata, puniceo-rubra.
Long. 2 lin., lat. $1\frac{2}{5}$ lin.

Reddish claret-coloured; very closely and finely punctate, head more coarsely than the rest. Prothorax broadest at posterior angles, with a slight tendency to expansion; anterior angles obtuse, posterior blunt, nearly rectangular; base bisinuate. Scutellum very small. Elytra with the anterior outer angles sloped off; apices rounded, truncate; posterior angles, both exterior and sutural, rounded. Pygidium partly visible. Underside finely punctate; segments of abdomen with an opaque margin.



Only two specimens received.

Correction on previous paper, vol. iv. p. 120.

Agabus hydroporoides should be *Celina* (*Hydroporomorpha*, Bab.)
hydroporoides.

I was misled into regarding this species as an *Agabus* by the fore and middle legs having become crossed, so that on examining what appeared to be the fore tarsi, I found five articles, which satisfied me that it could not belong to the Hydroporidæ, the anterior tarsi of which have only four articles.

The Rev. Hamlet Clark, who stands preeminent in knowledge of Hydradephaga, however, having, from a figure which I sent him, expressed doubts as to its being an *Agabus*, and suggested a reexamination to see if it were not a *Celina*, of which it had the facies, I submitted it to a more careful scrutiny, and discovered the transposition of the legs, and ascertained that the apparent middle legs were really the fore ones, and that they have only four articles in the tarsi, the rest having five. It thus belongs to the Hydroporidæ; but its possession of a scutellum of fair proportions shows that Mr. Hamlet Clark's divination from the facies was correct.

It is of interest as being another example, in addition to those I have already mentioned, of the occurrence of South-American

types on the Calabar coast. Of *Celina* all the species previously known were four from South America, one of which and another is also found in the United States. There are now :—

- Celina latipes*, Aubé. Interior of Brazil.
- *aculeata*, Aubé. Brazil.
- *angustata*, Aubé. United States and Cayenne.
- *grossula*, Leconte. Louisiana.
- *parallela*, Bab. Rio Janeiro.
- *hydroporoides*, Murr. Old Calabar.

[To be continued.]

XXX.—On the Entozoa of Man and the Domestic Animals in Iceland. By M. H. KRABBE*.

THERE has long existed in Iceland a very serious endemic disease which usually attacks the liver, where it causes tumours often of very large size, but also affects other organs, although less frequently. This disease has not escaped the attention of the physicians of the country; but until recently they were very imperfectly aware of its nature, and regarded it as a chronic hepatitis, an affection which presents itself but rarely in cold climates.

During a residence in Iceland in 1847 and 1848, M. Schleisner ascertained that it was not a disease peculiar to the liver, and at the same time demonstrated that it was produced by hydatids, which M. Eschricht subsequently recognized as *Echinococci*. At this period the investigations of Siebold, Küchenmeister, and Leuckart having thrown much light upon the relations of the vesicular worms to the *Tænia*s, the frequency of *Echinococci* in Iceland strongly attracted the attention of these naturalists; and, as I was fortunate enough to have assisted at the previous investigations of Eschricht, this question likewise awakened all my interest. It was in the domestic carnivora that the corresponding *Tænia*s were to be sought; and, in order that I might thoroughly know the worms which these animals harbour, and at the same time establish a basis of comparison for researches in Iceland carried on for several years, I made a special study of the Entozoa in question at the Veterinary School of Copenhagen.

On examining the intestines of 500 dogs of Copenhagen and its environs, I found *Tania marginata* in 14 per cent. of them,

* Translated by W. S. Dallas, F.L.S. &c., from the 'Comptes Rendus,' January 21, 1867, pp. 134-138.

T. cœnurus in 1, *T. serrata* in 0·2, *T. echinococcus* in 0·4, *T. cucumerina* in 48, *Bothriocephalus*, sp., in 0·2, *Ascaris marginata* in 24, and *Dochmius trionocephalus* in 2.

The distinctive characters of the first three species, established by Küchenmeister and Leuckart, have been disputed by other distinguished helminthologists; but, by examining these *Tænia*s carefully (as was done by M. Baillet at Toulouse), without knowing beforehand whence the worms originated, I convinced myself of their differences. In France M. Baillet has most commonly found *T. serrata* in dogs, and also frequently *T. marginata*; but he never found *T. cœnurus* except in animals which had been experimented upon. In Denmark *T. serrata* occurs but rarely, which is explained by the fact that few rabbits are bred there. Moreover, as regards the worms most commonly observed, I was able to ascertain the influence exerted by the age and size of the dogs, by the place which they inhabited, and their state of health. Thus the frequency of *Tænia marginata* increases considerably with age, and in a still higher degree with the size of the dogs; it is more common in the dogs of the suburbs than in those of Copenhagen, and is less frequently met with in sickly than in healthy dogs—facts which are explained by the mode in which those animals acquire the *T. marginata*.

The frequency of *T. marginata*, *cœnurus*, and *echinococcus* in Iceland depends especially upon the great number of sheep which the inhabitants possess, as their vesicular worms are the cause of the development of these *Tænia*s in the dogs. *Tænia canis lagopodis* is a very remarkable species; besides the dog, it is found in the cat and the *Isatis*; and, although mentioned by Abildgaard, it has not yet been described. This worm has the head unarmed, and is not furnished with genital orifices at the edges of the joints, by which, combined with a peculiar conformation of the internal organs, it approximates to *T. angustata*, *T. litterata* (a species still but imperfectly known), and *Mesocestoïdes ambiguus* of Vaillant. As to the *Bothriocephali*, those which I met with in the dogs of Iceland not only differed from *B. latus* and *cordatus*, but also varied so much among themselves that it is not without doubt that I venture to refer them to the same species. Some of these worms, which, although of considerable size, were completely destitute of generative organs, presented a mode of development of the joints quite unknown among the *Tænia*s, but which has been indicated in some *Bothriocephali* by Eschricht and Siebold. I refer to the increase of the number of joints by means of the secondary transverse division of the formed joints, a division which may even be repeated. Something analogous to this occurs also in various species of *Bothriocephali* inhabiting the intestines of the Seals,

as I had the opportunity of verifying at the museum of the University, where I examined a great number, chiefly collected in Greenland. Among these was *B. cordatus*, the commonest cestoid worm in the dogs of Greenland, but which also inhabits, besides man, *Phoca barbata* and *Trichechus Rosmarus*. It is not, however, in this *Bothriocephalus* that the phenomenon in question is met with, but in the species which I have called *B. variabilis* (from *Phoca cristata* and *barbata*) and *B. fasciatus* (from *P. hispida*).

It is particularly remarkable that whilst *Tænia cucumerina* is very common in the dogs of Iceland, I did not once meet with *T. elliptica* in the cats—a fact which renders the distinctness of these two species probable.

It is incontestable that in Iceland the *Echinococci* are the cause of one of the most dangerous maladies of man that exist in that country. Nevertheless its frequency has been somewhat exaggerated. M. Schleisner's opinion, that one-seventh of the inhabitants are attacked by it, is founded partly only upon a mere estimate. From observations collected during six years by M. Finsen, a physician in the north of Iceland, we must infer that the number of persons affected by *Echinococci* in a degree sufficient to allow the malady to be recognized is between one-fortieth and one-fiftieth of the population, which, indeed, is a high number.

Moreover it is always the *Echinococcus*, and not any other vesicular worm, that attacks the Icelanders. With regard to *Cysticercus tenuicollis*, mentioned with some reserve by Eschricht, the case to which he called attention no doubt rests upon an error: there is nothing to render probable the appearance of this worm in the human subject in Iceland.

According to Leuckart, the *Echinococci* of man and the domestic animals belong to a single species; and the researches that I was able to make in Iceland tend to confirm his assertion. It is by means of experiment, as indicated by Leuckart, that we must seek to test this opinion; and of six experiments made by me, in concert with M. Finsen, there are two which at least render it probable, and a third which can leave no doubt, as it had exactly the same result as a similar experiment made the same year at Berlin by M. Naunyn. Both of us have thus obtained the transformation of *Echinococci* procured from the human subject into *Tænia echinococcus* in the dog. In Iceland this little *Tænia* occurs in the dogs with extraordinary frequency; and both the large and small cattle harbour great numbers of vesicular worms, which furnish those animals with their cystic *Tænia*s, namely *Echinococcus*, *Cysticercus tenuicollis*, and *Cænu-rus cerebrealis*. On comparing 100 Icelandic dogs which I ex-

amined with 317 Danish dogs, all more than one year old, I found:—

	In the Icelandic dogs.	In the Danish dogs.
<i>Tenia marginata</i>	75 per cent.	20 per cent.
— <i>cœnurus</i>	18 „	1 „
— <i>echinococcus</i>	28 „	0.6 „

The number of dogs in Iceland is very great, and certainly unnecessarily so, although these animals are indispensable to the inhabitants, especially for bringing the sheep together. From the inquiries that I made on this subject, there is every reason to believe that this number may be taken as 1 for every 3–5 inhabitants; whilst in France, where they are subject to a tax, it is 1 to 22; and in Great Britain, where the tax on dogs is higher, it is only 1 to 50 inhabitants.

The proportion of cattle in Iceland is likewise very considerable, as for every 100 inhabitants there were:—

	Sheep.	Horned Cattle.	Pigs.	Total.
In Iceland (1861)	488	36	0	524
In Denmark (1861)	109	70	19	198
In Prussia (1858)	87	31	15	133

The Ruminants continually furnish the dogs with *T. echinococcus*, the ova of which are the origin of *Echinococcus-hydatids* both in man and cattle; and the frequent contact of the inhabitants with their dogs in damp and dirty dwellings must favour the propagation of the parasites in a high degree.

It is consequently by diminishing as much as possible the number of dogs, and by preventing them from eating the vesicular worms of the cattle, that we may succeed in combating the development of hydatids in man, as also of staggers in sheep. In the report which I addressed to the ministry in 1863, I proposed:—1. That the right to have dogs in Iceland should be regulated, in order that their number might be reduced to what was strictly necessary; 2. That a small memoir should be distributed among the Icelanders, in order to explain to them the part played by the dogs in the hydatid disease of man and the staggers of the sheep, and to indicate to them the precautions to be taken to hinder the development of those maladies. These propositions were adopted by the ministry. A popular treatise which I wrote upon this subject was translated into Icelandic and dispersed over the whole country; and, with regard to the first point, the authorities in Iceland pronounced in favour of the establishment of a tax on dogs.

XXXI.—On two new Species of Birds found in Victoria. By FREDERICK M'COY, Professor of Natural Science in the Melbourne University, and Director of the National Museum of Victoria, &c.

THE publication of my friend Mr. Gould's 'Handbook to the Birds of Australia' has given such an impetus to the study of ornithology in Australia that descriptions of two new species amongst the surprisingly few which escaped his researches may be of interest. One of these is a *Pardalotus* which seems to replace the *P. punctatus* in the north-west part of the colony of Victoria and in the adjacent colony of South Australia. The other is a third, well-marked species of the genus *Sphenura*, more robust than the other two.

Pardalotus xanthopygus, M'Coy.

(Yellow-backed Diamond-bird.)

Male. Crown of head, wings, and tail black, most of those feathers having a round spot of white near the tip; a strip of white commences on the nostril and passes over each eye; ear-coverts and sides of the neck grey, the margins being lighter, so as to give a slight transverse mottling; feathers of the back dark grey at base, with a large, triangular greyish-white spot near the tip, followed by a black edge; lower part of the back, under tail-coverts, throat, and front of chest rich yellow; upper tail-coverts crimson; abdomen pale-brownish cream-colour, flanks greyish; bill black; feet brown.

Female. Differs in having the head greyish, like the back, and the throat whitish.

Total length, from tip of bill to end of longest tail-feathers, 3 inches 8 lines; bill, from forehead, rather more than $2\frac{1}{2}$ lines; wing, from shoulder, 2 inches $3\frac{1}{2}$ lines; tarsus 8 lines.

This beautiful species belongs to the same section of the genus *Pardalotus* as the *P. rubricatus*, *P. punctatus*, and *P. quadragintus*, distinguished from the others by wanting the red sealing-wax-like appendages to the spurious wing-feathers. It most nearly resembles the *C. punctatus* (Lath., sp.), from which it differs in its more slender and slightly longer bill, the white instead of brownish spots on the fore part of the back, the paler abdomen, greyish instead of brownish flanks—and conspicuously by the hinder part of the back being of the same bright yellow as the throat and under tail-coverts.

Specimens are in the National Museum at Melbourne, from Swan Hill, near the junction of the Murray and Darling; and Mr. Waterhouse has presented some from near Adelaide in South Australia.

Sphenura Broadbenti, M'Coy.

(Rufous-headed Bristle-bird.)

All the back, shoulders, and flanks dull brown; wings and tail of a slightly richer and more rufous brown, the tail-feathers in some lights seeming to be transversely marked with faint, glossy, transverse, narrow bands of slightly lighter shade; crown of head, nape, and ear-coverts rich chestnut or rufous brown; triangular spot in front of and slightly over the eye, and the throat, greyish white; feathers of breast lunulated, greyish white at margin, dull brownish like the flanks at base; the greyish white extends in a narrow track along the middle of the abdomen; legs, feet, upper part and tip of bill dark brown; lateral margins of upper mandible and basal portion of lower one yellowish.

Length 7 inches 9 lines; wings 3 inches $4\frac{1}{2}$ lines; tail 4 inches 10 lines; bill, from gape, $11\frac{1}{2}$ lines, from forehead 7 lines; tarsus 1 inch 2 lines.

The greater length of the wing, tarsus, and bill easily distinguish this species from the two previously known, as well as the rufous head and ears and the greyish-white instead of buff colour over the front of the eye. I am uncertain what value should be attached to the much darker and stronger lunulation of the breast-feathers, as I have only seen one specimen, and am not certain whether it has attained maturity. The bill is stronger, being deeper as well as longer, and slightly more arched in the culmen than in the *S. brachypterus*, to which it is most nearly related. The sixth primary is also slightly longer than the fifth and seventh, which are equal; the claws are rather stouter than in that species, and the three or four large rictal bristles are rather weaker.

The specimen described was presented to the museum at Melbourne by Mr. Broadbent, who shot it in December 1858 in a dense scrub twenty-four miles from Portland Bay, uttering a note like that of the English thrush, running over logs on the ground. I have not since seen another specimen.

Melbourne, Dec. 26, 1866.

XXXII.—On the Identity of *Alepisaurus* (Lowe) with *Plagyodus* (Steller). By Dr. ALBERT GÜNTHER.

WHILST engaged in the study of the Salmonoids described by Pallas, I met with the description of a fish discovered by Steller at the Kurile Islands, and named by him *Plagyodus* (Zoogr. Ross.-As. iii. pp. 383, 384). An examination of the notes left

by Steller and published by Pallas leaves scarcely any doubt that they refer to the same fish which was discovered by Mr. Lowe at Madeira, and named by him *Alepisaurus*. Later researches have shown the existence of the same genus in the sea of Van Diemen's Land and on the north-west coast of America; and specimens from the latter locality have been named *Caulopus* by Mr. Gill. The name given by Steller will take precedence of the others; so that the three species known will stand as—

1. *Plagyodus ferox*, Lowe. Atlantic; Van Diemen's Land.
2. ——— *altivelis*, Poey. Cuba.
3. ——— *borealis*, Gill (perhaps the species seen by Steller).
North Pacific.

I add a translation of Steller's original notes, as Pallas's 'Zoographia' is not accessible to every naturalist:—

Among the papers of Steller there is mention of another fish, which he received in a dried state from the Kurile Islands, and thence described imperfectly under the name of *Plagyodus*. This, on account of its adipose fin, seems to belong to the Salmon Trouts, unless, indeed, it be an anomalous species of *Blennius*. To this fish, extraordinary both in structure and appearance, says Steller, I give this name on account of the breadth and tenuity of its teeth.

In a dried state the specimen was 44 English inches in length, the length of the pectoral fins being 6 inches, the breadth 2 inches. It was elongate, somewhat slender, rather tapering towards the caudal, and more flattened. Head large, broad, compressed on the sides, to some extent resembling that of a Pike, with the lower jaw very slightly the longest. Jaws white, very thin, lamelliform. Maxillaries 4 inches long from the tip to the angle of the mouth, with prominent, very sharp, equidistant teeth, $1\frac{1}{2}$ line long.

From the upper mandible, not far from the end of the mouth, project two, or even more, long, broad, flat, very pointed, pellucid teeth. At the distance of one inch from this point are many very pointed, flat teeth, situated obliquely towards the angle of the mouth; to these correspond as many teeth of a similar character in the lower jaw; but for the space of half an inch before the angle both mandibles are destitute of teeth. In the lower jaw, about one inch from the tip, there are some small teeth; after these there are three teeth, 3 lines in length; and the teeth are distributed in series in this manner in either jaw. The fish is doubtless rapacious, and bites very sharply. I have called it *Plagyodus*, on account of its broad and thin teeth, which are unlike those of any other fish with which I am

acquainted. The head has a sudden elevation over the eyes, towards the neck, afterwards becoming broader. The external lamellæ of the gill-cover are very finely radiated; the lamellæ on the summit of the head above the eyes are thin and radiated from the centre in a similar manner. Ossicles of gill-membrane four or five in number, very thin. This membrane joins to the lower jaw, and almost attains the tip of the mandible; hence the jaws, on account of the magnitude of the prey, can be dilated to a great extent; and this is also much facilitated by the very singular structure of the mandible, which is composed of small broad bones like the branchiostegal rays of other fish.

Postbranchial fins very long, sharply pointed. The dorsal fin extends beyond two-thirds of the length of the fish; the second dorsal takes its rise nine inches from the extremity of the tail, and is cutaneous in texture, as it usually is in Salmon, but very thin and without ossicles. The two ventrals are at the distance of $22\frac{1}{2}$ inches from the snout, being $2\frac{1}{2}$ inches long and 5 inches before the adipose fin; another simple fin commences on the belly, probably behind the anus; for there does not appear to be a vestige of the anal. Caudal fin 3 inches long, broad, with the posterior margin apparently forming the segment of a circle. No further characters are distinguishable, on account of the dried state of the specimen.

XXXIII.—On the Menispermaceæ.

By JOHN MIERS, F.R.S., F.L.S., &c.

[Continued from p. 95.]

42. CHONDODENDRON.

This genus, proposed in 1794 by the authors of the 'Flora Peruviana' (Prodr. 132) has been recognized by few botanists. De Candolle (Syst. i. 522) referred the typical plant to *Cocculus*, while Persoon regarded it as a species of *Epibaterium* (Ench. ii. 561). Original specimens exist in the herbaria of the British Museum and of M. de Boissier, each with a label in Ruiz's handwriting; so that the identification of the genus is placed beyond doubt: this is a fact of some importance, because hitherto its real characters have been involved in much obscurity. Pöppig in 1838 described and figured a plant (also from Peru) under the name of *Chondodendron convolvulaceum*, which he conceived to be a second species with female flowers: but in this reference he was greatly mistaken; for it belongs to my genus *Odontocarya*; and this mistake has given rise to the many misconceptions that have been entertained concerning the genus. When

I published my first notes on the *Menispermaceæ*, in 1851, I knew nothing of *Chondodendron* beyond the mere details of the male flower given in the 'Prodromus' of Ruiz and Pavon: two years afterwards I first saw the typical ♂ plant; and it was only lately that I ascertained with certainty the structure of the female flower and fruit, as derived from Spruce's plant from Tarapota. These showed that my genus *Botryopsis* differs in no respect, except in the relative size of its petals, and convinced me that it should now merge into *Chondodendron*. Mr. Bentham, in his "Notes on Menispermaceæ" (Journ. Linn. Soc. v. 2nd Suppl. p. 47), misled by Pöppig, also misapprehended the nature of the genus, and, influenced by his desire to abridge species, even went so far as to state his conviction that the *Chondodendron convolvulaceum*, Pöpp., is specifically identical, not only with *Chondodendron tomentosum*, R. & P., but also with several distinct Brazilian species of *Odontocarya*. In my description of the latter genus (*huj. op.* 3 ser. xiv. 99) I have animadverted upon these misconceptions.

Dr. Eichler, in his monograph of the Brazilian *Menispermaceæ*, in Martius's 'Flora Brasiliensis,' adopts the mistaken views of Mr. Bentham, and entangles with *Chondodendron tomentosum*, R. & P., all the species of *Odontocarya* which I have described, amalgamating all into a single species: this confusion is still further increased by his description of two species under *Botryopsis*, into the first of which he fuses most of the species of *Chondodendron* enumerated below, his second species being confined to Spruce's plant from Tarapota. The copious analyses which he has figured, in plate 36, for *Chondodendron* in reality represent the structure of *Odontocarya*, a genus belonging to a very different tribe of the family; while those given in plate 48 as being figurative of *Botryopsis* illustrate the characters of *Chondodendron*.

Under *Botryopsis* (*l. c.* p. 199), Dr. Eichler describes *Chondodendron* as being furnished with the unusual number of twelve petals, in which respect he is plainly again in error; for, contrary to all analogy, he has considered the six innermost sepals to be petals, forgetting that they are the largest of the whole series, which are imbricated around them in gradually decreasing whorls, and that, like all the rest, they are pubescent externally; while the six true petals are decidedly shorter and glabrous; and, indeed, in Spruce's plant (which he correctly figures) they are reduced almost to the size of hypogynous scales, one-sixth the length of those sepals which he incorrectly regards as petals. The justness of these observations may be seen by reference to the analyses given, in plate 48, of his *Botryopsis platyphylla* and *B. Spruceana*. It is therefore evident that

Chondodendron does not depart from the usual rule in the family, of having six petals, corresponding with an equal number of stamens. Owing to this misapprehension, the generic diagnosis of Dr. Eichler requires correction: he attributes to the genus from nine to twelve sepals; but if we add to these the six parts above mentioned, we must reckon, from his own details, a total of from fifteen to eighteen sepals—the number I originally stated.

This circumstance brings the genus *Synchnosepalum* of Dr. Eichler much closer to *Chondodendron* than he imagined, the principal distinction of the former consisting in the unusually great number of its sepals, as its name imports. He describes three species, to the first of which he attributes from eighteen to twenty-four, and to the second eighteen sepals, thus corresponding to the number in *Chondodendron*; his third species, to which he attributes a still greater number of sepals, will be seen to belong to a very different genus, to which I gave the name of *Detandra**. The next character which Dr. Eichler considers peculiar to *Synchnosepalum* is the presence of six free carpels, fixed by their stipitate supports upon a raised gynæcium: this is also a prominent feature in *Chondodendron*, where the six ovaries become matured into as many stipitated drupes, which remain so firmly attached to the receptacle that they can seldom be separated without rupture of the parts. In these respects, and in the habit of the plants, as well as in the manner of their inflorescence, there is an absolute identity of characters between the two genera. The only feature that remains by which *Synchnosepalum* can be distinguished is the structure of the stamens, which is certainly very different from that in *Chondodendron*. Confiding in the accuracy of the analytical figures given by Dr. Eichler, I have acknowledged his genus, for the same reasons, partly, that I maintained *Anelasma* distinct from *Abuta*, and also *Elissarrhena* from *Anomospermum*: but in those instances this is not the only differential feature; for others are found in the habit of the plants, in the venation of the leaves, and the character of the inflorescence. Dr. Eichler, however, refused to acknowledge the validity of such differences, and fused the two former and the two latter genera into each other. If he persist in this view, he cannot avoid sinking *Synchnosepalum* into *Chondodendron*, especially as it possesses fewer claims to maintain its distinctness than the others.

It should be mentioned that in the new 'Genera Plantarum,' at p. 34, the name *Odontocarya* should be placed instead of *Chondodendron*; and, again, at p. 38, *Chondodendron* should be

* Ann. Nat. Hist. ser. 3. xiii. p. 124; Contrib. Bot. iii. 18.

substituted for *Botryopsis*: in the latter paragraph, as an illustration of the genus *Chondodendron*, there is a reference to the *Cocculus cotoneaster*, DC. (Syst. i. 525), in Delessert's 'Icones,' i. tab. 93, which shows how little the *Menispermaceæ* have been understood even by the most eminent botanists. There is nothing in the habit of that plant, in the venation or form of its leaves, or in its inflorescence that approaches the genus: it is the drawing of a well-known Syngenesious plant from Chile, the *Proustia oblongifolia*, Don, with a panicle in an undeveloped state, as may readily be seen by comparing it with the dried plant, with which it agrees in all respects, even showing its spinuliform stipules.

All the species of *Chondodendron* are climbing plants, natives of Peru, Guiana, and Brazil. The leaves are usually subcoriaceous, glabrous above, somewhat tomentose beneath, often with lengthened petioles inserted upon, or a little within, the margin of the blade; the inflorescence assumes the form of long, lax, racemose panicles; the male flower consists of from twelve to eighteen sepals, externally smaller, the outermost minute and bracteiform, all imbricately placed in ternary series upon a somewhat cylindrical torus; six petals in two series, shorter than the larger sepals, but sometimes reduced in size and scale-like, affixed to the andrœcium; stamens six, in two series, the inner ones connivently erect, free to the base, but compacted upon the summit of the gynœcium, the outer ones slightly curved, all surmounted by 2-celled anthers, the cells being separated by a fleshy connective which is introrsely excurrent, the long apical obtuse points all inclining towards the centre. The female flowers have a similar number of sepals and petals, but no stamens, or only rudimentary ones; generally six ovaries are somewhat stipitately affixed on a central gynœcium; six or fewer drupes radiately attached, each firmly affixed by its long support upon a large clavate receptacle, which terminates the pedicel; the putamen is ovoid, subcompressed, coriaceous, bimar-supially divided by a septiform condyle, like that in *Hyperbæna*, which extends from the base beyond the centre, as in *Tiliacora*: the seed, which fills the cell, is thus deeply hippocrepical, exalbuminous, with two large, fleshy, accumbently curved cotyledons, and a very small radicle pointing to the style, which, owing to the excentric growth, is brought down close to the base of the fruit.

CHONDODENDRON, R. & P. *Botryopsis olim, nob.* — *Flores* dioici. *Masc. Sepala* 12–18, ordine ternario imbricatum disposita, ad torum subcylindricum seriebus alternis crebriter affixa, gradatim minora, exteriora minima, bracteiformia,

extus pilosula, 6 interiora majora, elliptica, apice subreflexa. *Petala* 6, staminibus opposita, interdum rotundata et squamiformia vel sæpius sepalis interioribus paulo minora, cuneato-oblonga, carnosula. *Stamina* 6, biserialia, centralia, libera, ad basin arcte aggregata, et in toro cylindrico subconnata, apice conniventia; *filamenta* curvatim suberecta, apice valde incrassata, claviformia et inflexa; *antheræ* 2-loculares, loculis ovatis, segregatis, subimmersis, utrinque rima longitudinali dehiscentibus, *connectivo* crasso, in apiculum longum introrsus curvatum sæpe subbifidum excurrente.—*Fæm.* *Sepala* et *petala* marium. *Stamina sterilia* 6, minima aut nulla. *Ovaria* sæpius 6, erecta, gynæcio brevi insita, gibboso-oblonga, sursum tenuiora, glabra, 1-locularia, *ovulo* unico lateri interno appenso. *Stylus* subnullus. *Stigma* rhomboideum, acutum, convexum, medio carinatum, deorsus reflexum. *Drupæ* 6 vel abortu pauciores, gibboso-vel cuneato-oblongæ, imo longiuscule stipitatae, et ad torum majusculum affixæ, subhorizontaliter radiantes, vix pulposæ, stigmatè basi proximo notatæ; *putamen* subcuneato-oblongum, paulo compressum, utraque facie a basi ultra medium sulcatum, chartaceo-coriaceum, 1-loculare; *condylus* omnino internus, septiformis, sulcis ad margines conversis, a basi ultra medium protensus. *Semen* loculum bimarsupiatum implens, et circa condylum hippocrepice subito inflexum, exalbuminosum; *integumentum* membranaceum, hippocrepice plicatum, in sinu *chalaza* obscura notatum, et hinc linea incrassata ad condylum adhærens; *embryo* valde carnosus, *cotyledonibus* magnis, acumbenter hippocrepice incurvis, rarius paululo inæqualibus, *radicula* brevi parva supera ad stigma spectante multoties longioribus.

Frutices scandentes *Americæ meridionalis intertropicæ*, cortice *tuberculato*, ramulis ad axillas cupuloso-nodosis; folia alterna, suborbicularia, ovata aut oblonga, rarius subcordata, sæpe paululo peltata, e basi 5-nervia, supra glabra, subtus sæpe subtomentosa; petiolo utraque extremitate tumido: paniculæ elongatæ, aut solitariæ et axillares vel in ramis annotinis aphyllis perplurimæ et fasciculatæ; flores minimi, pedicellati.

Descriptions of the following species will be given in the third volume of my 'Contributions to Botany':—

1. *Chondodendron tomentosum*, R. & P. (non Benth. nec. Eichl.), Prodr. Fl. Per. 132, Syst. 261;—*Epibaterium tomentosum*, Pers. Ench. i. 561;—*Cocculus Chondodendron*, DC. Syst. i. 522, Prodr. i. 98.—In Peruvia: v. s. in herb. Mus. Brit. et De Boissier, Pilláo (Ruiz et Pavon).

2. *Chondodendron crétosum*, nob.;—*Botryopsis platyphylla*, *Benth. in Journ. Linn. Soc. v. Suppl. 2. 51*;—*Botryopsis Spruceana*, *Eichl. in Mart. Fl. Bras. fasc. xxxviii. p. 199, tab. 48. fig. 1.*—In Peruvia alta: *v. s. in herb. variis* ♂ et ♀, Tarapota (Spruce, 4474).
3. — *platyphyllum*, nob.;—*Botryopsis platyphylla*, *nob. olim in Ann. Nat. Hist. ser. 2. vii. 43*; *Benth. l. c. 51*; *Eichl. (in parte) l. c. 199*;—*Cocculus platyphyllus*, *St. Hil. Pl. Us. tab. 42, Fl. Br. Mer. i. 59*; *Walp. Rep. i. 95.*—In Brasilia, prov. Diamantina.
4. — *obscurum*, nob.—In Brasilia: *v. v.* ♂ et ♀ in montibus Organensibus.
5. — *cinerascens*, nob.;—*Cocculus cinerascens*, *St. Hil. Fl. Bras. Mer. i. 59*; *Walp. Rep. i. 95*;—*Botryopsis platyphylla*, *Eichl. (in parte) l. c. 200.*—In Brasilia: *v. s. in herb. Mus. Brit. (Bowie & Cunn.)*.
6. — *æmulum*, nob.;—*Cocculus platyphyllus*, *Mart. (non St. Hil.) Fl. Bot. Zeit. xxiv. App. 2. 42*;—*Botryopsis platyphylla*, *Eichl. (in parte) l. c. 200, tab. 48.*—In Brasilia: *v. s. in herb. De Candolle* ♂ (Martius); *in herb. De Boissier* ♂, Bahia (Luschnatt).
7. — *ovatum*, nob.;—*Cocculus ovatus*, *Vell. Fl. Flum. x. tab. 141*;—*Cocculus platyphyllus*, var. *Ildefonsianus*, *St. Hil. et Tul. Ann. Sc. Nat. sér. 2. xvii. 134*;—*Cocculus paniculigerus*, *Mart. l. c. ii. 43*; *Walp. Rep. ii. 348*;—*Botryopsis platyphylla*, *Eichl. (in parte) l. c. 200.*—In Brasilia.
8. — *nemophilum*, nob.—In Brasilia: *v. s. in herb. Mus. Brit. Rio de Janeiro (Gardner, 5353)*.

43. SYCHNOSEPALUM.

In treating of *Chondodendron*, I have already commented on this genus, which was established by Dr. Eichler in Martius's 'Flora Brasiliensis.' I there showed how much it agrees with the former genus in habit and inflorescence, in the number of its sepals, petals, and stamens in the ♂, and in the number of floral parts, with six stipitated ovaries, in the ♀ flower. The only difference consists in the stamens; for in *Sychnosepalum* the outer filaments, always shorter, are free almost to the base, while the three inner ones, for nearly their whole length, are united into a central column, and at other times all the stamens are equally and more or less partially agglutinated together in two series; the anthers are 2-celled, the cells being introrse, oval, dorsally affixed on the apex of a narrower filament, collateral at their summit, but very divaricated at their base, and bursting by an obliquely longitudinal fissure. On the other hand, in *Chondo-*

dendron the stamens are free to the base, and, though connately erect in two series, they are all firmly agglutinated to the andrœcium; the filaments are thickened clavately at the summit, which is incurved, the anther-cells being lateral, widely separated and partially imbedded in the thick connective, which terminates in a long, salient, apical point, these points of the stamens being connivent in the centre. Notwithstanding the great identity of characters before mentioned, I consider this difference in the structure of the stamens to be a feature of considerable importance, and consequently I do not hesitate to acknowledge *Sychnosepalum* upon the same ground that I formerly urged in the instances of *Anelasma* and *Elissarrhena*. But in these latter cases Dr. Eichler has refused to acknowledge the validity of this distinction; and as long as he persists in that determination, he should consistently relinquish his claim for the distinctness of *Sychnosepalum*, and merge it into *Chondrodendron*—a course which I do not recommend. Dr. Eichler describes three species, two of which are recognized below; but his third species belongs to a very different genus, one which I formed many years ago upon two Brazilian plants of Blanchet's collection: one of these, *Detandra ovata*, nob., is the *Sychnosepalum microphyllum*, Eichl. The fruit is not yet known; but, from the singular resemblance of the ovaria of its ♀ flowers and in the relation of its floral parts to those of *Chondrodendron*, we may anticipate a similar seminal structure: I have therefore placed *Sychnosepalum* following the genus last mentioned.

SYCHNOSEPALUM, Eichl.—*Flores* dioici. *Masc. Sepala* 15–24, ordine ternario dense imbricata, exteriora gradatim minora, oblonga, acuta, extus valde pilosa, rigidiuscula, erecta, 6 interiora majora, elliptico-oblonga, subæqualia. *Petala* 6, sepalis dimidio breviora, oblonga, apice paulo truncata, imo gradatim angustiora, concava, lateribus a summo ad basin utrinque inflexis, carnosula, extus pilosa. *Stamina* 6, biseriata, petalis opposita, a basi plus minusve monadelphæ; *filamenta* crecta, 3 exteriora paulo breviora, fere ad basin libera, tertia, 3 interiora fere ad summum in columnam centram coalita aut rarius breviter coalescentia; *antheræ* 2-lobæ, filamento latiores, dorso adnatæ, lobis ovalibus, summo contiguis, imo divaricatis, rima obliqua singulatim introrsum dehiscentibus.—*Fœm. Sepala et petala* ut in masc. *Stamina sterilia* 6, libera, petalis opposita et æquilonga; *filamenta* tenuiter tertia, erecta; *antheræ* effætæ minutæ, glandulæformes. *Ovaria* 6, gibboso-oblonga, imo stipitata, apice in *stylum* brevem gradatim attenuata, extus pilosa, summo gynæcii insita, erecta et conniventia. *Stigmata* breviter subulata, paululo patentia. *Drupæ*

(immaturæ solum visæ) ut in *Chondodendro* ad receptaculum crassum affixæ, putamine 1-loculari et a condylo septiformi e basi intruso 2-marsupiato, semine ignoto.

Frutices scandentes in Brasilia septentrionali et Guiana crescentes; folia petiolata, ovata, subacuminata, integra, 5-nervia, transversim venosa, coriacea, pilosa: paniculæ ♂ supra-axillares, solitariae vel geminae, spicatum ramosæ; ramis brevibus, paucifloris; floribus brevissime pedicellatis aut sessilibus.

Ample characters of the two following species will be given in the third volume of the 'Contributions to Botany:—

1. *Synchosepalum Paraënse*, Eichl. in Mart. Fl. Bras. fasc. xxxix. 203, tab. 49. fig. 1.—In Para.
2. ——— *Sagotianum*, Eichl. l.c. p. 203, tab. 49. fig. 2.—In Guiana Gallica, Karouay (Sagot. n. 19).

44. HÆMATOCARPUS.

This is a very peculiar genus, established upon the *Fibraurea hæmatocarpus* of the authors of the 'Flora Indica;' but it is very different from that genus, and belongs to quite another tribe, its proper place being among the *Pachygoneæ*. It is remarkable for its fleshy fruit, which is far larger than any yet known among the *Menispermaceæ*. I am indebted to Dr. Thomson for one of the drupes, which he brought home in spirits; this enabled me to mark its distinctive features more completely than could possibly be done in the dried state. The drupe is of a dark colour, of a rounded oblong form, $1\frac{3}{4}$ inch long, $1\frac{1}{8}$ and 1 inch in its two transverse diameters, is supported on a fleshy stipitate support $\frac{1}{2}$ inch long, and articulated on the globose receptacle of the pedicel. The putamen is of a dark colour, thin, and coriaceous in consistence, $1\frac{1}{4}$ inch long, 8 lines in diameter one way, 6 lines across in the other direction, oblong, with straight sides, narrower towards the base, with a shallow grooved line running from that point along each of its broader faces for about three-fourths of their length, which grooves correspond with an internal transverse septum (the condyle), that divides the cell for the length just stated into two deep marsupial pouches, as in *Tiliacora*; the cell thus interrupted by the condyle is of a hippocrepical shape, with two very long, parallel, approximated arms, each semicircular in its cross section. The outer surface of the putamen is densely bristled with innumerable delicately membranaceous flat hairs (if they may be so called) about 2 lines long, and imbedded in thick fleshy pulp, much in the manner described in *Odontocarya* (*huj. op.* 3 ser. xiv. 98). The seed fills the space and assumes the same shape; the integument is membranaceous,

attached at its duplicature to the condyle, and marked near that point by a dark chalaza; there is no albumen; the two fleshy cotyledons occupy nearly the whole space of the cell, are 2 inches long, suddenly and accumbently bent to half that length by their sudden duplicature round the septiform condyle; the radicle, $\frac{1}{8}$ inch long, and therefore only one-sixteenth part of their entire length, is narrow and conical, situated at the lower extremity of one of the divisions of the cell.

In the Hookerian Herbarium, under *Tinomiscium*, I found a specimen, without leaves, but with ♂ flowers, which, I consider, belongs to the typical species, especially as it is also from Khasya, and from a similar elevation (3000–4000 feet). I was led to this conclusion by comparing it with another specimen, also from Khasya, having leaves of a similar texture and peculiar venation, and a habit quite conformable with *Hematocarpus Thomsoni*: on a former occasion I had selected this plant as the type of a new genus, *Baterium**, which now, therefore, merges into *Hematocarpus*. Another specimen in the same herbarium, without flowers, from the neighbouring district of Sikhim, may be considered the counterpart of the ♂ flowering specimen which I have referred to the typical species: it quite agrees with the ♀ plant in the size, texture, and venation of the leaves, only that they are a trifle broader and rounder at base. In all these specimens the leaves are oblong, acuminate, somewhat thick and coriaceous, very glabrous, subpolished above, glaucous beneath, with two principal simple nerves springing from the base, running parallel with the margin, and then arching with other short lateral nerves that rise from the midrib beyond its middle. In both species the ♂ inflorescence has from two to four panicles fasciculated in the axils, each on a slender rachis longer than the leaves, with short alternate branches, each bearing two small pedicellated flowers: these have twelve sepals in imbricated ternate series, gradually smaller outwards, membranaceous, glabrous, with ciliated margins, and marked with coloured spots; the six petals are half the length of the larger sepals, oblong, somewhat dark and fleshy, with two small, erect, auricular scales fixed upon their claw; the six stamens are opposite to them, the filament being short, flat, thin, widening at the apex suddenly into a larger, orbicular, membranaceous connective, which is galeately concave, with two much smaller anther-lobes widely separated, subdivaricated, and partly imbedded in its lateral margins, each opening introrsely by an obliquely longitudinal fissure; these stamens are in two series, connivent, and somewhat imbricated; in the

* See my synopsis of the genera of the *Menispermaceæ* (*huj. op. ser. 3. xiii. p. 124*).

centre, upon a short raised receptacle, are three abortive, small, subulate ovaries. The ♀ flower is not yet known.

I have adopted for the generic name that originally given to the typical plant, substituting for it, specifically, another to commemorate the name of its discoverer. The red colour of the fleshy sarcocarp of the fruit suggested the name *Hematocarpus*.

HÆMATOCARPUS, nob.*;—*Baterium*, nob. (♂).—*Flores* dioici. *Masc. Sepala* 12–15, in seriebus 4–5 alternatim disposita, gradatim minora, membranacea, ciliata, guttatim picta, 6–9 exteriora suborbicularia, 6 interiora majora, subæqualia, obovata, æstivatione imbricata. *Petala* 6, sepalis dimidio minora, ovata, fusca, glabra, marginibus membranaceis, imo auriculis 2 minimis involutis munita. *Stamina* 6, petalis æquilonga et opposita, biserialia, subimbricata, andrœcio centrali affixa; *filamenta* libera, brevia, apice in connectivum magnum late orbiculatum galeato-concavum submembranaceum guttatim pictum desinentia; *antheræ* 2-lobæ, lobis remote sejunctis, oblongis, subdivergentibus, submembranaceis, latere utroque connectivo semiimmersis et rima obliqua introrsum dehiscentibus. *Ovaria sterilia* 3, minima, subulata, filamento æquilonga, centralia.—*Fœm. Sepala* et *petala* ignota. *Ovaria* e cicatricibus in toro notatis 4–6. *Drupæ* totidem vel abortu solitariæ, ovali-oblongæ, maximæ, carnosæ, singulatim *carpodio* longiusculo et crasso stipitatae, styli vestigio hoc procul notatae; *putamen* subparallele oblongum, paululo compressum, imo aliquantulo angustius, tenuiter coriaceum, a basi longe ultra medium utraque facie sulcatum, extus fibrillis seu pilis tenuiter membranaceis anguste loriformibus erectis in pulpam carnosam immersis dense vestitum; *condylus* internus, septiformis, sulcos externos adversus, ultra medium loculi protensus; *loculus* hinc profunde bimarsupiat. *Semen* loculo conforme; *integumentum* membranaceum, latere interiore *chalaza* notatum et ad condylum affixum: *embryo* exalbuminosus, parallelum et adpresse plicatus, hinc longe bicurvis; *cotyledones* magnæ, crassissimæ, longissimæ, semiteretes, accumbentes, *radicula* brevi conica ad stylum spectante 16-plo longiores.

Frutices *Himalayenses*, scandentes; folia *petiolata*, oblonga, e basi 3-nervia, crasso-coriacea, glaberrima: paniculæ ♂ racemosæ, supra-axillares, 2–3-fasciculatae, rachi tenui, folio longiore, ramis brevibus, paucifloris: racemus ♀ axillaris, pauciflorus, fructifer petiolo paulo longior; pedunculus crassus, lignosus, toro subgloboso terminatus; drupæ 3–6, horizontaliter radiantes, toro affixæ.

* *Huj. op. ser. 3. xiii. p. 124.*

The two following species will be fully described in the third volume of the 'Contributions to Botany:'—

1. *Hematocarpus Thomsoni*, nob.;—*Fibraurea hæmatocarpa*, Hook. & Th. *Fl. Ind.* i. 204;—In Khasya et Sikhim: *v. s. in herb. Hook.* ♂ et ♀.
2. ——— *comptus*, nob.;—*Baterium validum*, nob. *l. c.* p. 124.—In Khasya: *v. s. in herb. Hook.* ♂, Khasya (Griffiths, Hook. & Th.).

[To be continued.]

XXXIV.—*Notulæ Lichenologicæ.* No. XIII.

By the Rev. W. A. LEIGHTON, B.A., F.L.S.

Biographical Notice of H. G. Flörke, by L' Abbé Eugène Coëmans.

HEINRICH GUSTAV FLÖRKE was born December 24, 1764, at Altenkalden, a small village of the grand-duchy of Mecklenburg, where his father was at that time Lutheran Minister. His mother was also the daughter of a protestant pastor, named Schmidt.

Flörke lost his mother whilst he was very young, without having had the good fortune to know her; and his father remarried some months afterwards for the interest of his young family. This second union was happy, and introduced no changes into the peaceful and retired habits of the family.

The Flörke family was very numerous, and possessed of little wealth, and were followers of the severe doctrines of the sect of mystic pietists of Dargung.

At the age of four years the young Flörke quitted his native village, with his parents, and went to dwell at Butzow, where his father was nominated *Præpositus*, i. e. Pastor-Inspector. This was where he received his first education.

The school of the town, which he attended, was at that time in a most unsatisfactory state. The master of the school, named Thube, did not comprise in his scholastic system the moral education of youth, but treated his pupils as a flock of sheep, which it was his sole business to keep in order, and entertained them with Jewish antiquities and ridiculous reveries instead of instructing them in religion and grammar.

Flörke remained three years in this miserable school, without having learned anything, and quitted it, in 1775, to go to the humble college of the little town where his parents dwelt.

Afterwards he entered the University of Butzow, then in existence, and during some years attended the theological lectures. Young Flörke, who was very diligent, and never negligent of

any opportunity of instruction, here attended at the same time courses of philology and mathematics.

After three years of study at this obscure university, Flörke was desirous, agreeably to the German custom, to visit a foreign university; but the straightened circumstances of his parents would not permit him even to think of such an advantage. He was therefore compelled to accept the place of tutor in a noble family living at Kittendorf in Mecklenburg.

Flörke had the good fortune to secure the attachment of this family; and when his young pupil was of an age to commence his superior studies, he attended him to the University of Göttingen, where the celebrated Blumenbach, in all the glory of his reputation, at that time instructed. The years passed at Göttingen were the most delightful ones of Flörke's life. Besides his acquaintance with Blumenbach, who taught natural history generally, he also made acquaintance with Hoffmann and the celebrated Persoon; and there can be no doubt that it was his connexion with these three savants which determined his vocation as a naturalist and botanist.

Flörke nevertheless professed only a moderate esteem for Hoffmann, and frequently reproached him for his whimsical gaiety and the noisy concerts of his friends, as being inconsistent with the dignity of professional gravity.

After the education of the young nobleman of Kittendorf was concluded, Flörke returned to his native place; and having in vain sought to establish himself in an independent position, he was compelled to renew his occupation as tutor, in the family of the Vice-Marshall of Oertzen, who at that time lived in the country. Our young botanist profited by this retired life to occupy himself with the flora of Mecklenburg; and he was the first person who discovered in Germany the *Poa sudetica*, and the pretty *Primula farinosa* on the sandy shores of the Baltic Sea.

Flörke was then nearly thirty years of age; and it became necessary for him to think of the future, and how he could acquire a more positive position in society. He therefore accepted, in 1794, the curacy of Kittendorf, which had become vacant, and of which the family of his first pupil possessed the right of patronage and presentation.

In his new position it would seem that Flörke ought to have been happy, inasmuch as he was loved by his old pupil, who had become seigneur of the village, esteemed by his parishioners for the goodness of his character, possessed of a well-endowed curacy, and with ample leisure to devote to his favourite studies.

But he lived at the end of the 18th century, and participated in the sceptical ideas of his times, and consequently his personal

opinions were not in accordance with the dogmas of the positive religion which it was his duty to promulgate.

One can readily understand, then, that this opposition between his teaching and his religious convictions would render Flörke unhappy. Nevertheless he was too true-hearted to retain for any lengthened time a charge the functions of which he was unable worthily to discharge; and therefore he resigned his pastorate, and quitted, at the end of three years, his beautiful cure of Kittendorf, notwithstanding all the prayers and entreaties of his friends.

After this sacrifice, Flörke quitted his native district and went to study medicine at Jena; and he travelled on foot through a great portion of Germany, herborizing everywhere, and already searching with a keen predilection for lichens, which subsequently he made the principal study of his life.

The first herbarium of Flörke is at the present day still preserved at Berlin, and contains the findings of these first peregrinations.

In 1799, having terminated his medical studies, he settled at Berlin, where his elder brother was publishing a philosophical and technological Encyclopædia. The two brothers entered into a sort of partnership; but after some months of common toil, death removed the elder one, and renewed the troubles of our poor botanist.

Flörke now saw that he could do nothing better than to marry the widow of his brother, and take upon himself the sole editorship of the Encyclopædia.

The sixteen years which Flörke passed at Berlin in the occupation of a compiler were the saddest of his life. In consequence of a disadvantageous agreement with his publisher, all the profits accrued to the latter, whilst nothing remained to himself in the partition but an ungrateful toil and a straitness akin to destitution.

Towards the end of his sojourn in this capital, he was even compelled to sell his herbarium, and to deprive himself of his cherished plants, which he had collected in his youth in the beautiful mountains of the Tyrol and in the Alps of Salzburg. His herbarium was purchased by a society of naturalists of Berlin, in whose possession it still remains.

The loss of his herbarium deeply affected Flörke, and, as he afterwards told his friends, plunged him into a deep melancholy.

We can well understand the feelings of a botanist who, at the end of his career, sells his herbarium to a museum or public library, and how, with a kind of paternal solicitude, he seeks out a sure resting-place for the child of his toil; but when he is obliged to deprive himself of his collections in the very middle

of his career and under the imperious necessity of want, it is a very great and painful sacrifice, especially to a mind like that of Flörke, who cherished science before riches and honours.

It was at Berlin that Flörke commenced to distinguish himself as a lichenographer. The 'Berliner Magazin' and the 'Beiträge' of Weber and Mohr were the most important and most esteemed scientific reviews of that period. He published in these a very great number of papers, which produced him the reward of a just renown, and placed him in communication with the first cryptogamists of his time. The intrepid Russian traveller Tilesius, Bory de Saint-Vincent, Weber, and Wallroth sent to him their lichens, and referred them to his skilful determination.

When Flörke began to write, Acharius had already edited his first works, and enjoyed a European reputation. Our lichenologist attacked him fiercely in nearly all his publications; and the two celebrated lichenographers continued rivals throughout their whole lives. Flörke was the better judge of species, Acharius was the creator of lichenography, and sought to establish his genera on microscopic characters. Both had incontestable merits, and it is difficult to pronounce on the superiority of talent of these two rivals. But every one smiled on Acharius, and the Court of Sweden heaped upon him her favours; Flörke, on the contrary, was poor and neglected: this tainted his writings, and his criticism was often too severe and sometimes even unjust, as I have remarked in my 'Cladoniæ Acharianæ.'

Nevertheless misfortune did not pursue Flörke to the end of his career. In 1816, Professor Treviranus having resigned the chair of Natural History at Rostock in order to accept that of Botany at Breslau, the vacant post was offered to our lichenographer, who accepted it with gratitude.

Flörke was nearly fifty-three when he became professor of zoology, of botany, and of natural history at Rostock. But honour had come too late; nevertheless he performed the duties of professor during fifteen years with zeal and reputation.

Flörke was not what may be termed a brilliant professor, but, simple, clear, correct, and conscientious in his lessons, he had the faculty of communicating to his pupils that love of science which he himself possessed.

Keeping himself *au courant* with the progress of the natural sciences, he voluntarily shared with his pupils the fruits of his studies, and often gave them, besides his official courses, supplementary lessons in popular astronomy, agricultural chemistry, or physical geography.

As professor of botany he attached little importance to vegetable anatomy and physiology. To him the descriptive part

constituted the whole science; and being a great partisan of the Linnæan system, he viewed with an evil eye the progress of the natural system.

During the last twenty years of his life, Flörke occupied himself almost exclusively with the study of lichens, and especially of the *Cladoniæ*. On quitting Berlin, he had commenced editing his 'Deutsche Lichenen.' This publication he continued at Rostock, and issued in succession ten fasciculi, containing 200 natural examples accompanied by excellent critical notes. Although he did not use the microscope in the analysis of his lichens, nevertheless this collection is distinguished for the exactitude of its determinations, and it is still one of the best that we possess.

Afterwards came out his 'Commentatio nova de Cladoniis, difficillimo Lichenum genere.' This is the most remarkable work of Flörke. He laboured in the preparation of it during nearly ten years, and had collected for its composition a quantity of materials truly immense. His 'Commentatio' is a *chef-d'œuvre* of patience and precision in the diagnoses, and is still the manual and indispensable clue for whoever shall engage himself in the morphological labyrinth of the genus *Cladonia*.

Flörke was desirous to complete and illustrate this latter work by a series of natural specimens of *Cladoniæ*, corresponding exactly with the descriptions of his types. In fact he issued in 1829 the first three fasciculi of his 'Cladoniarum exemplaria exsiccata.' But there the work rested; for whilst he was preparing the last fasciculi, he was struck with a cruel malady which interdicted for ever his scientific labours.

The last years of Flörke's life were replete with misfortune. A first attack of apoplexy surprised him in the midst of his labours in 1831, and left him paralyzed. In 1833 and 1834 the courageous professor endeavoured, nevertheless, to renew his course of lectures, and caused himself to be carried in a chair to direct, as far as he was able, the studies of his pupils. But in 1835 a fresh attack of apoplexy prostrated him entirely, and he died, after long months of suffering and of deep melancholy, on the 6th of November, 1835, in the seventy-first year of his age.

Flörke, by his works, has himself inscribed his name in the annals of the history of plants. Some friends have, moreover, endeavoured to transmit the remembrance of him to future generations. Weber and Mohr have dedicated a *Phascum* to him under the name of *Phascum Flörkeanum*; Mühlenberg has consecrated to him the genus *Flörkeana*, in the family of the Limnanthaceæ; and Elias Fries, in naming the *Cladonia Flörkeana*, has manifested his desire to eternize the labours of the Mecklenburg cryptogamist on the genus *Cladonia*.

Flörke has left us two herbaria: the first, that of his youth, is preserved at Berlin by the Society of Naturalists of that city. It contains a great quantity of lichens, and especially an immense collection of *Cladonia*. This herbarium has only a relative value, because it does not contain the types of the last and principal works of the lichenographer of Rostock.

The second herbarium of Flörke is found in the Museum of the University of Rostock, and is chiefly composed of cryptogams. The lichenological portion alone reckons 130 large "cahiers," and the genus *Cladonia* is represented by nearly 50,000 specimens! This collection comprises the true cryptogamic treasures and a quantity of authentic specimens from the most celebrated botanists, of whom I shall only cite Schærer, Mougeot, Von Martius, Acharius, Bory de Saint-Vincent, Sommerfelt, Wahlenberg, Persoon, Weber, C. Agardh, Fée, Wallroth, and Laurer.

Works of H. G. Flörke.

1. Repertorium des neuesten und wissenwürdigsten aus der gesammten Naturkunde. Berlin, 1811–1813, 5 vol. in-8vo, cum tab. (A mere compilation.)
2. In the *Berliner Magazin*:
 1807. Beurtheilung der bisher angenommenen Arten und Abarten der Becherflechten. 16 p. in-4to.
 1808. Beschreibung der *Capitularia pyxidata*. 19 p. in-4to, with a plate.
 1808. Beschreibung der rothfrüchtigen deutschen Becherflechten. 15 p. in-4to.

In these three publications are indicated the ideas on the genus *Cladonia* which Flörke remodelled in his subsequent works.

1808. Ueber die lange Dauer kryptogamischer Gewächse, p. 208.

In this interesting notice the age of many corticoliar lichens is calculated according to the elongation of the thallus relatively to the annual increase of the trees on which they grow, or according to old dates cut in the thallus of the lichens themselves.

1809. Kleine Lichenflora der Inseln Frankreich und Bourbon. 6 p. in-4to. (Revue critique des lichens rapportés des îles de France et de Bourbon, par Bory de Saint-Vincent.)
- 1808, 1809, 1810. Lichenologische Berichtungen, oder nähere Bestimmung einiger wegen ihrer Polymorphie verkannten Flechtenarten, 4 parties.

These dissertations contain long critical and synonymical details concerning the following species:—*Lichen frigidus* L. f., *Lecidea muscorum* Ach., *Bæomyces rupestris*, v. *sabuletorum* Ach., *Lecidea decolorans* Flk., *Parmelia incolorata* Flk., *Lecidea gelatinosa* Flk., *Lecidea fusco-lutea* Ach., *Lecidea corallinoides* Flk., *Lecidea immersa* Ach., *Lecidea fumosa* Ach., *Verrucaria ocellata* Hffm., *Urceolaria calcarea*, *tessulata* Hffm. et *contorta* Ach., *Patellaria calcarea* Hffm., *Parmelia amylycea* et *Lecidea albo-carulescens*, Wulf.

1810. Kritik der Gyrophoren oder Wirbelflechten. 10 p. in-4to.

1810. Kritische Bemerkungen zu den Becherflechten in der *Licheno-graphia universalis* von Dr. Erik Acharius. 19 p. in-4to.
Most of the remarks of Flörke are very just, and Acharius has attended to them in his Synopsis.
1811. Einige Lichenen von Kamtschatka und der benachbarten Inseln. Description of eighteen species of common lichens, collected in Asiatic Russia by Tilesius.
3. In *Beiträge zur Naturkunde* von Weber, Bd. ii. 1810:
Einige Bemerkungen über das Unbestimmte des Begriffs der Varietäten im Pflanzenreiche. 27 p. in-8vo.
Beschreibung der braunfrüchtigen deutschen Becherflechten. 64 p. in-8vo.
4. In Beisters *Berliner Monatschrift*, 1804: Einige allgemeine Bemerkungen über das Salzburgische Gebirge.
5. Deutsche Lichenen gesammelt und mit Anmerkungen herausgegeben von H.-G. Flörke. Atlas in-folio, text in-8vo; liv. i.-iii. Berlin, 1815; liv. iv.-vi. Rostock, 1819; liv. vii.-x. Rostock, 1821.
6. De Cladoniis, difficillimo Lichenum genere, commentatio nova. Rostochii, 1828, in-8vo.
7. Cladoniarum exemplaria exsiccata, commentationem novam illustrantia. Rostock, 1829, fasc. i.-iii. (60 N^o).
8. In the Calendar of Mecklenburg, 4to, a very great number of popular articles on physical geography, astronomy, and palæontology.
9. In the *Freimüthliche Abendblätter* (a weekly journal of popular science at Mecklenburg), many articles on popular natural history.
10. In *Neue Annalen der Mecklenburgischen Landwirthschaft-Gesellschaft*, for 1820, a long dissertation on spontaneous generation in the animal and vegetable kingdoms. (Flörke admitted spontaneous generation, as did most of the writers of his time.)
11. In the journal *Vandalia* of Dr. Masius, 1819, fasc. ii.-vi., many notices of physics and of meteorology.

In terminating this biographical notice of Flörke, it is my pleasing duty to offer my best thanks to my excellent friend M. J. Roeper, Professor of Botany in the University of Rostock, who, during my sojourn in that town, with the greatest courtesy procured me every kind of information concerning its former Professor.

XXXV.—*On the Young Stages of a few Annelids.*

By ALEXANDER AGASSIZ*.

[Plates V. & VI.]

THE study of immature animals has become so important that, before proceeding to my subject, it may be of some interest to those engaged in investigating marine animals, to know how the young may be collected. Johannes Müller was the first who successfully employed surface-dredging with a fine gauze hand

* Reprinted from the 'Annals of the Lyceum of Natural History of New York,' vol. viii., June 1866.

net; he has been followed with eminent success by many of his pupils, and now scooping the surface of the sea in search of diminutive animals, scarcely to be recognized with the naked eye, is one of the most profitable sources of supply for recent investigators at the sea-shore. Baur* has introduced fishing with the gauze net by sinking it to any desired depth; and this promises to be a fruitful mode of finding what cannot be reached with a hand net. Meyer and Möbius†, in their investigations of the Fauna of the Bay of Kiel, have even attempted, with remarkable good fortune, to pump up from the vicinity of the bottom any animals there abounding.

As a rule, the habits of the young marine animals are so utterly different from those of the adult, that we cannot expect to find them together, and must not search for the young in the retreats where lie concealed the adult Crustacea, in the mud flats or sandy beaches where are buried Annelids and Mollusca, along the rocky shores where so many Gasteropods abound, or under seaweeds and stones, the hiding-places of both Annelids and Mollusks as well as Crustacea. We must not look in rocky pools frequented by Starfishes, Sea-urchins, and the like for young Echinoderms; the young Polyps are not always to be found growing up by the side of their parents; neither can we expect to find the young Cod, Goosefish, Lumpfish, Flounder, Cottoids, and Perches on the feeding-grounds frequented by the fishermen in search of the adult. The young fishes abound close inshore, along sandy flats heated by the sun, seeking to avoid the dangers which would beset them in deeper waters; and they can scarcely be recognized for what they really are except by the most practised eye. Thus the earlier stages of most marine animals are passed under circumstances totally different from those of the adult. When the adults are sedentary in their habits, and capable of very limited motion, the young are almost always endowed with corresponding freedom, leaving them entirely at the mercy of the winds and currents. On the contrary, in the class where we have the greatest freedom of movements and least sedentary habits, we find the young, for the most part, fixed to the ground and incapable of any motion. What greater contrast can there be in this respect than the early stages of Hydroid Medusæ, when, plant-like, they remain for ever attached to one spot, giving rise to Medusæ endowed with the most varied and graceful movements, and often carried about helpless by the wind and tide.

* "Beiträge zur Naturgeschichte der *Synapta digitata*," in Verhandl. der K. L. C. Akad.: 1864.

† Fauna der Kieler Bucht.

The young of many of our Annelids present a similar contrast to the adult, the latter passing their existence buried in tubes sunk in the mud or sand, while in their early stages they are free and nomadic, and swarm near the surface of the sea. Who would have thought of looking for young Echinoderms among those erratic beings which perform such a conspicuous part in the phosphorescence of the sea, until the wonderful researches of Müller led the way to a field of investigation which has revealed changes of the most astonishing nature! The young Crustacea, until quite advanced, find their way to the top of the water, where they swim about in company with embryo mollusks, both very different in appearance and in their habits from the adults.

From the few complete embryologies we possess of the lower marine animals, it is apparent that there has not been, up to this time, any systematic method of working. Artificial fecundation can do much towards adding to our knowledge of the early stages of marine animals; but any one who has lived near the sea-shore and endeavoured to keep alive these tiny creatures, will soon find in this method insurmountable obstacles to pursuing his investigations beyond very narrow limits. The only way is to go to the fountain-head at once, to make one's self familiar with the currents at all hours of the tide and under all possible influences of wind, to notice the place where opposite currents meet and throw into long bands the wealth of animal life they have swept along, to become so perfectly familiar with what you may expect to find under certain conditions that no time shall be lost in looking for the most favourable spot, which otherwise you would only stumble upon accidentally. The habitat of the adult animals should be carefully observed, so that, by surface-dredging with the fine gauze hand net in the vicinity of their abodes, and by a close attention to the direction which the currents take from these places, at the time of breeding we can often obtain specimens at all ages and of all sizes, till they have ceased to be nomadic or have assumed the habits they retain in their adult condition.

According to the nature of each locality, spots are easily found where the currents which skirt along the shores are compelled to pass. Projecting points of land are barriers during certain hours of the day, and everything brought floating with the tide along their shores will accumulate, until it forces its way round or over the obstacles. Narrow passages between islets and the shore, through which the tide rushes with great rapidity, will give us a synopsis as it were of all that can be found in the vicinity. When the wind blows constantly from the same direction, it will heap up on the lee shore anything floating on the

surface, so that frequently the examination of a few rods will give us at once what otherwise we should find only after a protracted search.

Violent storms, which throw upon the beaches masses of seaweed, furnish a rich harvest of small animals, attached to the fronds, or concealed between the roots, only to be found in at other times inaccessible hiding-places. The roots of *Laminaria* are the resort of thousands of young Echinoderms, Annelids, Crustacea, and Mollusks after they have ceased to swarm near the surface of the water, and have assumed somewhat the habits of the adult. Not even the dredge will root these up, and we must snatch at the favourable chances an opportune storm throws in our way.

I have already shown, in my different papers on the Embryology of Echinoderms* and Acalephs†, how useful knowledge of this kind proved in order to complete missing links in the history of their development. In the following pages will be given some of the results obtained for a few Annelids by a similar mode of procedure.

Planaria.

Before the observations of Müller‡ on the development of Planarians, the embryos had not been found to differ materially from the adult; according to Siebold§, Schmidt||, and Quatrefages¶, they differed principally in size, and no trace of metamorphosis could be seen; similar results have been obtained by Van Beneden**, Keferstein and Ehlers††, and Claparède ‡‡.

* "On the Embryology of *Astracanthion berylinus*, Ag.," in Proc. Am. Acad., April 14, 1863. "On the Embryology of Echinoderms," in Mem. Am. Acad. ix. 1864. "Embryology of the Starfish," in vol. v. of Agassiz's Cont. Nat. Hist. of U. S., 1865.

† North American Acalephæ: No. 2 of Illustrated Catalogue of Museum of Comparative Zoology: 1865.

‡ "Ueber eine eigenthümliche Wurmlarve aus der Classe der Turbellarien u. aus der Familie der Planarien," in Archiv f. Anat. u. Phys. 1850, p. 485, pl. xii., xiii.

§ Wirbellose Thiere, in *Siebold* u. *Stannius* Vergleichende Anatomie, p. 171.

|| Die Rhabdocœlen Strudelwürmer des süßsen Wassers, beschrieben u. abgebildet: 1848.

¶ "Mémoire sur quelques Planaires marines," in Ann. Scien. Nat. sér 3, 1845, iv.

** Recherches sur la Faune littorale de la Belgique. Turbellariés de la côte d'Ostende: 1860.

†† Zoologische Beiträge gesammelt im Winter 1859-60, in Neapel u. Messina: 1861.

‡‡ Beobachtungen über Anatomie u. Entwicklungsgeschichte wirbelloser Thiere, an der Küste von Normandie angestellt. Leipzig, 1863.

Müller's observations first showed the existence of a metamorphosis in *Planaria*, while Leuckart and Pagenstecher* subsequently proved beyond doubt the existence of still more striking changes in *Pilidium*, of a sort of alternate generation giving rise to *Nemertes*, as previously suggested by the observations of Müller †, Busch ‡, Gegenbaur §, Wagener ||, and Krohn ¶—changes reminding us of a somewhat similar process in the development of an Echinoderm from a Pluteus. To these evidently dissimilar modes of development I still have to add the transformations of *Nareda*, as shown in a subsequent part of this paper, resembling the usual mode of development of Annelids; also a sort of retrograde development of a species of *Planaria* quite analogous to that more fully described in *Nareda*, where we have a gradual extinction, with advancing age, of very distinct articulate features of the young. As in *Nareda*, we find in this *Planaria* plainly marked articulations when young, which become less and less distinct with advancing development—a striking contrast to the evolution shown to exist in Planarians by Müller, and to the usual mode of growth in this family, where the young so early resemble the adult.

On examining a string of eggs, mistaken at first for those of some naked mollusk, I was surprised to find young *Planaria* in different stages of growth, with a ramifying digestive cavity somewhat similar to that of adult specimens, but showing besides one distinct articulation for each spur of the digestive cavity. The eyes were well developed; and when the young became free, the articulations were still distinct, and the ramifications of the digestive cavity sufficiently advanced to enable me to determine with tolerable certainty the species to which these young belonged—probably the *Planaria angulata*, Müll.*

In the youngest specimen observed (Pl. V. fig. 1) the spurs of the digestive cavity were quite prominent, eleven in number (the first trace of the ramifications of the adult); each spur was

* "Untersuchungen über niedere Seethiere. *Pilidium* die Larve einer Nemertine," in Arch. f. Anat. u. Phys. 1858, p. 569, pl. xix.

† "Ueber verschiedene Formen von Seethieren," in Arch. f. Anat. u. Phys. 1854, p. 81. "Bericht über einige neue Thierformen der Nordsee," in Arch. f. Anat. u. Phys. 1846, pl. v.

‡ Beobachtungen über Anatomie u. Entwicklung einiger wirbelloser Thiere. Berlin, 1851.

§ "Bemerkungen über *Pilidium gyrans*, *Actinotrocha branchiata* und *Appendicularia*," in Zeitschr. f. wiss. Zool. 1853, v. p. 346.

|| "Ueber die *Mesotrocha sexoculata* von Wilh. Busch," in Arch. f. Anat. u. Phys. 1847, p. 187.

¶ Archiv f. Anat. u. Phys. 1856, p. 78. "Ueber *Pilidium* u. *Actinotrocha*," in Archiv f. Anat. u. Phys. 1858, p. 289.

** O. F. Müller, 'Zoologica Danica.'

placed in a distinctly marked transverse ring. The two anterior and posterior rings were much larger than the others. In this stage the young *Planaria* scarcely answers to its name; it is almost cylindrical, and only slightly compressed. In fig. 2 the processes are larger and more distinctly developed, and the young worm has become considerably flattened. It seems scarcely necessary to refer to the opinion advanced by Girard*, that the Planarians are naked Gasteropods.

On the Adult of Lovén's Annelid Larva (Nareda, Gir.?) †.

Although Lovén was the first to publish observations on the development of Annelids proper, as early as 1842 ‡, when he traced the development of an Annelid, supposed at the time to be the larva of some *Nereis*-like animal, yet up to the present day his observations have not been confirmed, in spite of the many memoirs we now possess on the metamorphosis of several families of true Annelids. Milne-Edwards, who followed closely upon Lovén with a most exhaustive history of the development of *Terebella* §, laid the foundation of generalizations on the mode of formation and norm of succession of rings in the young Annelids, which subsequent observations have completely confirmed. These were somewhat different from what would seem to be logically deduced from the observations of Lovén; so that it is of considerable interest to have the observations of the latter repeated, to show that the development of this larva does not differ very materially from the general mode of evolution observed in other Annelids.

The large disk of the anterior extremity in Lovén's larva was regarded by Milne-Edwards as simply due to the distention of that portion of the young Annelid, similar to what he had often observed in some of the younger stages of *Terebella* while in motion. Larvæ with similar disks have since been observed by Sars, Busch, Müller, and Claparède, which are known to be the young of *Polynoë*. It was therefore, to judge from the general resemblance of these larvæ, most natural to associate Lovén's larva with those of *Polynoë*, as has been

* "Researches upon Nemerteans and Planarians.—I. Embryonic Development of *Planocera elliptica*," in Journ. Acad. Nat. Sciences, Phil. 1854. "On the Development of *Planocera elliptica*," in Proc. Bost. Soc. N. H. iii. p. 348.

† Charles Girard, in 'Synopsis of Marine Invertebrates of Grand Manan,' by W. Stimpson, in Smithson. Cont. 1853.

‡ "Jagttagelse öfver metamorfos hos en Annelid," in K. Vet. Akad. Handl. Stockholm, 1840, p. 93; Archiv f. Naturg. 1842, i. p. 302; also in Ann. d. Scien. Nat. sér. 2, 1842, xviii. p. 288.

§ "Observations sur le développement des Annélides," in Ann. d. Scien. Nat. 1845, iii. p. 145.

done by Claparède in his classification of Annelid larvæ. From what is shown hereafter (and we have, as far as I know, no exceptions to this in the embryology of Annelids) there are points of difference showing at once that the association is not a natural one. The oldest stage figured by Lovén has as yet no trace of any feet or bristles; and the only feature by which it might possibly be associated with the Nereidæ or Eunicææ, as has been done by Lovén, is the presence of two short antennæ at the anterior extremity. We should expect, from what has been shown thus far by all writers on young Annelids, to find in somewhat more advanced stages that these tentacles have considerably increased in length; but such is not the case in the specimens of a closely allied species which I have had the opportunity to observe, and to keep alive long enough to leave but little doubt that Lovén's larva does not belong to the Rapacious or Tubicolar Annelids, but to the Turbellariæ, and probably to some Nemertean genus like *Nareda* of Girard.

We find, in stages subsequent to those figured by Lovén (figs. 14 and 17), that the antennæ gradually disappear by a sort of retrograde metamorphosis, similar to that of *Terebella*, observed by Milne-Edwards and Claparède, where the young, resembling far more the normal type of rapacious Annelids than the adult, lose their few rudimentary organs of sense and locomotion soon after they have commenced building their case. Lovén observes that the absence of feet and bristles prevented him from ascertaining the genus to which his young Annelid belonged; while it is this very absence of feet and bristles, as well as the distinct separation of the digestive cavity into œsophagus, stomach, and intestine, plainly described by him in his young worm, which should have guided him, as well as subsequent writers on this subject, in referring the larva to its proper place. Had it not been for the deceptive appearance caused by the temporary presence of antennæ and their resemblance to *Polynoë* larvæ, this would undoubtedly have been done long ago, especially when taking into consideration the differentiation of the digestive cavity, so prominent in Lovén's larvæ: this separation takes place in other Annelid larvæ long after the family (and sometimes even the generic) characters have been fully developed. The early growth of bristles, and the resemblance of the young larvæ of *Polynoë* to the adult at so young a stage, should at once have directed attention to such an anomalous type as that of Lovén's, having no feet or bristles long after the young worm had lost its embryonic character as well as all trace of the row of vibratile cilia round the head.

The passage of Lovén's figures from the condition with a disk

to the most advanced stage he observed is somewhat abrupt. I have been able to supply this defect in the observations given below (see figs. 7-16). Although my larvæ differ somewhat from those of Lovén, there can be no question of the family identity of the two. In the youngest larva (fig. 3) we find, as observed by Lovén, no trace as yet of any articulations; but we have, besides the large circle of vibratile cilia round the anterior extremity (*v*) described by Lovén, a similar powerful ring (*v'*) round the posterior extremity. This anal circle either does not exist in Lovén's larva, or must have escaped his attention. Our larva is, like Lovén's, transparent as glass; it has in addition, following the course of the two vibratile rings, a single row of most brilliantly coloured orange pigment spots of different shades and sizes; similar pigment spots are scattered in three unequal rows along the unarticulate body between the anal and anterior vibratile chords; there is besides a crescent-shaped row of spots along the posterior edge of the mouth (*m*). The two jet-black eye-spots (*e*) on each side of the summit of the disk are also found in our larva (seen only when facing the ventral or dorsal side, as in fig. 7). The eyes have a totally different appearance from the other pigment spots found along the body and vibratile rings. They are apparently connected with a nervous ganglion sending off delicate branches to the anterior vibratile ring. The mouth opens behind the anterior vibratile chord, leading into a well-defined œsophagus communicating with a stomach, which is distinctly separated at its posterior extremity from the intestine; the latter opens externally in the middle of the anal vibratile chord, placed at the base of the anal ring; this is slightly conical, and projects somewhat beyond the vibratile chord.

Lovén distinctly states that the rings are formed immediately at the base of the anterior disk behind the mouth: this is probably an error of observation, owing to the advanced period at which the articulations first commence; or the rings are simply folds due to contraction. He describes all the rings of his young larva (Lovén, fig. 2) as made up of four pieces, and represents the same thing again in his fig. 5. Nothing of the kind could be seen in the formation of the rings in our larva (figs. 4 & 5). In somewhat more advanced stages, after the first rings were distinctly developed, I had no difficulty in finding near the anal ring a small part of the body of the worm in which the articulations became more and more distinct as they were more distant from the anus (fig. 6), showing beyond doubt that new rings are formed between the anal rings and the older anterior rings, as in other Annelid larvæ, and not immediately below the disk near the mouth as stated by Lovén. The larvæ figured by

Lovén were probably not in a healthy condition; and as he himself mentions his inability to keep them beyond a few days, it seems probable that the peculiar composition of the rings (of four pieces) is simply due to contraction. The same thing has frequently been observed in our own larvæ; and those thus showing this apparent division (succeeding a stage where nothing of the sort existed) invariably died soon afterwards, as was the case with Lovén's young Annelids.

As far as I could ascertain, a number of rings make their appearance at once (fig. 4), and are the more distinct the nearer they are placed to the mouth; they appear at first like faint transverse lines, readily mistaken for furrows formed by contraction. In the present stage (fig. 4) we find otherwise no striking difference from the previous one; the posterior part is somewhat more elongated, and we have the lines of ventral and dorsal spots increased in number. With the growth of the larvæ the pigment spots of the body become smaller and more irregularly scattered (fig. 5), while there is no diminution as yet in the size and brilliancy of the pigment spots of the oral and anal vibratile rings. As the body elongates, the articulations become more distinct, the digestive cavity narrower; and the disproportion in width between the oral disk and the diameter of the body attains its maximum in the present stage; the anal ring has become somewhat more prominent than in the previous stage. The part of the body as yet not divided into rings can be plainly seen in fig. 6 placed next to the anus; the whole of the stomach is lined with powerful vibratile cilia, particularly well developed at the opening of the œsophagus into the stomach, and at the beginning of the intestine (*c*, fig. 6).

There appear at the stage of fig. 4, in front of the eyes, two small tentacles (*t*) (as observed by Lovén), placed nearly at the extremity of the young worm. The body of the larva now takes a rapid development; and in the stages next represented here, fig. 7 (which, with the previous stage, fig. 5, are phases not fully described by Lovén), we find as many as forty-three rings, and the pigment spots of the body more numerous than in previous stages. The lengthening of the body is accompanied by a decrease in the relative size of the anterior disk, no longer so much out of proportion as to give the larva the hammer-shape it possessed before; the part of the disk anterior to the vibratile ring has somewhat elongated; the mouth (*m*) when seen from the ventral side (fig. 8) appears quadrangular with rounded edges; it is situated close behind the anterior vibratile chord, and edged on the posterior extremity with a row of large pigment-cells.

We now come to a series of changes plainly showing the

passage from the stage represented by Lovén in his fig. 5 to that of his fig. 6. Although the body of the young worm is much elongated, the number of rings (fig. 9) has not greatly increased; they are further apart, and there is a tendency in the stomach (which occupies nearly the whole width of the body) to become folded, so as to correspond to the articulations; the anterior part of the head has greatly elongated, and the general appearance of the young worm reminds us somewhat of the larva of *Sipunculus nudus* figured by Keferstein and Ehlers. The vibratile rings are greatly reduced, the antennæ have slightly increased in length, and the head of the worm presents a certain resemblance to a Nereid or some allied form. The swelling of the posterior extremity has also been reduced, and the anal vibratile chord scarcely projects beyond the line of the body. The pigment spots of the rings have diminished in number, but slightly increased in size; and the brilliant row of spots of the oral and anal rings is beginning to fade, the vibratile cilia are losing much of their activity, and the little worm, though still capable of swimming freely about, and often caught at this stage with the dip net, moves quite slowly and has gradually lost, with the extension of the posterior part of the body, the rapidity of motion it enjoyed in the earlier stages (figs. 3, 4). When kept in confinement they are often found at the bottom of the vessel coiled up, and when disturbed creep slowly away by undulations of the body, assisted by the remnants of the vibratile rings. In a somewhat more advanced stage (fig. 10) the pigment spots have further diminished in size as well as number, the convolutions of the digestive cavity are more distinct, the antennæ have decreased in length, and the vibratile rings have lost their former power. In a subsequent stage (fig. 11) the head has become more distinct, the anterior vibratile ring scarcely exceeds the diameter of the body, and the antennæ are quite prominent. The little worm is only rarely fished up in this stage, swimming about very slowly, and becoming somewhat more active when creeping upon the bottom, where they now prefer to remain. This is their most advanced nomadic stage; and, from their subsequent habits, it is necessary to keep them in confinement in order to follow their later changes.

We find in fig. 11 the pigment spots becoming smaller than in preceding stages: the convolutions of the digestive cavity, which has acquired a light yellowish colouring, are extremely well defined. Up to this time we have still no trace of feet, bristles, or appendages of any sort, except the two tentacles of the head; and were it not for these, it would seem as if the young worm were the larva of some *Nemertes*-like animal, not-

withstanding the different development of Nemerteans observed by Müller*, Busch†, Gegenbaur‡, Krohn§, Wagener||, Leuckart and Pagenstecher¶, and others, which, when we know more of the general plan of development of Annelids, may after all not present any greater differences, when compared with the present type of growth, than we find in the embryology of Echinoderms, between the plutean and sedentary mode of development. There can be no doubt that we have in Annelids as in Echinoderms closely allied genera undergoing a widely different metamorphosis—an additional analogy between these two classes, but not, it seems to me, a sufficient reason for uniting Echinoderms with worms, as has been urged with so much ingenuity by Huxley. The observations of Desor** hint at some such widely different transformations for the Nemerteans; but his observations are too inaccurate to afford any data for a satisfactory analysis.

The persistence of the antennæ and absence of feet and bristles would show that it belonged to some genus of Annelids as yet not described, the only Annelid without setæ being *Phoronis* of Wright††, to which, however, from the descriptions given by Allman in his Freshwater Polyzoa‡‡, and by Van Beneden§§, it has not the slightest relationship. On examining subsequent stages this stumblingblock is found gradually to vanish by a sort of retrograde development; and as the little worm grows older it loses little by little the embarrassing appendages, and shows, in the most advanced stages thus far observed, a tolerably close resemblance to such well-known Nemerteans as the *Nareda* of Girard||| and some of the species of *Polia* figured by Quatrefages¶¶ in the 'Voyage en Sicile,' although as yet I have not been able to trace in the embryo worm anything of the complicated structure of the Nemerteans.

The little worm (fig. 11) has now attained a length of one

* *L. c.*, in Archiv f. Anat. u. Phys. 1847.

† Entwicklung u. s. w. *l. c.* p. 107.

‡ *L. c.*, in Zeitsch. f. wiss. Zool. 1853, v. p. 346.

§ *L. c.*, in Archiv f. Anat. u. Phys. 1856, p. 78.

|| Archiv f. Anat. u. Phys. 1857, p. 204.

¶ Archiv f. Anat. u. Phys. 1858, p. 569.

** "On the Embryology of *Nemertes* . . ." in Proc. Bost. Soc. Nat. Hist. vol. vi. p. 1, 1848.

†† Edinb. New Phil. Journ. 1857, v.

‡‡ A Monograph of Freshwater Polyzoa, p. 55, note.

§§ "Note sur un Annélide Cephalobranche sans soies, désigné sous le nom de *Crepina*," in Bull. Acad. Roy. de Belgique, sér. 2. v. no. 12.

||| C. Girard, in Smiths. Cont. 1853.

¶¶ "Mémoire sur la famille des Némertiens," in Recherches Anatomiques . . . voyage sur les côtes de la Sicile . . . vol. ii., par H. Milne-Edwards, A. de Quatrefages et E. Blanchard.

quarter of an inch; the subsequent changes are principally limited to alterations in the shape of the head and the gradual disappearance of the articulations, the only trace of them left being the corresponding convolutions of the digestive cavity. The oral and anal vibratile cilia disappear rapidly (figs. 12 & 13); the head becomes more rounded; the antennæ, having attained their maximum size (figs. 12 & 13), grow less and less prominent and rapidly vanish; so that the head of the young worm has now the shape of fig. 14, which was its condition four months after the stage represented in fig. 11. The articulations have become obliterated; no trace can be found of the pigment spots, which have gradually grown smaller and less numerous; and the young worm in its motions and attitudes reminds us strongly of *Nemertes* and the like Annelata. About a month later the head is even less prominent, and is separated from the body by the characteristic neck of the Nemerteans, the tentacles having altogether gone, the only trace of them being very slight swellings on each side of the head. The young worm loses at the same time its cylindrical shape, and in fig. 14 has already become greatly flattened. This is quite well shown in fig. 16, a profile view of fig. 15. The young Nemertean is now nearly half an inch long, and is usually found slightly coiled on the bottom of the jar in which it is kept; on being disturbed their motions are somewhat like those of the Nemerteans. The posterior extremity is much smaller than the anterior, the width of the worm increasing towards the head. As it grows older this difference is lost, the head becomes still less prominent, and finally, as in fig. 17, when the young worm is five months older than fig. 11, the width of the head is less than that of the body, and the eyes have moved nearer the neck.

There is but little doubt, from the foregoing observations, that Lovén's larva becomes eventually a Nemertean closely allied to *Polia*; my oldest larvæ, however, were far from being adults, and their generic affinities cannot be more closely intimated at present. There is little exceptional in the development of the larva from that of the other Annelids, as has been maintained; and, like other Annelids, it early assumes the features of the adult; and new rings are developed next to the anal ring, in accordance with the observations of all writers on the subject.

Spirorbis spirillum, Gould (non Pagenst., an Lam.?).

The history of the development of *Spirorbis* has been given in full by Pagenstecher*; I bring up the subject here to show

* "Untersuchungen über niedere Seethiere aus Cette. Entwicklungsgeschichte u. Brutpflege v. *Spirorbis spirillum*," in Zeits. f. wiss. Zool. 1863, xii. p. 487, pls. 38 & 39.

some differences in our observations, quite important as far as they bear upon the mode of development of the tentacles, and refer to a few features respecting the peculiar tendency of the development in these Annelids, which has not been sufficiently dwelt upon.

The species to which my observations are limited is found attached mainly upon *Fucus*. It is undoubtedly the *Spirorbis spirillum* of Gould*; but, judging from the differences existing between specimens of our coast and the descriptions of Pagenstecher, it certainly is not the *S. spirillum* of Lamarck investigated by him: the shape of the bristles of the three large clusters on the collar is totally different, as well as the arrangement of the small rods of the collar, which in our species form a single well-defined loop, placed immediately behind the posterior bundle of long bristles, entirely unlike the arrangement of the same parts as described by Pagenstecher.

The development of the eggs also takes place quite differently; and the present species, although furnished with a large, simple, funnel-shaped tentacle serving as an operculum, does not use it as an ovarian case as has been observed by Pagenstecher in *S. spirillum*, Lam. The eggs, of a dark reddish brown colour, are found in strings formed of two rows (fig. 18), either on each side of the alimentary canal in the anterior part of the body, where in the adult we find a considerable space free of bristles (as in fig. 25), or else when the strings have been laid they are found on the sides of the body, between it and the limestone tube, and here the young undergo their transformations. This is contrary to the statements of Pagenstecher, who says the young undergo their development in the funnel-shaped tentacle, used thus as a sort of breeding-case; it is, however, more in accordance with what we know of the method of laying eggs, within the tube in which they live, in *Terebella*, *Serpula*, and *Protula*.

As is already known from the observations of Milne-Edwards on *Protula*, the young lead a nomadic life but a short time, and soon build a tube in which they live and complete their growth. Pagenstecher has observed the same thing in *Spirorbis*; and it would appear from my own observations that the nomadic life of *Spirorbis* is not longer than eight or ten hours. The young *Spirorbis* has attained quite an advanced stage of growth when it leaves the tube of the parent and swims freely about (in search of a place of attachment) during a night at the outside; even with specimens kept in confinement, in perfectly clean glass vessels, the young escaping from the egg-cases are rarely caught while swimming about; it frequently happens

* Report on the Invertebrates of Massachusetts, 1841, p. 8.

during a night that the smooth sides of the vessel are completely covered with small limestone tubes, formed by the young *Spirorbes* hatched since the evening before.

We may perhaps find in our *Spirorbis* the explanation of the anomalous development of *Terebella Medusa** observed by Spence Bate, in what he calls uterine sacs, which may prove identical with the tubes containing the eggs and forming strings (fig. 18) which I have observed in this species, placed on each side of the alimentary canal, in the naked part of the body immediately behind the collar. The young are quite advanced within the body of the parent previously to the transfer of the egg-sacs to the cavity of the tube, where they complete the greater part of their growth. Spence Bate says these sacs pass through the intestinal canal into the tube: this seems scarcely possible; but, in whatever manner this may be done, the string of eggs find their way whole from the sides of the alimentary canal to the cavity of the tube.

As I shall have to refer constantly to the development of the tentacles in *Terebella* as observed by Milne-Edwards, I give here a short description of an identical mode of development in one of our common species—the *Terebella fulgida*, Agass.† The figure represents it at a time when there are but five tentacles and no signs of the branchiæ; these are only developed much later, when there are no less than from sixteen to eighteen tentacles, and are at that time short processes with very simple bifurcations appearing at the extremity. In the condition here figured (fig. 19) our young *Terebella* closely resembles fig. 24 of Milne-Edwards, at the time when, as shown by him, they are more closely allied to rapacious Annelids, before they lose their embryonic characters and acquire more distinctly those of the adult. The eyes are still in prominent clusters and not yet formed into a ring round the collar as they are arranged while gradually disappearing; below them we find on each side of the body the concretions (fig. 19 *γ*) first seen in Annelids by Leuckart‡ and Fritz Müller§, and also observed by Claparède in the young of his *Terebella conchilega*. This is the only point of importance in which the young of *Terebella fulgida* differ from those of *Terebella nebulosa*: in each we find, as in fig. 19, tentacles developing alternately on opposite sides, in the order marked in the figure; the first ring having dorsal setæ has also a row of hook-shaped bristles (fig. 19^a), found in each ring nearly to the posterior extremity. This combination

* "On *Terebella Medusa*," in Ann. & Mag. Nat. Hist. 1851, viii. p. 237.

† "Studies in Annelids," in Proc. Boston Soc. Nat. Hist. iii. p. 191.

‡ Leuckart u. Pagenstecher, in Archiv f. Anat. u. Phys. 1858, p. 591.

§ Archiv fur Naturg. 1861, l. p. 46.

is different from that observed by Claparède in *T. conchilega*, where no such hook-shaped bristles were observed before the fifth ring. The description given by Stimpson* of the genus *Lumara* agrees so well with some of the stages of *Terebella*, that I am inclined to consider it only an embryonic condition of some allied *Terebella*. Long after the stage here figured, even when the branchiæ have become quite well developed, it is very common to fish up with the dip net these young *Terebella*, which are capable of a certain amount of motion by the contortions of the tentacles and body. They build their cases very late, and frequently leave them, to climb about on eel-grass, piles, &c., making considerable progress with the aid of their tentacles, by which they drag themselves along.

Pagenstecher has invariably represented the tentacles of the anterior extremity of *Spirorbis* as developing symmetrically and in pairs. This is not the case in our species, where they are formed very differently from what has been thus far observed in this family. We have between these two modes of growth a difference similar to that existing between *Terebella nebulosa* and *T. conchilega*, where in one case the tentacles appear successively, while in the other they are formed in pairs. The oldest tentacles of our *Spirorbis* are formed on the outside, new tentacles appearing successively singly nearer the median line on alternate sides, and not in pairs, the corresponding tentacles on each side of the middle line being of very different lengths. This want of symmetry is readily seen in the youngest specimens figured (figs. 20, 21, 22); and though it is more difficult to trace this in older stages (fig. 25), the presence of the simple opercular tentacle always introduces a prominent asymmetrical element, soon lost in the more advanced stages of the development of *Terebella*. The two eyes are quite prominent, and can generally be traced in the adult, although they are not so striking as in the younger stages; the ocular spots are always limited to two, and we find at no time either a ring or clusters of eye-specks.

The first tentacle appears on the right (fig. 20 t_1); next comes the corresponding tentacle of the left, and only later (fig. 21) the rudiment of the odd opercular tentacle (t_0 , fig. 22), covering in fig. 21 the right tentacle. The bristles make their appearance in fig. 21, where we find two of the three bundles of the collar-like projection of the anterior extremity, always distinctly marked in such young embryos. In the next stage the collar is more prominent, and an additional bristle is found, representing the third bundle of the collar (fig. 22). The pos-

* Marine Invertebrates of Grand Manan, 1853, p. 30.

terior extremity has lengthened, the anal cirri have nearly disappeared, and a couple of very indistinct articulations can be traced behind the collar. There are also two additional tentacles placed between the first pair, which readily show in what order they have appeared (t_2 , t_3), the opercular tentacle always retaining its peculiar shape.

In subsequent stages (fig. 23) the posterior extremity has lengthened but slightly. There are along the side of the posterior part of the body a couple of bristles similar to those of the adult; we can trace the first stage of the bifurcation of the four tentacles at their extremity, rendering the age of the tentacles more apparent, as in fig. 24; the opercular tentacle has become more funnel-shaped. At about the period represented in fig. 23, the young *Spirorbis* escapes from the egg, and leads a short nomadic life; it soon attaches itself, and in less than twelve hours after hatching has built its limestone tube, in which it henceforth lives: subsequent observations can only be made by crushing the shell, as it is not transparent enough to show the young worm. The tentacles take a rapid development; and in fig. 25 we have a small *Spirorbis* having only nine rings, with tentacles nearly as branching as those of the adult, and a well-formed operculum, which with advancing age loses all trace of its former tentacular nature. The tentacular nature of the operculum in this family has also been observed by Fritz Müller*.

The principal changes take place almost exclusively in the anterior extremity; the posterior part of the body does not lengthen until the collar and tentacles may be said to be fully developed; and although we find papillæ on the sides of the posterior part of the body similar to those forming the single loop of the collar of the adult, as well as the peculiar scythe-shaped bristles of each ring, yet the young *Spirorbis* has, up to this time, passed through no phase of growth during which the increase of the posterior part was in the least to be compared with the changes of the anterior extremity. In nearly all other Annelids we find the posterior extremity playing a much more prominent part in determining the shape of the young worm. This is undoubtedly due to the shortness of their nomadic life; and though capable of active movements during that period by means of the collar, their freedom soon comes to an end, and they complete their development after having assumed the habits of the adult.

[To be continued.]

* Für Darwin. Leipzig, 1 64.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

January 10, 1867.—Lieut.-General Sabine, President, in the Chair.

“On the Appendicular Skeleton of the Primates.” By St. George Mivart, F.Z.S., Lecturer on Comparative Anatomy at St. Mary’s Hospital.

The author began by mentioning the principal variations found in the order Primates, as to the absolute and relative length of the pectoral limb with and without the manus; and then taking each bone separately, described the modifications undergone by each in all the genera of the order*, as also the relative size of the segments and bones of the limb compared to each other and to the spine. The pelvic limb was then similarly treated of, and, in addition, its segments and bones were compared with the homotypal segments and bones of the pectoral limb.

The author after this reconsidered the question as to the use of the terms “hand” and “foot,” and the applicability of the term “Quadrumanous” to Apes and Lemuroids.

He controverted the position lately assumed by Dr. Lucaet†, that both anatomically and physiologically the pes of apes is more like the human hand than the human foot. At the same time he recommended the use of unambiguous homological terms, such as “manus” and “pes” (already adopted by some) instead of “hand” and “foot,” in all treatises on comparative anatomy.

Tables of the dimensions and proportions of the limbs, their segments, and bones were then given, exhibiting the variations presented in these respects throughout the whole series of genera.

The author then considered the more peculiar forms of the order, beginning with Man.

The principal resemblances and differences in form, size, and proportion between the human appendicular skeleton and that of other primates were given in detail, followed by a list of those points in which man differs, as to the bony structure of his limbs, from all other primates.

The limb-skeletons of the Orang, Marmoset, Indri, Slender Lemur, Tarsier, and Aye-aye were then similarly reviewed, and lists given of the absolute peculiarities found in each.

The conclusion arrived at from these comparisons was, that Man differs less from the higher Apes than do certain primates below him from each other, and that he, *thus judged*, evidently takes his place amongst the members of the suborder *Anthropoidea*.

* Except certain Lemuroids, of which no specimens exist in this country.

† Abhandlungen von der Senckenbergischen Naturforschenden Gesellschaft (Frankfort, 1865), vol. v. p. 275.

MISCELLANEOUS.

On the Flowering and Fructification of the Vine.

By H. MARÈS and J. PLANCHON.

IN this succinct summary of our researches upon a subject apparently exhausted we shall confine ourselves to the exposition of some prominent facts, passing designedly over points of secondary importance.

The general structure of the flowers of the cultivated vine is well known:—a calyx with five denticles, a corolla with five petals, the edges of which touch and remain adherent at the apex, so as to form a hood, which is most frequently raised by the stamina; five stamina opposite to the petals, with subulate filaments longer than the corolla; five hypogynous nectariferous glands; an ovary with two or three cells, produced into a short style, which is terminated by two or three imperfectly marked stigmatic lobules.

A singular deviation from this normal structure has been indicated by one of us in certain varieties of vines grown in the south, especially in the "Terrets." These are the stocks or the bunches of flowers called in the idiom of Languedoc *avalidouïres*, from an old word *avali*, which implies the idea of disappearing, or becoming effaced, without leaving any traces. The entire stocks affected by this degeneration remain, in fact, absolutely sterile, except by the intervention, whether accidental or artificial, of pollen derived from other bunches, and capable of fecundating the ovaries of their flowers. These flowers may be recognized at first sight by the following characters:—their corolla, which persists for a long time, opens and spreads into a five-rayed wheel, instead of forming a hood and falling in a single piece; their petals are greener and thicker than in the normal state. The stamina, with comparatively short filaments, present large anthers, of which the two thick turgid cells, with well-marked fissures of dehiscence, either do not open at all or only imperfectly, and contain only a pollen with lax and wrinkled grains; that is to say, these stamina are barren. The ovary and stigma, on the contrary, are well formed and susceptible of impregnation.

Another type of abnormal flowers is that of the stocks called *coulards*, a word which sufficiently expresses that we have to do with bunches subject to drop and only forming scattered grapes. This relative sterility, however, does not depend upon external causes, such as unfavourable climatic conditions, although these may aggravate it. It is due to the structure of the dropping flowers. These, in some respects, occupy a middle place between the *avalidouïres* and the normal flowers. They often present one, two, or three free petals side by side, with four, three, or two others which adhere by their apices to form an incomplete hood. The æstivation of these petals is slightly imbricated. Very often the five petals remain more or less united; but their widened apices, which are slightly undulated and bordered with a little red edge, have an open-

ing between them enabling the stigma to be seen. Of the stamina of a single flower, some have the filaments slender and the anthers dehiscent; these are more or less fertile; the others with shorter filaments, and with the anthers imperfectly dehiscent, are, of course, sterile. The pistil is constructed as usual. Consequently the pollen of the few fertile anthers, or that of neighbouring flowers, causes a few of the ovaries to develop into fruits. Artificial fecundation by means of the pollen of other flowers of the vine greatly increases the proportion of these fertile fruits in the *coulards*.

A third deviation from the normal type is met with in the flowers. This is the case of double flowers, by the transformation of the ordinary into more or less petaloid stamina, of the five nectariferous glands into five staminodes either free, or united into a tube, and, lastly, of the ovary into a bundle of little, imperfect leaves, forming a sort of bud in the centre of the flower, and each of which, representing a carpellary leaf with or without rudiments of ovules, may be ovuliferous upon its margins, or at once upon its inner, stigmatic and polliniferous surfaces, for a variable portion of its apex. This curious monstrosity, of which one of us intends publishing the details in the 'Annales des Sciences Naturelles,' possesses peculiar interest in a botanical point of view; in fact it recalls the normal state of the genus *Leea*, just as the *avalidouïre* abnormal type does the normal flowers of *Cissus*.

After the above statements as to the regular or monstrous organization of the flowers of the vine, it will be easy to explain the principal physiological facts of our subject.

The flowers of the cultivated vine seem to be all hermaphrodite. Perhaps, indeed, nearly the whole of them are so, although a very great number of the flowers of a bunch regularly fall without setting and, especially, without ripening fruits. The habitual abortion of a large proportion of the fruits, and the incomplete development of many others, depend less, no doubt, upon the state of the organs of fecundation than upon the preponderance early acquired by the young fruit situated at the extremity of each branch of the thyrsus. These young fruits serve to starve their neighbours, and sooner or later bring on their atrophy.

There are, nevertheless, cases in which, in flowers apparently well formed, the anthers, whiter than usual, prove to be empty of pollen. These flowers, which have become female by the imperfection of their stamina, sometimes accompany the ordinary or hermaphrodite flowers. Here, therefore, we have polygamy with excess of pistils (or, if it be preferred, imperfection of stamina) in some flowers.

In other cases a very great number of ovaries set and pass into the state of fruit, but furnish grapes of very small size and destitute of seeds. These grapes are called *millerands* (probably from *mille grana*). An imperfect fecundation has developed only the pericarp, leaving the ovules in a rudimentary state. We shall recur hereafter to the characters of this imperfect development of the fruit.

This is the place to indicate some remarkable peculiarities of the flowering of the *Lambrusques*, or wild vines, which occur in such

great abundance in the woods and copses of our southern Departments. At the first glance it is easy to see that the flowers of these wild vines differ considerably from those of the cultivated vines. Their stamina have the filaments longer and more slender; their style, on the contrary, is much shorter, or might almost be said to be wanting. They are, moreover, more odorous, the nectariferous glands being proportionally more developed. The fruits are much smaller, with the stones less numerous and larger in proportion than in the ordinary cultivated varieties.

Notwithstanding the hundreds of flowering bunches with which the climbing stems of the "Lambrusques" are covered, entire stocks remain absolutely infertile—that is to say, without fruit. Nevertheless their flowers seem to be regularly constructed. The old individuals are the only ones which bear fruit. Does the barrenness of the young stocks arise from the too great luxuriance of the vegetative organs in the period of their first vigour? This would appear to be proved by the fact that cultivated "Lambrusques" habitually become infertile, and that pruning, which gives vigour to their shoots, prevents their setting fruit.

We postpone the closer examination of this question of the "Lambrusques," both from a physiological point of view and as regards the relations of this supposed wild type to the cultivated varieties of the vine.

Let us now study the mode of fecundation of the vine. It has long been suspected that impregnation takes place beneath the hood itself of the calyptriform corolla. Appearances indicated this, and our observations have placed it beyond a doubt; at least this is the mode in which the phenomenon usually occurs. In the morning especially, at the moment when the first rays of the sun of May or June strike the buds which are ready to open, we see, in a few seconds, the corollas, splitting in five lines from the bottom, detach themselves from the calyx, rise under the pressure of the stamina (the inflected filaments of which erect themselves rapidly), and lastly fall in a single piece, exposing the stamina, which separate by diverging and curving backwards, whilst the pistil makes its appearance with its stigma already powdered with pollen. Microscopical examination shows that this pollen acts very quickly upon the stigma of its own flower, producing fecundating tubes in a few hours. Another proof that fecundation takes place beneath the hood of the corolla is, that, in certain stocks, on particular bunches the hood of the corolla, instead of falling, remains hermetically applied to the summit of the ovary, and even dries there, serving as a permanent cap to the young grape when it is already set and growing.

This direct fecundation of a pistil by the pollen of its own flower is therefore habitual in the vine. It is not, however, the only possible mode; and the proof that there are others consists in the evident existence of intercrossings between varieties of vines, and the results which have been for a long time obtained from them.

One of the most remarkable of these crossings, especially as regards the effect produced, is certainly to be found in the hybrids

obtained by M. Bouschet-Bernard père and M. Henri Bouschet between various southern stocks (*aramon, grenache, &c.*) with colourless juice and the grape called the *Teinturier*, of which the juice is coloured. Leaving out of consideration M. H. Bouschet's notions, in our opinion incorrect, of the influence of the pollen of the "Teinturier" as a direct modifier of the ovary of the varieties which it fecundates, we admit as indubitable the mixed, hybrid nature of the *Petit Bouschet* or *Aramon-teinturier*, and of the *Alicant-Bouschet*, and even of quadron hybrids, all with coloured juice, between the *Petit Bouschet* and other stocks with colourless juice. Now in these cases the impregnation was effected by a very simple process, namely the approximation of the flowering bunches of the two types by interlacing and contact. This last condition, however, is not indispensable. It is sufficient that the distance of the bunches to be mutually fecundated be but small; the seeds of the approximated grapes furnished mixed products having evident traces of the characters of their parents.

What, in this process and generally in nature, is the agent of transport of the pollen from one flower to another? Is it the wind? Is it the mutual friction of the flowers in contact? Is it the intervention of insects? Perhaps one or all of these, according to circumstances. That the wind transports mixed pollinic dust will not be disputed by any one who has seen the flowering bunches of the vine, their abundance and their pulverulent and light pollen. That friction may act is probable in the case of stocks which, like those of the southern vines, so slightly interlace their branches and floriferous thyrsi. Lastly, we may suppose that insects assist, at least as regards the nocturnal Lepidoptera (*Noctuidæ, Pyralidæ, &c.*); in the daytime, on the contrary, we have only seen upon the flowers of the vine, at least habitually, a species of *Dasytes*, and a larva or nymph of a *Locusta*, leaving out of the account the caterpillars of *Pyralis*, and especially of *Cochylis*, which haunt the bunches rather as enemies than as auxiliaries, and destroy much more than they fecundate.

To sum up. The impregnation of the flowers of the vine is effected habitually beneath the hood of the corolla; each flower then fecundates itself. Foreign pollen may nevertheless, in various ways, attain the stigma of flowers, either unimpregnated (*avali-douïres, coulards*) or already covered with pollen. The sterility of certain flowers is explained by the imperfection of the stamina (*avali-douïres, coulards*); that of the young or pruned "Lambrusque" is probably caused by the too great vigour of the vegetation, a derivation of the sap from the flowers towards the leaves; that of the double flowers is due to the transformation of the stamina and pistils into petaloid or foliaceous organs.

It may be added that the floral degenerations known as *avali-douïres, coulards*, and double flowers appear sometimes suddenly in vines which presented no traces of them, that they occur especially in wet soils in which the rains of winter and spring remain, that they affect entire stocks, that they persist habitually in the stock

when once they have attacked it, and are even propagated by layers and cuttings, that grafting alone can cure the evil, when it is desired to avoid the radical remedy of pulling up, and, lastly, that certain varieties are more subject than others to this organic change—the “Terret noir,” for example, being most inclined to become *avalidouïre* or *coulard*, and the “*Clairette blanche*” being hitherto the only one which has furnished us with double flowers.—*Comptes Rendus*, February 11, 1867, pp. 254–259.

Note on the Law of Sexual Development in Insects.

By H. LANDOIS.

It is generally supposed, from the observations of Dzierzon and Von Siebold, that the working bees originate from ova fecundated by the queen which deposits them, by means of the semen of her *receptaculum seminis*, whilst the male bees issue from non-fecundated ova. Von Siebold especially averred that the demonstrated existence of spermatozoids in the eggs of worker-cells, and their non-existence in those of drone-cells, sufficiently prove that in bees the formation of the sexes depends upon fecundation. But the eggs from which worker bees originate are deposited, as is well known, in different cells from those of the males; and, moreover, the paste which serves for the nourishment of the young bees is not the same in the two cases. Hence naturally arose the question whether it would not be possible to produce male bees from eggs laid by the queen in cells intended for workers, by transferring these eggs into cells made for drones, and taking care that the adult workers should not give the larvæ any nourishment but that on which the drones are fed. On the other hand, by a similar transfer, might not workers be produced from drone-eggs?

I have made this experiment several times,—at first, indeed, without success, because the bees quickly destroyed my work of transfer; but finally I succeeded in deceiving them, not only once, but repeatedly. I may remark that we cannot succeed in the transfer of the eggs if they are removed from an oviferous comb into another containing no eggs. The eggs being extremely delicate, care must be taken not to touch them in transferring them. To manage this, by means of a small pointed knife I cut the bottom of the cell a little round each egg, and then, removing the little fragment of wax with the egg which it bore, I transported it into another cell.

I was surprised to see worker bees originate from male eggs, and *vice versd*. There could not be any error in the experiment, for I made my observations several times every day; besides, when the bees had emerged, the shell of the egg was still to be seen placed upon the little morsel of wax which had served to transport it. According to these experiments, therefore, it is not to the fecundation of the eggs, or to the want of this fecundation, that we can ascribe the production of workers or drones; but it is upon the food that the sexual characters of the bees depend.—*Comptes Rendus*, February 4, 1867, pp. 222–224.

On the Structure of the Heart in Fishes of the Genus Gadus.

By M. JOURDAIN.

In 1858 Professor Hyrtl of Vienna published an interesting memoir on the absence of blood-vessels in the hearts of certain Vertebrata. He announced that the heart in the Batrachia is completely deprived of vessels—a peculiarity previously unknown, and the reality of which, we may say in passing, we have ascertained in the Batrachia of this country. The aortic bulb alone possesses some very delicate vascular branches, comparable to the *vasa vasorum*, of which M. Hyrtl indicated the origin, course, and termination with the rigorous exactitude characteristic of that anatomist, a recognized master in the art of injection.

The heart in the bony fishes presents a state intermediate between the heart *without vessels* of the Batrachia and the *vascular* heart of the Mammalia and Birds,—that is to say, that only one-half of the thickness of the ventricular wall, the outer stratum, receives branches of the arterial system, and that the other half is completely deprived of them. The heart in the osseous fishes might therefore be designated a *semivascular* heart. The central organ of the circulation presents this plan of construction in the fishes of our coasts. The most penetrating fine injections never implicate more than the outer layer of the ventricle, the compact structure of which approaches what we are accustomed to see in the heart of the Mammalia and Birds. The inner layer, in which, we repeat, the most minute examination fails to detect the least trace of vascularity, presents, on the contrary, a soft and spongy texture, and separates readily from the outer layer of dense tissue—a peculiarity alluded to by Cuvier, Döllinger, and Rathke, who did not, however, understand its significance.

The *Gadi* present an exception which the mode of circulation in fishes renders worthy of remark. Like that of the Batrachia, the heart of the *Gadi* is destitute of the vascular element. Fine injections driven in through the arteries so as to return by the veins, never penetrate into the walls of the ventricle, nor into those of the auricle. The aortic bulb alone possesses some very slender branches; but these never pass the scissure which separates this last cardiac chamber from the preceding one. The arterioles are furnished by the hyoidian artery, which is dependent upon the first two epibranchials; the venules open into the hyoidian veins, which in their turn are tributaries of the common venous sinus. With this absence of vessels corresponds a peculiar structure of the ventricular walls, very analogous to that observed in the Batrachia. The muscular fibres, instead of constituting by their apposition a dense and compact tissue, form bundles and trabeculæ, which divide and interlace in such a manner as to give origin to an areolar and spongy mass. It is in the irregular passages and lacunar spaces thus produced that the venous blood diffuses itself at the moment of the ventricular diastole. At this moment the blood permeates the walls of the ventricle like a sponge, and it is pressed out again by the movement of systole which succeeds.

The heart in the *Gadi*, like that of osseous fishes in general, being a venous heart, and, on the other hand, its ventricle and auricle being always deprived of vessels with red blood, it follows necessarily that the venous blood alone serves for the nutrition of muscular fibre, and maintains the contractility of the latter. It is by the repeated conflict of the venous blood and the muscular fibre that is produced the double movement of assimilation and decomposition which constitutes nutrition. We are convinced that the venous blood issuing from the heart would furnish on analysis a somewhat higher proportion of carbonic acid than that which enters the auricle, since the blood driven into the branchial artery must contain in addition the acid formed by the muscles of the auricle and ventricle in consequence of their contraction.—*Comptes Rendus*, January 28th, 1867, pp. 192–194.

On a new Specimen of Telerpeton Elginense.
By Prof. T. H. HUXLEY, LL.D., F.R.S., V.P.G.S.

The specimen which was described in this paper had been broken into five pieces, exhibiting hollow casts of most of the bones of *Telerpeton Elginense*. It is the property of Mr. James Grant of Lossiemouth, and came from the reptiliferous beds of that locality, along with some highly interesting fragments of *Stagonolepis* and *Hyperodapedon*. The casts described by the author consisted of impressions of the bones of the skull, together with the lower jaw and the teeth, of most of the vertebræ and ribs, of the greater portions of the pelvic and scapular arches, and of representatives of most of the bones of the fore and hind limbs; and it was stated that the characters of all these portions of the skeleton indicated decidedly Lacertilian affinities.

In describing these remains, Professor Huxley discussed especially the biconcave character of the vertebræ, the mode of implantation of the teeth (which he believed to be Acrodont, and not Thecodont), and the anomalous structure of the fifth digit of the hind foot (which presents only two phalanges, a proximal and a terminal)—a structure which differs from that of all known Lacertilian Reptiles, whether recent or fossil. His researches had led him to conclude that the animal is one of the Reptilia, and is devoid of the slightest indication of affinity with the Amphibia. In all its characters it is decidedly Saurian, and accords with the suborder Kionocrania of the true Lacertilia; but the author had not been able to make sure that it possessed a columella. He also remarked that the possession by *Telerpeton Elginense* of vertebræ with concave articular faces does not interfere with this view, as, although most recent Lacertilia have concavo-convex vertebræ, biconcave vertebræ much more deeply excavated than those of *T. Elginense* are met with among the existing Geckos.

Professor Huxley in conclusion drew attention to the interesting fact that *Telerpeton* presents not a single character approximating it towards the type of the Permian Proterosauria, or the Triassic

Rhynchosaurus and the probably Triassic African and Asiatic allies of that genus, or to the Mesozoic Dinosauria, and that, whether the age of the deposit in which it occurs be Triassic or Devonian, *Telerpeton* is a striking example of a *persistent type* of animal organization.—*Proc. Geol. Soc.* Dec. 19, 1866.

On the Incubation of the Eggs of the Small Spotted Dogfish (Scylium catulus). By M. COSTE.

At Concarneau, in a reservoir of 1500 metres surface and of 3 metres in depth, divided into six compartments, hollowed out in a granite rock and defended by thick walls from the violence of the waves, we have succeeded, by means of grated floodgates which may be opened or closed at pleasure, in imitating the conditions of the open sea, with its flux and reflux, so well that organic phenomena hitherto most completely concealed in the depths of the ocean are accomplished there under the eye of the observer. Not only do most of the species live there in a state of familiar domesticity, exhibiting all the peculiarities of their habits, but their reproduction is effected, presenting a new field of observation in embryogeny. Of this the following is a fresh example:—

“At the beginning of April 1866,” M. Guillou writes to me, “we put into one of the compartments of the vivarium a pair of the Little Spotted Dogfish (*Squalus catulus*, Linn.). The female laid eighteen eggs in the course of the month. These eggs hatched at the beginning of December; the incubation therefore lasts about nine months. The young are very lively.”

Thus a phenomenon which lasts nine months (and one of the most delicate phenomena, since it implies the formation of a superior organism) may be accomplished under these artificial conditions with as much certainty as if it took place at the great depths where this species usually deposits its eggs. This, in my opinion, is one of the most decisive proofs of the perfection of the vast hydraulic apparatus in which we carry on our experiments. Thanks to the perfection of this apparatus, we shall henceforward study the development of marine species, day by day and hour by hour, just as we investigate that of the chicken in the egg.

At one of the extremities of the vivarium there is a large building, of which the ground-floor is provided with numerous aquaria for the isolation of objects which it is desired to observe closely; whilst its first floor has been converted into rooms for dissections and microscopic observations. Six French and foreign naturalists came last summer to take their places in this laboratory, and devoted themselves in perfect freedom to any investigations that they chose to undertake. I offer the same hospitality to any who may be disposed to profit by it. It is from this laboratory that we have derived all the principles which served for the basis of the regulation of the marine fisheries, and all the methods the application of which justly claims the title of the “agriculture of the sea.”—*Comptes Rendus*, January 21, 1867, pp. 99-100.

New Reptiles from Chili, Brazil, and Persia.

By Dr. STEINDACHNER.

1. *Hemipodion Kotschyianum*, nov. gen. et sp. (Fam. *Scincoidei*).—Body much elongated; extremities slightly developed, the anterior with three, the posterior with two toes of unequal length; nasals divided; no supranasal shield; ear-orifice not visible; inferior eyelid with a transparent disk; palate without teeth; scales smooth; brown points in regular lines on the sides of the body and on the tail. From Persia.

2. *Dromicus chilensis*, sp. n.—Scales in twenty-three rows; three postocular shields; back brown, with four yellow longitudinal lines, of which the upper ones extend to the posterior end of the upper margin of the eye. From Chili.

3. *Geoptyas collaris*, sp. n.—Nearly allied to *Geoptyas* (*Coryphodon*) *pantherinus*. Scales in seventeen rows; black streaks on the hinder margins of the 4–7th upper labial shields and corresponding lower labials; a black band running obliquely backwards and downwards on each side of the neck. From Brazil.

4. *Geoptyas flaviventris*, sp. n.—Back light brown, sometimes with regular black transverse lines, without black streaks and bands on the head and neck; belly light yellow. From Brazil.

5. *Liophis pulcher*, sp. n.—Black oval transverse spots, between which smaller ones are placed, on each side of the body, and reaching down to the last but three of the longitudinal rows of scales (counting from the ventral margin). A broad black band on each side of the head, extending from the posterior margin of the eye to the neck, and then united by a transverse band with that of the opposite side. Scales on the body in nineteen rows; eight supralabial shields; anal shield divided; ventral shields 193. From Chili.—*Anzeiger der Akad. d. Wiss. in Wien*, February 7, 1867, pp. 40–41.

On the Nature of Anthers.

J. Müller, the elaborator of the Euphorbiaceæ for DeCandolle's *Prodromus*, has published three brief papers in the 'Mémoires de la Société de Phys. et d'Hist. Nat. de Genève,' upon points relative to the anther, which fell under his observation in the progress of his work. The first is a case in which the anther had reverted to a leaf, giving evidence that this organ is homologous with a plane lamina, its margins or line of dehiscence answering to the margins of a leaf. The second is upon the trilocular anther of *Pachystemon*, neatly showing that this (and, by just analogy, the three-celled anther of *Ayenia* also) is not a combination, but answers to a single leaf. The third exhibits the double flexure, in the bud, of the apex of the filament in *Cephalocroton*, the anther remaining upright, as contrasted with the inverted anthers of *Croton*.—*Silliman's American Journal*, January 1867.

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[THIRD SERIES.]

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XXXVI.—*Note on the Excavating Sponges; with Descriptions of four new Species.* By ALBANY HANCOCK, F.L.S.

[Plates VII. & VIII.]

SINCE the publication of my paper on the excavating Sponges*, I have reexamined nearly all the species therein described, and have carefully investigated several new and interesting forms from various parts of the world; and, as a result of these researches, I have only become more confirmed in the opinion that these lowly organized creatures are endowed with the power (of whatever nature it may be) of forming in shell and other hard calcareous bodies the crypts and channels within which they lie concealed. The means by which this work is achieved is still, I frankly admit, involved in much obscurity.

Shortly after the appearance of the paper above alluded to, I satisfied myself that the larger bodies found in contact with the surface of *Cliona celata* were not organically connected with it, as I originally thought, but were really nothing more than decalcified portions of the horny membranous tissue of the oyster-shell within which the *Cliona* was buried; and some time ago I wrote to Dr. Bowerbank to this effect†. If, therefore, *Cliona* works out the cavities it inhabits in the manner I supposed, namely, mechanically, it must be by the aid of the smaller bodies described in my paper, or by the spicula themselves.

My object, however, on the present occasion is not to discuss the means by which *Cliona* excavates its habitation, but rather to give some additional specific characters that distinguish the British species, and which originally escaped observation. But in the first place it must be stated that Dr. Bowerbank is not exactly correct when he asserts, as he has done in the second

* Ann. & Mag. Nat. Hist. ser. 2. vol. iii. p. 321, May 1849.

† On the 28th of February, 1866.

volume (p. 216) of his recently published 'Monograph of the British Spongiadæ,' that I have divided Dr. Johnston's *Halichondria celata* into twelve species. It does not appear that Dr. Johnston ever saw any one of the species described by me; there is certainly nothing in his description to show that he had examined more than one form of *Cliona**. Neither do I see any reason for believing that Dr. Bowerbank himself has enjoyed any greater advantage; for if he had had in his possession specimens of my species, he assuredly would never have written that "nearly all these proposed new species have the same habit and the same forms of spicula, with only such an amount of variation in size and form as may readily be found in a single field of view beneath the microscope in any well-known specimen of *Halichondria celata* of Johnston, when mounted in Canada balsam"†. Now I have numerous slides, so mounted, of *Cliona celata*, Grant, which species is undoubtedly the same as Johnston's second variety under that specific denomination, and I have never found on any of them more than one form of spiculum, or any of the forms that characterize *Cliona Northumbrica*, *C. gracilis*, *C. Howsei*, *C. Alderi*, *C. corallinoides*, *C. lobata*, or *C. vastifica*; neither have I, in any of these species, found the exact form of spiculum that distinguishes *C. celata*. In fact the habit of the sponge and the characters of the spicula are so well pronounced that, with the exception of one, which I admit to be critical, few naturalists, after a careful examination of the species I have described, will doubt their distinctness.

And here it may be observed that the study of *C. celata* alone is not sufficient for the full comprehension of the questions connected with the excavating Sponges. This species is not by any means typical of the group: it has but one form of spiculum, while by far the greater number have two or three kinds, and the sponge itself does not assume in a decided manner that lobed structure which is so dominant among the species. All the British forms should be carefully examined; and the foreign, which are very abundant, should be investigated with equal assiduity. When this is done there will be little difference of opinion on most questions connected with the subject.

When I drew up the descriptions of the species, I had not

* This, however, does not appear to have been Dr. Johnston's own opinion. In a letter I had the pleasure of receiving from that excellent naturalist shortly after the publication of my paper on *Cliona*, speaking on this subject he says, "I have no doubt my *C. celata* embraces several species." But this was a hasty utterance, written on the spur of the moment, and probably meant nothing more than an expression of his conviction that there are more than one species of British *Cliona*.

† Monograph of the British Spongiadæ, vol. ii. p. 216.

mounted any of the spicula in balsam; it was not till some time afterwards that this was done, and the discovery made that a third minute form of spiculum had been overlooked in several of the species. It was unfortunate that this had escaped observation in the first instance, as it aids materially in distinguishing the species, though the characters originally given appear amply sufficient for the purpose.

Cliona celata possesses only pin-like spicula, according to all writers on the subject; and it is equally true that most of the *Clionæ* have likewise pin-like forms: but in very many instances they have also associated with them other forms; and it is such association of various kinds of spicula that chiefly characterizes the species, and that distinguishes most of those I have described from *C. celata*. Dr. Bowerbank, however, denies the existence of a second kind of spiculum, fusiform or "acerate," in any of the British species*. This distinguished naturalist believes the fusiform spicula described by me to be adventitious, adhering accidentally to the surface of the sponge. Such belief is perfectly untenable. The fusiform spicula are not attached to the surface, as assumed by the Doctor, but are imbedded throughout the substance of the sponge in vast numbers; they are certainly numerically equal to the pin-like form, as is stated to be the case in the original description of *C. corallinoides* and *C. Canadensis*. There is no more reason for supposing the fusiform spicula to be adventitious than there is for assuming the pin-like forms themselves to be so; both kinds undoubtedly belong to the organism. It may also be stated that numerous foreign species examined by me have similar fusiform spicula associated with the pin-like form; and in many instances there is likewise present the third minute kind already mentioned as occurring in several of the British species. But even when only the pin-like spicula are found, they are usually sufficiently characteristic to distinguish the species; when, however, this form is, as just stated, associated with other kinds of spicula, there can rarely be any doubt on the subject.

All the three forms of spicula are found in each of the membranes of the sponge. In such species as *C. Northumbrica*, *C. corallinoides*, and *C. vastifica* the pin-like form is the least numerous, being only sparingly distributed in the internal membranes, though they are densely crowded in the papillæ, where they are arranged longitudinally in parallel order, with the heads mostly in one direction; so that when the papillæ are flattened or retracted, they assume a radiating disposition. The fusiform spicula are in vast numbers in connexion with the external and

* *Op. cit.* vol. ii. p. 216.

internal membranes, and occur also in the papillæ, where they are frequently arranged transversely. The minute spicula are found everywhere, but in the greatest number in the external membrane, particularly on the papillæ; they are sometimes crowded together in vast multitudes. In the species which have only pin-like spicula, these spicula equally pervade all the membranes; but I have not observed that they assume any definite arrangement in the papillæ, though in *C. globulifera*, one of the species described in the sequel of this paper, which has only the pin-like form, they are occasionally arranged in a radiating manner in the internal membranes. Thus it appears that, in some instances at least, *Cliona* does show a limited degree of order in the distribution of the spicula.

It must not, however, be supposed that the spicula supply the only characters that distinguish the species: the colour of the sponge must also be taken into account, as well as the size, number, and distribution of the papillæ; the general habit and mode of branching, or, in other words, the size and character of the burrows containing the sponge are highly characteristic. But here, again, we are unfortunately at issue with Dr. Bowerbank, who asserts that these burrows are made by "lithodomous Annelids"*; and consequently the branching of the sponge must be accidental, being entirely dependent for its character on the form of the cavities within which the sponge is lodged, being moulded, in fact, in worm-burrows. I shall not here reiterate the facts and arguments brought forward in my former paper to refute such an opinion. It may, however, be asked how it is that, while *C. celata* is found in vast abundance on our coasts, inhabiting excavations in shells and limestone, the worm or annelid assumed to have made the cavities has never yet been determined. Surely, if these are worm-burrows, we ought naturally to expect to find the maker of them, as frequently at least as *Cliona*, in peaceable undisputed possession of its habitation. But no, *Cliona* alone occupies these cavities; no worm has yet been taken that the naturalist can pronounce to have made them. Then why not allow *Cliona* to be the fabricator, as it is the constant possessor, of its excavated home?

Dr. Bowerbank, indeed, mentions "several" instances of having found Annelids occupying the "numerous sinuous canals" in large *Balani* from the Guliot caves in Sark, and also of finding "living Annelids in deeply seated portions of the perforations in the limestone boulders of Tenby"†. There is nothing surprising in this; in fact we might have expected such instances to occur much more frequently to a naturalist

* *Op. cit.* vol. ii. p. 221.

† *Ibid.*

of Dr. Bowerbank's experience. Many worms and other marine animals conceal themselves in any hole or crevice they can find, and numerous worms or annelids perforate both shells and limestone and other hard calcareous bodies. Living worms occupying their own burrows in these substances are frequently met with; and it is not uncommon to find such burrows in shells perforated by *Cliona*, and mingling in the most intricate manner with the excavations of the latter. But there is never any difficulty in determining which was made by the worm and which by the sponge. And if the instances mentioned in the 'Monograph of the British Spongiadæ' are genuine worm-burrows, neither can there be, in these cases, any uncertainty as to the fact of their being so.

Worm-burrows are always linear, usually cylindrical, and are more or less tortuous; they never assume a dendritic form, are sometimes double, or as it were bent upon themselves, and a little flattened; the surface is invariably smooth, never punctured or shagreened, as it is in the burrows of *Cliona*, the excavations of which, on the contrary, are always dendritic, dividing dichotomously, anastomosing, usually constricted at intervals by perforated septa, so as to form a congeries of small chambers, and having the surface constantly punctured or shagreened, and generally giving off on every side numerous delicate cæcal tubes.

To account "for the vast number of perforated shells, and the comparative rareness of the Annelids," it is suggested, in the work on the British Spongiadæ before quoted*, that the worms assumed to have made these perforations obtain their nutriment by passing the excavated substance, "abounding in animal matter," through the digestive organs, the analogy of the earthworm being relied on. Unfortunately, however, for the advocacy of such an idea, the excavations inhabited by *Cliona* are of the same character and equally extensive in limestone. Whatever made these burrows in the one material also made them in the other; of this there can be no doubt; and yet it would be very hard to believe that these hypothetical worms would be able to derive much nutriment from limestone, however much they might obtain from shell. This fact, indeed, sufficiently disproves the nutritive theory; and the difficulty still remains with those who assume the agency of worms, to account for the great number and vast extent of the excavations occupied by *Cliona*, and the almost entire absence of worms.

But there is another equally formidable obstacle in the way of attributing these excavations to worms, and which appears to be perfectly insurmountable. In all the excavations

* Vol. ii. p. 220.

occupied by *Cliona* there are numerous circular orifices opening at the surface of the shell or stone containing the parasite; now the papillæ or oscula of the sponge, communicating with the water, always protrude through these apertures, and invariably correspond to them in size, number, and position, leaving no orifice unoccupied, and exactly fitting each, whether there be upwards of two hundred to the square inch, as in *C. vastifica*, or only about twenty-five or less, as in *C. celata*. How are we to account for such a fact as this, if it be maintained that these orifices were drilled by worms? Are we to consider that this complete correspondence between these parts of the sponge and the orifices is a mere chance coincidence—wonderful, indeed, if true? or that the worm made the openings purposely, in strict accordance with the requirements of the sponge that on some future day might take up its abode in the deserted excavation? or is it that the sponge has the power of modifying the position, number, and size of these important organs to meet the circumstances of its usurped home? The first two propositions cannot be entertained for a moment, and the last is contradicted by the fact that *C. vastifica* is never found with few and large papillæ, like *C. celata*; nor in the latter species are they ever very numerous and minute, as is the case with the former. And, indeed, the arrangement, size, and number of the papillæ are good specific characters throughout the genus.

If we now refer to what is stated in my former paper on the subject, already quoted, and at the same time take into account what is advanced on the present occasion, we shall find that the following facts seem to be sufficiently demonstrated. And they certainly appear cogent enough to satisfy the most scrupulous inquirer that *Cliona* excavates for itself its abode in hard calcareous bodies:—

1. That the sponge, when examined in a good state, is always found to fill every part of the excavation, even to the minutest ramification.
2. That the excavations are as frequently in limestone as in shell.
3. That no worm has been found that can be pronounced to have made these excavations, and that worms are rarely or never taken in them.
4. That these excavations have no resemblance whatever to the burrows of worms.
5. That the surface of the excavations inhabited by *Cliona* is always shagreened or punctured in a peculiar manner, while that of the burrows of worms is always smooth.
6. That *Cliona* with the papillæ of the same size, number,

and arrangement, and with the same kind of spicula, always occupy similar burrows.

7. That the oscula or papillæ always correspond in size, number, and position to the external orifices in the surface of the shell or stone enclosing the sponge.

8. That *Cliona* has been traced through every stage of growth, from the microscopic gemmule adding branch after branch and lobe after lobe, to the fully developed sponge, excavating step by step its complicated abode in sound transparent shell*.

Cliona undoubtedly works out the cavities it inhabits, whether mechanically or otherwise. Whatever the process may be, the difficulty in believing that a sponge, even if deprived of all mechanical agency, can burrow into hard substances is much lessened since I first wrote on the subject. It has recently been ascertained that some of the Polyzoa bury themselves in hard calcareous bodies, as does also *Lagotia viridis*, a minute and feeble animalcule†; and it is now well known that certain unicellular *Fungi* live immersed in the shells of mollusks and in other hard calcareous bodies‡. And, surely, since such is the case, since plants, without motion or any mechanical aid, work out for themselves crypts and channels in hard shell, there can be no difficulty in the way of believing in the possibility of a sponge forming its habitation within substances of the same nature. And it is interesting to observe how similar the ramifications of these *Fungi* are to those of *Cliona*, the resemblance being so close in many instances as to lead to the idea that they might prove to be microscopic sponges, had we not the high authority of Kölliker for believing in their fungoid nature.

Before concluding these few remarks, a word or two may be said on a certain relation that appears to exist between *Cliona* and the Foraminifera. All the excavating Sponges display a lobed structure, some of them to a very remarkable degree. The lobes are usually angulated, sometimes more or less rounded, and are always connected together by exceedingly short constricted stems into branches which, dividing dichotomously, anastomose, the division and anastomosis usually going on to such an extent that the sponge ultimately becomes a congeries of small lobes. Now the sarcode of the Foraminifera is generally composed of a series of similar lobes, which are united in like manner by short constricted stems, or "stolons," as they are called, only differ-

* Ann. & Mag. Nat. Hist. ser. 2. vol. iii. p. 327, pl. 14. fig. 4.

† Described by Strethill Wright, M.D., in Edinburgh New Philosophical Journal, new series, vol. vii. p. 276.

‡ "On the frequent occurrence of Vegetable Parasites in the hard structures of Animals," by Prof. Kölliker, Ann. & Mag. Nat. Hist. ser. 3. vol. iv. p. 300, Oct. 1859.

ing from *Cliona* in the fact that they are usually arranged either spirally or cyclically, and do not assume a regularly branched character; but nevertheless the arrangement of the lobes in the two groups is occasionally very similar.

If we remove the testaceous covering of any of the *Rotalinae*, and suppose the sarcode unrolled, we shall see at once how much the structure resembles a branch of *Cliona corallinoides*, for instance: both are composed of a series of nodules or lobes united by very short constricted stems. The sarcode of *Nodosaria*, however, requires no unrolling to exhibit this relationship; but it will be best understood on comparing the figures of the various species illustrating my paper before referred to on the excavating Sponges with the many instructive figures of the sarcode given in Dr. Carpenter's 'Introduction to the Study of the Foraminifera,' published by the Ray Society. On examining the representation of the cast of the chambers of *Orbitoides Fosteri* therein given from Ehrenberg*, it is seen that the chambers or lobes are arranged cyclically; but in a radial direction they assume a branched distribution; and if we trace the connexion of the lobes (Pl. VII. fig. 8) from the centre to the circumference, beginning with those next the primordial lobe, we can easily observe not merely that they are connected into branches by delicate stems, but that these branches divide dichotomously and anastomose very much in the same manner as do those of *Cliona*. Indeed the structure appears to be essentially the same in both, differing only in the fact that in *Orbitoides* the lobes, in addition to a branched, partake of a cyclical arrangement.

Should this similarity in the structure of the Foraminifera and *Cliona* be anything more than a mere vague analogy, spicula might be expected to occur in some species of the former; and accordingly such seems to be the case. A few years ago Dr. J. E. Gray discovered spicula in a new generic form designated by him *Carpenteria* †; and at the time he commented on the fact as proving the connexion supposed to exist between the Foraminifera and Porifera: it is possible, however, that these spicules may be parasitic. It would therefore seem likely that there is something real in the relationship pointed out; and, indeed, when we recollect that the *Clionae* are among the lower-organized Sponges, their intimate connexion with the Foraminifera is what might be looked for.

I shall now close these few remarks with emended descriptions of the spicula of the British *Clionae*, and with full descriptions

* Pl. 22. fig. 2.

† Proceedings of the Zoological Society, pt. xxvi. p. 266, April 27, 1858.

of four new foreign species. The characters of the additional spicula in the former are put in italics, so that the reader may see at a glance what is now added.

Cliona celata. Pl. VII. fig. 7.

Spicula pin-like, long and stout, a little fusiform and somewhat bent, measuring upwards of $\frac{1}{5}$ of an inch in length; the head is well defined, globular, approaching to ovate, with generally a terminal obtuse point, being placed not exactly at the end of the shaft.

Cliona gorgonioides.

Spicula pin-like, large and stout, measuring $\frac{1}{3}$ of an inch long; the head oval, and frequently at some little distance from the extremity; thence the shaft gradually tapers to the other or pointed end, and is usually much bent, particularly towards the head, and sometimes the pointed extremity is a little recurved.

This is a critical species, and is probably a mere variety of *C. celata*.

Cliona Northumbrica. Pl. VII. fig. 1.

Spicula of three kinds. The 1st much the largest, measuring $\frac{1}{7}$ of an inch in length, is pin-like, straight, sharp-pointed, with the head large, round, and terminal: the 2nd kind is fusiform, scarcely more than one-fourth the length of the first, rather stout, much and suddenly bent in the centre, with both ends sharply pointed, and when viewed through the $\frac{1}{6}$ th-of-an-inch object-glass is seen to be minutely spinous: *the 3rd form is very minute, being not more than $\frac{1}{1800}$ inch long; it is cylindrical, bent sharply in the centre, and apparently smooth under the $\frac{1}{6}$ -inch object-glass, though occasionally there are slight indications of spines; the extremities are recurved, slightly enlarged, and rounded.*

The second and third forms are more numerous than the first, which is most abundant in the papillæ.

When dry, the sponge is of a pale, clear ochreous-yellow colour. Since the publication of my former paper, a few additional specimens have occurred on the Northumberland coast, and one in an oyster-shell, probably from Scotland.

Cliona vastifica. Pl. VII. fig. 2.

Spicula of three kinds. The first pin-like, $\frac{1}{8}$ inch in length, straight, rather slender, and diminishing imperceptibly to a very fine point at one end, the other terminating in a perfectly globular head: the second kind is about one-third the length of the first, and is much thinner; it is stoutish in the centre, where it rather suddenly bends a little, and thence tapers gradually towards the ends, which are sharply pointed; it is

throughout minutely spined; but in some instances the spines are sufficiently strong to be observed with the $\frac{1}{4}$ -inch object-glass: *the third form is $\frac{1}{2100}$ inch long, cylindrical, irregularly bent or angulated once or twice, occasionally three times; it has a central angle, and is strongly spined; the extremities are obtuse.*

Several specimens have recently occurred in oyster-shells, but the locality is not known. When dry the sponge is of a yellowish-white colour. There are both large and small papillæ in this species; the former are three times the size of the latter, and are scattered at wide intervals among the others.

Cliona corallinoides. Pl. VII. fig. 3.

Spicula of three kinds. The first, $\frac{1}{70}$ inch long, is pin-like, slender, generally bent in the centre, tapering gradually to a sharp point at one end, and at the other furnished with a well-defined elliptical head: the second kind is scarcely one-third the length of the first; it is fusiform, very delicate, and suddenly bent in the centre, and when observed with the $\frac{1}{6}$ -inch object-glass is seen to be minutely spined; the extremities are sharply pointed: *the third form is minute, being only $\frac{1}{2000}$ inch long; it is spinous, with the extremities obtuse, and is generally zigzagged, having three angles, one being in the centre.*

A year or two ago Mr. H. T. Menzell obtained at Guernsey a specimen of this species in a valve of *Pecten maximus*. The dried sponge is of a brown colour.

Cliona gracilis. Pl. VII. fig. 4.

Spicula of three kinds,—the first pin-like, about $\frac{1}{77}$ inch long, generally a little bent, stout, and inclining to fusiform, with the pointed end gradually tapering; head rounded, somewhat elliptical, and merging imperceptibly into the shaft; the second kind is fusiform, one-third the length of the first, less stout, and gradually bent in the centre; it is minutely spined, and has the extremities sharply pointed: *the third form is about $\frac{1}{1500}$ inch long, and is usually zigzagged so as to form four or five angles; it is most minutely spined, and has the extremities rounded and recurved.*

When dry, the sponge is of a yellowish-brown colour.

Cliona Howsei. Pl. VII. fig. 5.

Spicula of three kinds,—the first pin-like, about $\frac{1}{1000}$ inch long, very delicate, generally straight, with the head broadly ovate, short, well-marked, terminal, and having the narrow end at the extremity, and sometimes a little prolonged: the second form is abundant and generally somewhat longer than the first; it is equally slender, mostly slightly bent, and gradually diminishes to

a fine point at one extremity; the other has usually two heads—one terminal or nearly so, the second about one-third down the shaft; the terminal head is frequently wanting: *the third form is about $\frac{1}{60}$ inch long, rather stout, cylindrical, usually irregularly bent or angulated, and strongly spined, with the extremities obtuse.*

A few additional specimens have occurred on the Northumberland coast. The sponge, when dry, is of a pale yellow-ochre colour.

Cliona Alderi.

Spicula of two kinds,—the first pin-like, $\frac{1}{10}$ inch long, moderately thick, slightly bent, with a small head near one end, and tapering to the other extremity; the second form is scarcely shorter than the first, and has one end truncate, the other pointed, and is decidedly bent in the centre.

Sponge, in a dried state, of a yellowish-brown colour.

Cliona lobata. Pl. VII. fig. 6.

Spicula of two kinds,—the first $\frac{1}{10}$ inch long, not very slender, mostly a little bent, and brought gradually to a sharp point at one end, the other with an irregularly rounded head, sometimes slightly elliptical, and generally not exactly terminal: *the second kind, which is $\frac{1}{50}$ inch long, is cylindrical, rather stout, arched, and zigzagged, being six or seven times angulated; it is strongly spined, particularly at the angles; the extremities are obtuse.*

I am indebted to Mr. Charles Adamson, of Newcastle-upon-Tyne, for the second specimen I have seen of this very distinct species: it is in the shell of an oyster obtained from the rocks on the west coast of Scotland. The dried sponge is of a dark snuff-colour.

After a careful perusal of the above descriptions of the spicula, few naturalists, I believe, will doubt the existence of more than one species of British excavating Sponge.

The foreign species, which are undoubtedly very numerous, exhibit a considerable variety of spicula, though the prevailing forms are similar to those found in the British species. A few have only the pin-like kind, in this respect resembling *C. celata*; but by far the greater number have either two or three kinds, as in *C. lobata* and *C. Northumbrica*. The following descriptions are of four well-marked foreign species that have recently come under my notice:—

Cliona vermifera. Pl. VIII. fig. 2.

Sponge, when dry, of a pale yellow-ochre colour; branches

crowded and confused, composed of numerous series of irregular elongated lobes about $\frac{3}{10}$ inch wide, which communicate with each other by constricted stems; papillæ not numerous, varying in size, the largest about $\frac{1}{2}$ inch wide. Spicula of two kinds: one, $\frac{1}{10}$ inch long, is pin-like, unusually stout, mostly a little bent, with the head terminal, broadly ovate, the wide extremity in connexion with the shaft; the other form, which is scarcely one-fourth the length of the pin-like kind, is rather stout, cylindrical, arched, worm-like, undulated frequently three or four times, with the extremities obtuse. Both kinds are numerous.

Two specimens of this well-marked species have occurred, both in a species of *Chama* in my cabinet. The spicula are very characteristic. I have met with no other species which has the undulated or worm-like kind; and the stout shaft and broadly ovate head of the pin-like form are very striking. The surface of the excavations is strongly shagreened, and exhibits a few scattered punctures.

Cliona Mazatlanensis. Pl. VIII. fig. 1.

Sponge, when dried, of a soiled brown or pale drab-colour, made up of a vast number of minute lobes about $\frac{1}{10}$ inch wide, irregularly rounded, united by very short constricted stems, and so crowded that the mode of branching is perceptible only at the margin of growth, where it is seen to be dichotomous, the terminal twigs being rather short, delicate, and obtuse; papillæ very numerous and minute, distributed without apparent order, $\frac{1}{30}$ inch wide; there are a few larger ones scattered amidst the others, and about three times their size. Spicula of three kinds: the first is pin-like, $\frac{1}{75}$ inch long, with the shaft straight, delicate, and gradually tapering to a fine point at one end, the other exactly terminated by a large oval head, within which a cavity is distinctly seen; the second kind is fusiform, about half the length of the former, most minutely spined, pretty regularly arched, and with both ends sharply pointed; the third form is quite minute, not more than $\frac{1}{300}$ inch long, cylindrical, sharply bent in the centre, roughened or minutely spined, and with the extremities obtuse.

I have seen but one specimen of this species: it has overrun the entire surface of a *Purpura* from Mazatlan, presented to the Newcastle Museum by Dr. P. P. Carpenter. The surface of the burrow is strongly shagreened.

Cliona globulifera. Plate VIII. fig. 3.

Sponge of a pale clear yellow colour when dry, composed of numerous globules or rounded lobes, about $\frac{1}{2}$ inch wide, united by short, cylindrical, more or less constricted stems, and so

crowded that the usual dendritic character is scarcely discernible; the terminal twigs are excessively short, and there are very few spine-like processes; papillæ few and large, measuring sometimes as much as $\frac{3}{20}$ inch in diameter. Spicula pin-like, $\frac{1}{8}$ inch long, usually straight, occasionally a little bent, tapering gradually to the pointed extremity; the head oval, mostly placed a considerable way from the end, which is rounded; frequently the head is almost obsolete, sometimes entirely wanting; and two heads are not by any means uncommon, one placed a little below the other.

A finely developed specimen of this species has penetrated the shell of *Spondylus gæderopus* from the Mediterranean. It is allied to *C. celata*, as is evinced by there being only one kind of spiculum, and that pin-like. The form of this organ, however, is sufficiently characteristic; but perhaps the colour of the sponge, the delicacy of its texture, and the lobulated mode of its growth are the best distinguishing features.

Cliona Carpenteri. Pl. VIII. fig. 4.

Sponge, when dry, of a pale yellowish colour, formed of numerous crowded angulated lobes scarcely $\frac{3}{20}$ inch wide, each united to its neighbours by two or three short, much constricted, cylindrical stems; papillæ about $\frac{1}{20}$ inch in diameter, not very numerous, varying little in size, and scattered without apparent order. Spicula of three kinds,—the first pin-like, $\frac{1}{100}$ inch long, straight, slender, rarely a little bent, with the head distinct, perfectly globular, and exactly terminal: the second kind, which is half the length of the first, is fusiform, unusually stout, with occasionally an indistinct narrow nodule in the centre, where it is suddenly bent; the extremities are very sharply pointed: the third form is very minute, being only $\frac{1}{2000}$ inch long; it is usually straight, slightly fusiform, a little bent, and strongly spined, with the extremities obtuse.

Only one specimen of this species has been obtained; it occurs in the shell of a *Serpula* adhering to a *Chama* from Mazatlan, presented to the Newcastle Museum by Dr. P. P. Carpenter.

EXPLANATION OF THE PLATES.

PLATE VII.

Fig. 1. Spicula of *Cliona Northumbrica*: a, pin-like spicula; b, fusiform ditto; c, the minute or third form of ditto.

Fig. 2. The minute or third form of spicula of *C. vastifica*.

Fig. 3. Ditto of *C. corallinoides*.

Fig. 4. Ditto of *C. gracilis*.

Fig. 5. Ditto of *C. Howsei*.

Fig. 6. The minute or second form of spicula of *C. lobata*.

Fig. 7. Spicula of *C. celata*.

Fig. 8. A few of the cells of *Orbitoides Fosteri*, from Dr. Carpenter's figure, after Ehrenberg: *a*, cell next primordial cell; *b, b*, stolons or stems uniting the cells.

Fig. 9. A portion of an undescribed *Cliona* immersed in the shell of *Pecten Magellanicus*: *a, a*, lobes of the sponge corresponding to the cells in fig. 8; *b, b*, stolons or stems.

PLATE VIII.

Fig. 1. Spicula of *Cliona Mazatlanensis*: *a*, pin-like spicula; *b*, fusiform ditto; *c, c*, minute or third form of ditto.

Fig. 2. Spicula of *C. vermifera*: *a, a*, pin-like spicula; *b, b*, the second or worm-like ditto.

Fig. 3. Ditto of *C. globulifera*.

Fig. 4. Ditto of *C. Carpenteri*: *a, a*, pin-like spicula; *b*, fusiform ditto; *c, c*, the third or minute form of ditto.

XXXVII.—On the Young Stages of a few Annelids.

By ALEXANDER AGASSIZ.

[Concluded from p. 218.]

POLYDORA, Bosc (*Leucodora*, Johnst.).

Claparède having given, in his 'Beobachtungen,' a very complete history of the development of what he calls *Leucodora ciliata*, the following observations would be superfluous as far as they relate to new phases in *Polydora*, but may be useful in clearing up the confusion existing concerning the identity of *Leucodora*, Johnst., and *Polydora*, Bosc. Quatrefages, in his Synoptic Table*, has introduced these two genera as distinct, and separates them on account of the remarkable structure of the bristles of the fifth ring in *Polydora*, which he says is not to be found in *Leucodora*: this must evidently be a mistake, as Johnston's figure† certainly possesses the peculiar bristles of the fifth ring, as maintained by Claparède in his 'Beobachtungen.' Yet, notwithstanding this correction of Quatrefages by Claparède‡, in his review of the system proposed by the former, and the accurate description given by him (Claparède), in Müller's 'Archiv'§, of *Polydora cornuta*, we find him associating with the genus *Polydora*, in his embryology of *Leucodora ciliata*, a genus which is certainly not *Polydora* as he himself has limited it, but may be a species of *Spio* or *Nerine*, or per-

* "Note sur la Classification des Annelides," in Comptes Rendus, 27 March, 1865 (Annals, ser. 3. vol. xvii. pp. 1, 107).

† "Miscellanea Zoologica," in Mag. Zool. Bot. 1838, ii. p. 66.

‡ Bibliothèque universelle de Genève, Avril 1865. [Annals, ser. 3. vol. xvii. p. 100.]

§ "Ueber *Polydora cornuta*, Bosc," in Archiv für Anat. u. Phys. 1861 p. 542.

haps what Quatrefages understands by *Leucodora*. At any rate it is self-evident, from the following embryology of a species of true *Polydora*, and of a species of what Claparède has called *Leucodora* in his 'Beobachtungen,' that we have in each, developed at a very early period, genuine characters which refer undoubtedly one form to *Polydora* and the other to a different genus (*Leucodora*, Clap., non Johnst.), probably *Nerine*, Johnst.—thus proving the assertion of Quatrefages* of the generic difference between *Leucodora*, Clap., and *Polydora*, Bosc. And yet, in spite of this generic difference, Claparède was correct in maintaining the identity of *Leucodora*, Johnst., and *Polydora*, Bosc, as can readily be seen on examining the descriptions and figures of Bosc†, Johnston, Oersted‡, Leuckart§, Claparède, and Keferstein||. The error arises from Claparède's mistaking for the young of *Polydora* the young Annelids figured by him on pl. 7 of his 'Beobachtungen,' which, having no trace of the characteristic fifth segment, belong therefore not to *Polydora*, Bosc, but to some closely allied genus, as suggested above. It is not probable that such an accurate observer as Claparède would have overlooked this segment, so prominent in the youngest specimens of our *Polydora*, as well as the presence of the glands, so early developed in the young worm, and which he noticed in his description of the adult in Müller's 'Archiv.' In my earlier observations I made a similar mistake between the young of *Polydora* and *Nerine*; and it was not till the striking difference of the fifth ring and the presence of glands were noticed that I could afterwards always readily distinguish the young of these two genera, so easily mistaken at first sight.

I shall introduce a few of the stages of *Nerine*, with a short description of the adult, for the sake of comparing them with the different stages of *Polydora*, which will be given more in detail, and of identifying them, as far as possible, with those observed by Claparède. It is apparent at the first glance, on comparing his drawings of *Leucodora* with those here given of *Nerine* and *Polydora*, that they represent closely allied genera; but, as similar young stages of other genera have also been figured by Leuckart and Pagenstecher as *Spio*, as well as by

* "Note sur la Classification des Annelides, et réponse aux observations de M. Claparède," in Ann. des Sc. Nat. 5^e ser. iii. 1865 (Annals, ser. 3. vol. xvii. p. 107).

† Histoire Naturelle des Vers.

‡ "Zur Classification der Anneliden," in Archiv für Naturg. 1844, i. p. 105.

§ "Zur Kenntniss der Fauna von Island," in Archiv f. Naturg. 1849, i. p. 200.

|| "Untersuchungen über niedere Seethiere," in Zeits. f. wiss. Zool. xii. p. 116, June 1862.

Busch and by Frey and Leuckart*, the adults of which are not known, we must be exceedingly careful in our identifications of apparently closely related forms, and give these identifications more as hints for future observers than as positive statements.

The young of *Polydora* and *Nerine*, like the young of *Leucodora*, Claparède, are kept in confinement with the greatest ease; hence the possibility of tracing the changes of growth in a connected manner until they have assumed unmistakably the features and habits of the adult, and built their cases on the bottom of the jars where they are confined. The youngest stages observed (Pl. V. fig. 26) are considerably more advanced than those of Claparède, having already lost, if they ever possessed them, the bunches of ringed bristles so characteristic of the younger stages of many Annelids, such as *Leucodora*, Clap., *Nerine*, and *Spio*. The tentacles of the head are developing; and there remain but slight traces round the head and anus of the former rings of vibratile cilia, as well as very narrow bands of short vibratile cilia on the dorsal side; similar bands are found on the lower side, composed of larger cilia, which greatly assist in locomotion. These bands are less powerful towards the extremities, being greatly developed towards the middle, especially on the lower side. The vibratile ring surrounding the anus is less prominent than in Claparède's embryo; the anterior and posterior rings of cilia, as well as the transverse bands, diminish rapidly in size with advancing age, so much so that in fig. 28 they have almost totally disappeared. In the youngest stage seen (fig. 26) there are four well-developed anterior rings, each provided with an upper and lower bunch of bristles, the dorsal bunches being the longest, and diminishing in length as they recede from the head, the lower bunches consisting of bristles all of the same length; the fifth ring (r_5) is much wider than any other, and has only three short, stout bristles on each side; then comes the sixth ring, each side having a bundle of bristles similar to those of the smaller cluster of the four anterior rings; in the subsequent rings, which are nearly equally developed, having a slight lateral swelling and rudimentary dorsal cirrus, we find a similar bundle of bristles, and, in addition, in the seventh, eighth, and ninth, a single hook-shaped bristle; while immediately in front of the anal extremity the rudimentary rings have merely a couple of thin bristles. The three rings following the sixth have rudimentary glands (*g*), first observed in this genus by Claparède in his description of *Polydora*; they consist, however, of a smaller number of glands, only two or three in each bag. The general colour of *Polydora* at this period

* 'Beiträge zur Kenntniss wirbelloser Thiere' (Braunschweig, 1847), pl. 1. fig. 19, p. 98.

is quite a delicate grey, of a yellowish tinge, with a bright yellow line along the middle of the back and following the outline of the head; this is rendered more brilliant by its contrast with the black pigment-spots which are well developed on the head and first ring and attain their greatest prominence on the sixth, seventh, and eighth, gradually diminishing to a few isolated dots near the anus. On the head it is almost impossible to distinguish the eyes proper from the pigment-spots; it is, however, evident that the eyes are more numerous in the young than in the adult, which is the case with many other Annelids, as observed by Milne-Edwards, Agassiz, and Claparède. The identity of the pigment-spots and eyes has been suggested by Claparède, who could discover no difference between them; and we have, perhaps, in the pigment-spots scattered over the whole surface of the body something analogous to the presence of eyes in *Fabricia* at the anal extremity. The distribution of the pigment-spots in *Polydora* is quite different from that in *Leucodora*, and from that observed by Claparède and by myself in *Nerine*: in the latter they are more abundant and intense in the anterior extremity; while in *Polydora* they take their maximum development from the middle of the body towards the posterior part, leaving the anterior extremity, with the exception of the head, nearly colourless.

The mouth opens, by a longitudinal slit formed by the thickening of the lips, into an ill-defined œsophagus which extends to the fifth ring and then opens into a digestive cavity terminating at the anus and not yet divided into a true stomach and intestine.

In the next stage (fig. 27) we find no material change in the anterior part, with the exception of the slight increase in length of the tentacles, the diminution in number of the pigment-spots round the eyes, and their increase on the four anterior rings. The posterior part has considerably increased in size, a number of additional rings having been formed in front of the anal ring; the pigment-spots are now arranged in two regular rows; the dorsal cirri have not increased in size; but we find in the seventh and succeeding rings, at the base of the bunch of thin bristles, two hook-shaped bristles instead of one; the œsophagus is more clearly marked than in the preceding stage; the glands are found in all the rings except the last. In the following stage (fig. 28) there has been a still further growth of the tentacles, and we find the pigment-spots arranged both above and below in four parallel rows, the outer rows being the smaller and less prominent. There are now four hook-shaped bristles at the base of each of the dorsal cirri, which are readily recognized as such in the rings immediately

following the seventh. The bunches of long bristles of the four anterior rings are gradually losing their prominence, becoming less numerous in the present stage, and are replaced by bristles similar to those of the other bunch. At this period the number of rings does not increase rapidly; the principal changes are confined to the growth of the dorsal cirri and of the tentacles, as well as to changes in the pigment-spots. When examined in somewhat more advanced stages (fig. 29), from the lower side, we still have the pigment-spots prominent and well marked; the only change consists in the lengthening of the tentacles and the dorsal cirri, which are both fringed on their anterior edge by vibratile cilia.

On examining a young *Polydora* from the dorsal side, somewhat more advanced (fig. 30), still having the same number of segments in front of the anal ring, we find the four lines of brilliant star-shaped pigment-spots diminished to four rows of dots; the body has grown somewhat opaque and assumed a reddish tinge, especially along the alimentary canal. At about this period, also, the young begin to build their case, secreting a copious viscid fluid (from the glands at the base of the dorsal cirri?), to which particles of sand and mud become attached as they creep along the bottom; although they frequently leave this case, they no longer possess the great power of locomotion of the young larvæ (figs. 26-28), which moved about rapidly by means of their rows of vibratile cilia and bunches of long bristles. The pigment-spots of the head have disappeared, except four prominent eye-specks,—the same number as found in the adult, in which, however, they are far less conspicuous than in this stage of the young.

When the young worm has already thirty-five rings, there have been no changes of any consequence besides the further lengthening of the dorsal cirri and the increase of the rudimentary cirrus at their base, which can first be traced in fig. 29; two small tentacles have been formed at the anterior part of the head (Pl. VI. fig. 31). The number of bristles of the fifth ring has increased to five, and the number of glands in each envelope to eight or ten. In nearly full-grown specimens, when seen from below, these glands are particularly prominent (fig. 32), as well as the six hook-shaped bristles at the base of the short cirrus. The black pigment-dots have all disappeared, and the worm is gradually assuming a darker tinge; the fifth ring has increased in width, the larger of its bristles assuming the shape they have in the adult, as in fig. 37, with a slight notch at their swollen exterior extremity. The simple hook-shaped bristles of the seventh and succeeding rings have developed a slight process on the convex side, with a stiff bristle (fig. 38) extending from

the base of the curve, as in the adult *Polydora*. The anal ring has taken a somewhat funnel-shaped form, with which the little worms can attach themselves quite firmly; this anal disk (fig. 34) is made use of by the adult almost as freely as the sucking-disk of a leech.

In the adult (fig. 33) the dorsal cirri equal in length the thickness of the body, and have lost their vibratile fringe; the glands have taken a great development, consisting of no less than from thirty to forty comma-shaped bags packed closely together within one envelope, as in fig. 36. The digestive cavity has undergone slight changes; the œsophagus has remained as in previous stages, but we have a short intestine into which the long stomach empties. When seen from above, the head is pointed; seen in profile, it projects in a quadrangular flap, and shows the rudimentary tentacles formed at the base of the larger ones (fig. 35). The eyes are small, four in number; the fifth ring has nine stiff bristles in different stages of growth; their number, however, is not limited, as we always find small ones growing even in the oldest specimens. Their use seems to be, as far as I can ascertain, to assist the worm in retreating into its case when disturbed.

The adult worms are found between high- and low-water mark, about half-tide; they abound in places where there is a mixture of sand and mud, building their cases upright, in large colonies, closely crowded together. The younger stages (figs. 26–28) were always caught in great numbers with the dip-net, the more advanced stages being raised from them in captivity. Their growth is very rapid, as in less than six weeks they pass from the stage of fig. 28 to that of fig. 32.

The species here described is probably the same as the *Polydora* found by Claparède on the coast of Scotland; it is not the species called *Polydora cornuta* by Bosc, which occurs plentifully in sand and mud-flats on Sullivan's Island, in the harbour of Charleston, S. C. The South Carolina species differs from its northern representative by the length of its head, its short antennæ, and greater size. Our species seems closely allied to, if not identical with, *Polydora ciliatum*, Clap. (*Leucodora ciliatum*, Johnst., Kef.).

NERINE, Johnst.

The youngest stages of this species of *Nerine* (fig. 39) resemble young Annelids figured previously by Busch* and by Leuckart and Pagenstecher†, and referred by them to the closely

* Beobachtungen, pl. 7. fig. 5.

† "Die Entwicklung von *Spio*," in Archiv f. Anat. u. Phys. 1858, p. 610, pl. 23. fig. 4.

allied, if not identical, genus *Spio*. We find in both the large brushes of stiff, serrated, temporary bristles observed by Claparède in his young *Leucodora*, which, at the least disturbance, they spread fan-like in every direction, roll themselves up into a ball like a hedgehog, and become quite motionless, but soon start off again on their rapid gyrations, performed by means of an exceedingly powerful circle of vibratile cilia surrounding the head. The body at this early stage consists of seven distinct rings, and faint indications of a couple more in front of the anal ring, also surrounded by strong vibratile cilia. The dorsal cirri are slight swellings, and at the base of each we find two brushes of permanent bristles—the one composed of serrated, file-like, rough bristles (fig. 42^a), similar to those observed by Claparède in an unknown Annelid larva*, the other of smooth setæ, like those of the adult, placed immediately at the base of the rudimentary dorsal cirrus. The œsophagus and stomach are separated by a slight constriction. The younger stages (fig. 39) have no pigment-cells, and are moderately transparent; there are six eyes, the two larger ones, placed nearer the sides of the body, soon disappearing.

In subsequent stages the body lengthens and becomes more pointed; pigment-spots appear near the head, extending towards the anal ring; they resemble those of *Polydora*, pass through the same stages, and, before they disappear, have lost their beautiful star-shaped form, making a double row of more or less rectangular spots, as in fig. 40. The changes have been principally in proportions; the tentacles have slightly developed, the large anterior brush of serrated bristles losing its prominence. The dorsal cirri, as well as the tentacles, now develop rapidly, the powerful circle of vibratile cilia round the head having nearly disappeared (fig. 41). We find in some of the rings of the anterior part of the body the first appearance of the clusters of stiff hook-shaped bristles, like those of fig. 44, found with the lower brush of smooth bristles in the adult; the eyes are four in number, quite small; the pigment-spots have disappeared, as well as the anterior brush of temporary bristles. The little worm now enters a stage when it rapidly assumes the appearance of the adult. The number of rings increases rapidly; the dorsal cirri, as well as the tentacles, lengthen materially; the stomach proper becomes much narrower, and towards the anal extremity a distinct intestine (fig. 42) has been formed. In a stage preceding (fig. 40) it has many characteristics of the larva figured by Busch, on plate 8. figs. 1 & 2 of his 'Beobachtungen.' The serrated bristles

* Beobachtungen, pl. 6. fig. 6.

of these young worms are not lost (as in other Annelids, where the ringed bristles are always temporary), but remain to form in the adult a brush of long bristles on the posterior side of the dorsal cirri (see fig. 43). With the lower bunch of smooth setæ we find the row of hook-shaped bristles first noticed in fig. 41; in fig. 42 we have already from five to six of these bristles at the anterior rings. The upper brush of serrated bristles is found in specimens measuring no less than 4 inches in length, not raised in confinement, but collected on the beach, where they are found in company with *Polydora*, but by no means so common. Along the middle of each ring, on the dorsal side of the younger stages (figs. 39, 40), we find a row of short vibratile cilia; similar rows, less numerous, of larger cilia occur on the lower side. The anal ring terminates, in the adult, in a simple opening with slightly corrugated edges (fig. 45).

The general mode of development is so similar to that of *Leucodora* given by Claparède, and of *Polydora* as figured in the present paper, that only those stages have been introduced which tended to elucidate the comparison with figures previously published resembling them. The resemblance between the young larvæ certainly warrants the affinity between *Nerine*, *Spio*, and *Polydora*, suggested by Claparède (who places them with the *Ariciæ*), and does not justify us in associating the former with other families, as has been done by Quatrefages in his Systematic Table, and thus bringing them in close relationship with groups having a totally different embryonic development, such as *Phyllodoce* and *Nereis*. The species of *Nerine* here investigated is probably the *Nerine coniocephala* of Johnston*.

Phyllodoce maculata, Oersted†.

Max Müller is thus far the only one who has observed larvæ of *Phyllodoce*‡; from his description they must have been in a condition nearly identical with the oldest larvæ here represented (fig. 52). The youngest stages (figs. 46, 47) have a slight resemblance to the larvæ of *Polynoë* figured by Sars§, Max Müller||, and Claparède¶. We find in these earlier stages a very powerful ring of vibratile cilia extending round the middle of the anterior part of the animal, but no trace of cilia

* Mag. Zool. and Bot. 1838, ii. pl. 2. figs. 9-13, p. 70.

† Grönlands Annulata dorsibranchiata, 1843, pl. 3. fig. 46, p. 39.

‡ Note on p. 17, in Archiv f. Anat. u. Phys. 1855.

§ "Zur Entwicklung der Anneliden," in Archiv f. Nat. 1845, i. p. 11, pl. 1. fig. 12.

|| "Ueber die Entwicklung u. Metamorphose der Polynoën," in Archiv f. Anat. u. Phys. 1851, p. 223, pl. 13.

¶ Beobachtungen, pl. 8. figs. 7, 8.

round the anal extremity. There are two very prominent eyes placed near the anterior extremity, and two quite rudimentary tentacles. There is as yet no exterior communication from the digestive cavity, which is simply blocked out, occupying little more than two-thirds of the space in front of the vibratile ring and of the large shield extending behind it; when seen in profile (fig. 47, upper figure), the cavity is somewhat retort-shaped, and occupies mainly the dorsal portion of the embryo. Immediately behind the shield (fig. 46), we find the small conical body, where we can already trace the first indications of the broad paddles of *Phyllodoce* as delicate transverse swellings on each side, connected by slight articulating lines. The articulations are tolerably distinct when seen in profile (fig. 47, upper figure); from this point of view the embryo appears far from cylindrical; the head is quite rectangular, with rounded corners, and nearly as large as the rest of the embryo. The shield bulges out nearly to the anal extremity, where it suddenly terminates and leaves exposed the small rings preceding the anal ring; this terminal ring has not the prominence so characteristic of other Annelid embryos. On the lower side, immediately behind the vibratile ring, we find a slight swelling towards which the digestive cavity points, and where the mouth eventually is formed (fig. 50), while the rudimentary paddles of the rings are plainly visible along the sides. The motion of these larvæ, as can be readily imagined from the size of the cilia, is exceedingly rapid; and though occasionally at rest for a short time, their gyrations are most unfavourable for careful observations.

In subsequent stages we find that the posterior part, as in nearly all young Annelids, undergoes the greatest changes. The head has retained its shape, and its appendages have not enlarged. The shield and the body have both lengthened (fig. 47, lower fig.); the rings of the young worm are quite distinct, the broad flap (the future paddle) is more prominent; small cirri are developed, from which push out a single rather stiff bristle and two smaller jointed ones. Two small anal cirri have grown at the extremity of the anal ring; on each side of the anterior end of the shield we find two long tentacles, of different sizes (the first pair of tentacles of the adult), the dorsal one being the longest. When viewed in profile (fig. 50), the mouth is seen as a large rectangular opening (fig. 49), placed within the edge of the shield, which extends on the lower as well as the upper surface, though only as a narrow band on the ventral one, without covering any of the rings. The body behind the shield is fully as prominent as the remainder of the embryo, and the broad oars of the rings show undoubtedly that we have

to deal with a *Phyllodoce*. A second pair of small anterior tentacles is budding at the base of the first. Though the digestive cavity opens externally at the mouth and anus, there is as yet no trace of a division into œsophagus, stomach, and intestine; the main cavity still extends from the eye-specks and trends towards the anal opening, gradually diminishing in size. The chord of vibratile cilia have lost none of their power; and it is quite remarkable how long these embryonic features remain, even after the generic characters have become well developed, and how early we can distinguish the family to which our larva belongs. This is even more remarkable in *Polynoë*, where before the young has more than six rings it is already a complete picture of the adult; the same is the case in young of Nereidæ described by Milne-Edwards* and Claparède†, the young worm of not more than four rings possessing already all the generic features of the adult.

These young larvæ thrive readily in confinement; they grow rapidly, passing in about ten days from the stage of fig. 46 to that of fig. 50. Subsequently the increase is somewhat slower, and it requires about four weeks longer to find the young *Phyllodoce* so far advanced that we can unmistakably refer it to its proper species. In the next stage (fig. 51) the head and shield begin to lose the prominence they formerly held, the two large tentacles lengthen considerably, and two additional ones are formed on each side, thus making eight long tentacles on the two sides of the now small rounded shield; the anterior tentacles become also somewhat more prominent, as well as the lateral cirri, from which project the bristles, each bundle being composed of four or five besides the aciculum. In a somewhat more advanced stage (fig. 52), having twenty-five rings, we find the anal cirri slightly lengthened, the broad lateral flappers are very distinct, the small lateral cirri assuming nearly the shape they retain in the adult. The head has also become shortened, the two pairs of anterior antennæ are equally developed, and the shield is reduced to a small circular patch. The changes henceforth are limited to the head, to the increase of the broad flappers and anal cirri, and to the different degrees of development of the antennæ, placed, in the stage of fig. 52, directly one behind the other, although at the outset they originate one beneath the other; there is no trace to be seen of the rings corresponding to these antennæ, as we should expect theoretically. They lose little by little the ring of vibratile cilia; the head elongates; the eyes are brought nearer the base of the antennæ, until finally the anterior part of

* Ann. Scien. Nat. 1845, iii. p. 167, pl. 10. fig. 57.

† Beobachtungen, pl. 12.

the little *Phyllodoce* has the shape of fig. 53, and the broad flappers resemble fig. 54, while the anal cirri have nearly assumed the shape of fig. 55.

From the earliest stages, the larva is never very transparent; it is distinctly tinged with brown, becoming darker with advancing age, till, in the stage of fig. 52, marked spots darker than the main colour appear on the median line, which gives these young Annelids such an unmistakeable resemblance to an adult *Phyllodoce* well known to me, and which I had always identified as *Phyllodoce maculata*, Oerst., that I scarcely needed the additional proof of raising these young to the full-grown *Phyllodoce* to convince myself of their identity.

On the Types of Development in Annelids.

Several attempts have been made to classify the larvæ of Annelids. Busch*, Müller†, Schultze‡, and Claparède§ have endeavoured to reduce the forms observed to a few general types. Claparède has fully demonstrated that neither the classification of Busch, Müller, nor Schultze will satisfy the facts thus far observed; and it seems probable that Claparède's classification must share the same fate: we should only remember that all these attempts are based upon such few and incomplete observations that we cannot expect them to apply to subsequent discoveries. The features used by Claparède to form his subdivisions seem somewhat objectionable, as it would be impossible, unless the complete development of the larva were known, to ascertain to which of his divisions they belong; and yet these characters are, as far as the development of Annelids is now known, the best that have been proposed. The presence of temporary bristles is a good criterion for one division, and appears to be connected with fundamental differences in the larvæ, though the other division, based upon their absence, is liable to the usual objections to characteristics derived from negative features alone. How much more remains to be done before any such classification of the Annelid larvæ can be attempted with the least chance of success is best shown by examining in any tabular view the number of families of which we know nothing as yet of their embryonic conditions. And though (since the time of the first papers by Lovén, Sars, Milne-Edwards,

* Beobachtungen, p. 55.

† "Ueber die Jugendzustände einiger Seethiere," in Monatsb. d. Akad. der Wiss. zu Berlin, 1851, p. 422.

‡ "Ueber die Entwicklung von *Arenicola piscatorum*, nebst Bemerkungen über die Entwicklung anderer Kiemenwürmer," in Abhand. Nat. Ges. zu Halle, iii. 1855, p. 213.

§ Beobachtungen, p. 84.

Quatrefages, and Müller) Krohn, Max Müller, Van Beneden, Wagener, Schneider, Keferstein, Pagenstecher, and others, but more especially Claparède, have lately done so much to advance our knowledge of the development of Annelids, we can hardly be said to have more than commenced the investigation of the development of the Annelids proper, which in this respect are far behind the intestinal worms; and we must wait for further observations before classifications of embryonic Annelids can be of material advantage for systematic studies.

Among the young Annelids not yet traced to their adult condition, I would figure two forms totally unlike any hitherto described. They both come in the group of *Metachætæ* of Claparède; and though I cannot refer them to their minor subdivisions, they already show most remarkable features. One of them (fig. 56) reminds us somewhat of *Polydora*, on account of the shape of its head and tentacles; it has, however, already a distinct œsophagus, stomach, and intestine, and not the slightest trace of bristles along the sides of the distinctly articulate body. We find on the anterior extremity, on each side, immediately behind the tentacles an immense cluster of long, smooth setæ, seven to eight in each pencil, nearly twice as long as the young worm. The posterior ring is edged with vibratile cilia, and terminates in a club-shaped appendage. The eyes are distinct, two in number. This little worm ($\frac{1}{30}$ inch in length) I have frequently fished up, throughout the summer, with the dip-net, but, unfortunately, always in the same stage. We have perhaps here again a case similar to that of Lovén's larva, described above, of a young worm, having articulations and well-developed appendages, which has reached a condition when, in other Annelids, the temporary bristles have vanished, the permanent ones replacing them, and in which we find as yet nothing to tell us to what genus our larva may belong. Were I to be guided by analogy (especially on account of the perfect differentiation of the stomach, œsophagus, and intestine, which are always divided late in the larval condition in other Annelids, long after the generic characters have appeared), I should be strongly tempted to consider it the embryo of the young worm represented in figure 57. This would involve a case of retrograde development so much more remarkable than the one described above in the *Nareda*-like worm, that it seems scarcely possible. The number of rings is also different, yet the general aspect of the head, and particularly the lightning-speed of the larvæ, darting off like a shot from perfect rest, are points of great similarity; and I give this suggestion for what it may be worth. The changes to be undergone are of the same nature as in *Nareda*: the tentacles must disappear, the temporary bristles

drop off, and the articulations become less numerous and eventually be lost, as in the adult Nemerteans.

Another young worm, equally striking, is represented in figure 58: it is a parasitic Annelid, attached by its posterior extremity to the underside of the carapace of lobsters, measures about $\frac{1}{30}$ inch in length, and consists of numerous rings. The mouth is edged by a series of small hooks. On the two sides of the anterior part we find three large temporary (?) articulate bristles, four or five times as long as the width of the body; the middle bristle is the longest; next come eight rings without appendages of any sort; the succeeding three rings are each provided with a long bristle, similar to those of the anterior extremity: these are the only appendages of the Annelid, the numerous rings of the body being bare. The anal extremity is somewhat club-shaped. The digestive cavity was not as yet subdivided into separate regions; and nothing in this young worm, in spite of the great number of rings, indicated even the family to which it might belong.

Although the embryological data at our command will not suffice in guiding us to any valuable systematic conclusions, yet the presence of temporary bristles of huge size in the young of so many Annelids is a feature of the greatest interest from a palæontological point of view. We find repeated in Annelids the same striking coincidence between certain features only embryonic in the present types, and characters of the adults in past geological times. I was particularly struck with this coincidence when examining a series of drawings of fossil Annelids kindly shown me by Mr. O. C. Marsh, of New Haven, which were all provided with bunches or single bristles of these large, rough setæ, entirely out of proportion to the width of the body, and similar to those found in the embryonic Annelids we have noticed. The nature of the setæ and bristles, and their order of appearance in the types we have thus far examined, seem the only characters capable of general application of any systematic value; when a greater number of Annelids have been studied, the dorsal cirri, as well as the characters of the tentacles of the anterior part of the body, will furnish us with valuable additional guides for classification in relation to the rank of families and genera; and, as far as we can make use of them, they seem to coincide remarkably with the generally received notions of superiority and inferiority of the principal families current among the most accurate investigators of Annelids.

EXPLANATION OF PLATES V. & VI.

<i>v</i> , anterior vibratile ring.	<i>t</i> , tentacles.
<i>v'</i> , anal vibratile ring.	<i>y</i> , concretion capsules.
<i>m</i> , mouth.	<i>a</i> , anus.
<i>e</i> , eye-specks.	<i>r</i> ₅ , fifth ring in <i>Polydora</i> .
<i>o</i> , oesophagus.	<i>r</i> , first ring; the rings are counted from here.
<i>s</i> , stomach.	<i>g</i> , glands of <i>Polydora</i> .
<i>c</i> , intestine.	

PLATE V.

- Fig. 1.* Young *Planaria angulata*, with distinct articulations, seen from above.
- Fig. 2.* Somewhat older than fig. 1; both figures greatly magnified.
- Fig. 3.* Youngest stage of *Nareda* observed; seen in profile.
- Fig. 4.* Somewhat more advanced than fig. 3; the pigment-spots have increased in number, the tentacles of the head are making their appearance: seen in profile.
- Fig. 5.* Older stage, in which the difference in width between the anterior disk and the body has attained its maximum; large increase in number of pigment-spots, diminution in diameter of digestive cavity: seen in profile.
- Fig. 6.* Posterior extremity of young *Nareda*, about in the condition of fig. 5, showing the intestine and place of formation of new rings; seen in profile.
- Fig. 7.* Stage in which the anterior disk is diminishing in size and becoming slightly elongated; seen from the dorsal side.
- Fig. 8.* Head of *Nareda* in stage of fig. 7: seen from the mouth side.
- Fig. 9.* Older stage than fig. 8; the rings are further apart, the pigment-spots larger; the head has become greatly elongated, and the tentacles are more prominent: seen from the dorsal side.
- Fig. 10.* Older than fig. 9; the pigment-spots have become quite small, and the vibratile rings are much reduced: seen from the dorsal side.
- Fig. 11.* Somewhat more advanced than fig. 10; the anterior disk has lost its prominence, the vibratile cilia have nearly disappeared, the stomach has become convoluted, the pigment-spots are scarcely perceptible, and the articulations quite indistinct: seen in profile: very sluggish in its movements; about one-fourth of an inch long.
- Fig. 12.* Head of specimen slightly older than fig. 11; seen in profile.
- Fig. 13.* The same, seen from the dorsal side; the tentacles are contracting.
- Fig. 14.* Young *Nareda* which has lost almost all trace of the tentacles of the head, about half an inch long.
- Fig. 15.* Head of a somewhat older specimen.
- Fig. 16.* The same as fig. 15; seen in profile.
- Fig. 17.* The head of a *Nareda* which has become less wide than the body; about five months older than fig. 4.
- Fig. 18.* Portion of string of eggs of *Spirorbis*.
- Fig. 19.* Young *Terebella fulgida*, Ag., showing the order of development of the tentacles, *t*₁, *t*₃, and the concretionary lime capsules, *y*; greatly magnified.
- Fig. 19^a.* Stiff bristles of the rings; magnified.

- Fig. 20. Young *Spirorbis* soon after its escape from the egg, having only one tentacle developed, on the right, t_1 .
- Fig. 21. Somewhat more advanced than the preceding figure, showing the first trace of opercular tentacle.
- Fig. 22. Young *Spirorbis*, having three pairs of bristles; somewhat older than the preceding stage.
- Fig. 23. The anterior extremity of a specimen more advanced than fig. 22, showing the first trace of bifurcation of the tentacles.
- Fig. 24. Anterior extremity of a still older specimen, in which the contrast between the opercular tentacle (t_0) and the others (t_1-t_4) becomes very marked.
- Fig. 25. Young *Spirorbis*, in which all the characters of the adult can be readily recognized. Lettering as above.
- Fig. 26. Young *Polydora* having already lost the temporary bristles of the anterior rings.
- Fig. 27. Somewhat older than the preceding figure; the pigment-spots of the anterior part are more marked: from below.
- Fig. 28. Older than fig. 27; the dorsal cirri are quite apparent.
- Fig. 29. Young *Polydora*, seen from below; the pigment-cells are more concentrated than in the preceding stages.
- Fig. 30. Somewhat more advanced: seen from the dorsal side: the pigment-spots are reduced to mere dots; the number of rings has not increased from the preceding stage.

PLATE VI.

- Fig. 31. Head of *Polydora* having forty rings.
- Fig. 32. Anterior of young *Polydora* not quite full-grown; from below.
- Fig. 33. Adult *Polydora*, seen from above.
- Fig. 34. Profile view of anal extremity of *Polydora*.
- Fig. 35. Profile view of the anterior extremity of *Polydora*.
- Fig. 36. Gland found at the side of each of the rings beyond the sixth, at the base of the dorsal cirrus.
- Fig. 37. Stiff bristles of the fifth ring.
- Fig. 38. Small hook-shaped bristle of rings following the fifth.
- Fig. 39. Young *Nerine* provided with the temporary bunch of bristles.
- Fig. 40. *Nerine* in which the tentacles and dorsal cirri have begun to develop, which has lost the large bunch of serrated bristles.
- Fig. 41. Somewhat more advanced than fig. 40.
- Fig. 42. Young *Nerine*, having most of the characters of the adult.
- Fig. 42^a. Portion of one of the serrated bristles of the temporary cluster of fig. 39.
- Fig. 43. Anterior extremity of an adult *Nerine*, seen in profile.
- Fig. 44. Hook-shaped stiff bristles of the lower side.
- Fig. 45. Posterior extremity of *Nerine*.
- Fig. 46. Young *Phyllodoce*, from the dorsal side.
- Fig. 47 (upper fig.). Fig. 46 seen in profile.
- Fig. 47 (lower fig.). The tentacles of the anterior part of the *Phyllodoce* have developed; the body has considerably lengthened; seen from the dorsal side.
- Fig. 49. The same, seen from the mouth side.
- Fig. 50. Young *Phyllodoce*, seen in profile in stage of fig. 47 (lower fig.).
- Fig. 51. Somewhat older than the preceding stages; seen from above.
- Fig. 52. Young *Phyllodoce* in which the body has greatly elongated; seen from above.
- Fig. 53. Head of adult *Phyllodoce maculata*, from above.
- Fig. 54. Paddle and setæ of adult of fig. 53; seen in profile.

Fig. 55. Anal extremity of the same.

Fig. 56. Embryo Annelid, with immense bunches of temporary bristles.

Fig. 57. Adult of fig. 56?

Fig. 58. Minute Annelid parasitic on shell of lobster.

XXXVIII.—*Description of a new Species of Mesoprion.*

By Dr. ALBERT GÜNTHER.

[Plate IX.]

THE finest specimens of stuffed fishes which I have seen are prepared by the native employés of the Madras Museum. Capt. Mitchell, curator of this museum, has sent a small collection of such examples to the coming Universal Exhibition at Paris. Among them I have observed a new and very aberrant species of *Mesoprion*, distinguished by very feeble jaws and canine teeth, a very narrow præorbital, short snout, &c. I propose to name it

Mesoprion Mitchelli. Pl. IX.

D. $\frac{11}{13}$. A. $\frac{3}{9}$. L. lat. 70. L. transv. 10/22.

The height of the body is one-third of the total length (to the end of the middle caudal rays), the length of the head two-ninths. The snout is but little longer than the eye, which is nearly one-fourth of the length of the head. Jaws feeble, the lower projecting beyond the upper; the maxillary scarcely extends beyond the front margin of the orbit. Teeth in the jaws, vomer, and palatines villiform, in very narrow bands; the upper jaw only is armed with a pair of minute canines. Præorbital very narrow, its width being about half that of the orbit. Scales on the cheek in four or five series, the naked portion of the præoperculum being very broad at the angle. Præoperculum very finely serrated behind, the angle being radiated, each radius terminating in a scarcely perceptible spine. Basal half or third of the vertical fins densely covered with scales. Dorsal fin with the upper margin even; spines slender; the first is one-third as long as the second, which is not much shorter than the fourth and fifth, which are the longest and half as long as the head. The second and third anal spines are feeble, equal in length, and shorter than the second of the dorsal. Caudal fin emarginate. Pectoral falciform, longer than the head, not extending to the vent. Dark oblique and longitudinal lines run along the series of scales. Vertical fins with a narrow blackish edge.

The specimen is 16 inches long; it has been kindly promised for the Collection of the British Museum, after the close of the Paris Exhibition.

XXXIX.—*Remarks on the Falces and Maxillæ of Spiders.*

By JOHN BLACKWALL, F.L.S.

[Plate X. figs. 1, 2, 3.]

SPIDERS usually have the groove which is situated on the inner surface of the basal joint of the falces, and receives the terminal joint, or fang, when in a state of repose, armed on each side, to a greater or less extent, with conical, pointed processes which, by a figure of speech, are commonly denominated teeth; but that they are not the homologues of true teeth is rendered sufficiently evident by the fact that the falces do not constitute any part of the oral apparatus, being lethal instruments employed by the Araneidea in seizing, killing, and compressing their prey.

Eminent arachnologists have stated that the species belonging to extensive divisions of the family *Mygalidæ* are entirely destitute of tooth-like processes on the basal joint of the falces; but the fallacy of this opinion may be easily detected by a careful inspection of specimens taken from the genus *Mygale*, the most typical division of the family. In confirmation of the fact that many of the *Mygalidæ* are provided with a longitudinal row of tooth-like processes, situated between two dense fringes of long, curved, red hairs on the inferior surface of the basal joint of their falces, various examples might be adduced; but it will suffice on the present occasion to name the *Mygale ursina* of Koch, the *Mygale zebra* of Walckenaer, and the *Atypus Sulzeri* of Latreille.

Near the extremity of the outer margin of the maxillæ of numerous species of spiders there is a slight dark-coloured ridge, surmounted by a series of extremely minute close-set spines, which I have long known and regarded as contributing to give firmness to the most exposed part of those organs, and as affording some assistance in restraining the action and in the retention of the insects on which such spiders prey. Miss Staveley, on examining this structure under a high degree of magnifying power, has arrived at the conclusion that it may be resolved into a row of minute teeth (Ann. & Mag. Nat. Hist. ser. 3. vol. xvii. p. 399)—an opinion which its connexion with the maxillæ would probably tend to suggest; by its position and conformation, however, it appears to be little, if at all, adapted to aid in the office of mastication.

As the maxillæ of those species of the family *Mygalidæ* that have the palpi articulated at or near their extremity might be expected to present other modifications of structure, it became an object of some interest to subject them to a careful examination; with this view, I dissected several specimens of the *Myga-*

lidæ, belonging to different genera, from which I obtained the following results:—In no instance was any appearance of a ridge provided with a series of minute close-set spines observed near the extremity of the outer margin of the maxillæ; but *Mygale ursina* and *Cteniza nidulans* were found to have that deficiency amply compensated by short, distinct, black spines, grouped, apparently without order, on the inferior surface of the base of those organs, towards their inner margin, and to have the apex of the lip also provided with similar spines; *Mygale zebra* has spines at the base of the maxillæ, but none at the extremity of the lip; and *Atypus Sulzeri*, which has the palpi inserted near the base of the maxillæ, on the outer side, is provided with numerous short spines on the inferior surface of those organs, towards the inner margin, but is without any either at their base or at the apex of the lip.

I have hesitated to apply the term teeth to the conspicuous spines at the base and towards the inner margin of the inferior surface of the maxillæ and at the apex of the lip of certain species of the family *Mygalidæ*, notwithstanding that they are employed by them in retaining and also, to some extent, in lacerating their prey; but to a remarkable group of spines, situated on the superior surface of the maxillæ of *Mygale zebra*, and clearly indicating, by its position and structure, that the principal function it performs must be that of mastication, the appellation of teeth appears to be more appropriate. The spines composing this group, which are of a dark-brown colour, and have their pointed extremity directed towards the inner margin of the maxillæ, are fewer in number, enlarged at the extremity, and much longer and more distinct near the posterior end of each group than the closely compacted ones that form its anterior part. These spines, by their figure and arrangement, present a highly interesting subject for inspection under the microscope.

From the foregoing observations it is evident that much careful investigation is yet required to complete our knowledge of the various minute appendages connected with the external organs of spiders and of the purposes to which they are subservient.

EXPLANATION OF PLATE X. figs. 1-3.

Fig. 1. The left maxilla and palpus of *Mygale ursina*, magnified: *a*, the spines at the base of the former.

Fig. 2. The lip of *Mygale ursina*, magnified: *b*, the spines at its apex.

Fig. 3. The right maxilla and palpus of *Mygale zebra*, magnified: *c*, the spines on the superior surface of the former.

XI.—Description of a new Land-Shell from Trinidad.

By R. J. LECHMERE GUPPY, F.G.S.

[Plate X. fig. 4.]

Helicina lamellosa, Guppy. Pl. X. fig. 4.

Shell orbicular, depressed, thin, somewhat diaphanous, light fulvous; sculptured with sharp spiral ridges, bearing thin, lamellar free edges, of which about four are on the upper side of the whorls and from seven to ten on the scarcely convex under surface, interlined with smaller ridges; the interstices between the ridges of the upper surface finely striate spirally, of the lower surface shining, crossed by fine lines of growth; whorls $4\frac{1}{2}$ –5, keeled, with a lamellar free edge on the periphery. Spire depressed, conoidal; apex blunt, rather mamillary. Aperture oblique, roundish, angulate by the carination of the whorls. Peristome expanded and somewhat reflected, bearing obsolete blunt points corresponding to the spiral ridges: columella very short, simple: umbilicus covered by a thin, granular, whitish callus. Operculum semiovate, concave, thin, transparent, slightly tinted with fuscous, lined with numerous concentric striæ; nucleus subcentral.

Height $2\frac{1}{2}$ millims., greatest diameter $4\frac{1}{2}$ millims.

The animal resembles that of *Helicina barbata*, a species found in Trinidad. It is of a dark ashy-grey colour, passing into black on the two somewhat obtusely pointed tentacles, at the bases of which are the small black eye-spots. The lingual dentition is similar in general characters to that of the other species of *Helicina* I have examined. The shell differs from all the typical *Helicinae* by being more depressed, and by the spiral ridges and keel. The concentric striation of the operculum, which differs in texture from that of most *Helicinae*, is also an unusual character; and many naturalists might be disposed to give the present shell a new generic name. It may, indeed, be necessary to mark its distinctness by a subgeneric title. I propose, therefore, for the shells characterized by the peculiarities I have just noted the name of

PERENNA.

Operculum thin, suboval, concentrically striate; nucleus subcentral. *Shell* like *Helicina*, depressed; whorls lirata and carinate. *Animal* like *Helicina*.

Judging from the description of *H. lirata*, Pfeiffer (a native of Yucatan), that species may possibly belong to the group now characterized.

I have found *H. lamellosa* only on one of the rocky islets called the Cotoras, in the Gulf of Paria.

Port of Spain, Trinidad.

February 5, 1867.

XLI.—Notes on Professor Owen's Description of *Euphysetes simus*. By Dr. J. E. GRAY, F.R.S. &c.

PROFESSOR OWEN, in a note to his paper on Indian Cetacea, in the 'Transactions of the Zoological Society,' vol. vi. p. 37, observes:—"M. de Blainville figures, but makes no mention of, this bony ridge bisecting the 'postnarial' cavity. Dr. Gray, in appending the term *Kogia* to the *Physeter breviceps*, De Blainy. (Zoology of the Erebus and Terror, Cetacea, 4to, 1846, p. 22), is equally silent—indeed, adds nothing to De Blainville's meagre sketch of so remarkable a cranium, and quotes his admeasurements as in English inches and lines, without correction for the difference of the French 'foot.' Macleay was the first who pointed out the heavy ridge of bone that longitudinally divides the spermacetic cavity into two unequal parts (*op. cit.* p. 47) as subgenerically distinguishing his *Euphysetes* from *Physeter* or *Catodon*."

To this I have only to observe:—First, that the skull from the Cape figured by M. de Blainville does not possess the "heavy ridge of bone" found in the Indian and Australian skulls, but in the place of it has a couple of thin elevated plates united in front and forming a funnel-shaped cavity. The possession of the heavy bony ridge described by Mr. Macleay is the best character to separate the Australian and Indian species from that of the Cape.

Secondly, that I acknowledged that what was printed in the 'Zoology of the Erebus and Terror' was a mere translation of De Blainville's account; and if I had corrected the admeasurements into English feet, I should only have misled the reader. As I had only seen the skull years previously for a few minutes, I did not venture, from recollection, to make any addition to the original description. I am very glad that my essay to unravel the Cetacea, which, until my paper in the 'Voyage of the Erebus and Terror' above cited appeared, had scarcely been studied in a zoological point of view since the appearance of M. Cuvier's researches in the 'Ossemens Fossiles,' can only be assailed by such trivial observations as those above cited and the objection that I had not stated as clearly as I might the length of the symphysis of the lower jaw of *Steno* (*l. c.* p. 19); yet I should have thought that any one reading the characters would see that I compared the length of the suture with that of the lower jaw itself.

The publication of the observations on Whales in the 'Zoology of the Erebus and Terror,' which I know are very imperfect, and which I have since done all in my power to improve, has been followed by the recognition of three times as many large Whales as were known before its appearance, and they have lately been

defined and studied in a manner which must lead to the discovery of many more.

The result of the study I have bestowed on them has been that the British Museum contains the largest collection of the remains of the species ever brought together, and preserved and arranged in the best manner for the use of scientific men—much more so than if they were set up in large galleries, which would have the effect of sending the general visitors away disgusted at looking at what to them would seem like the repetition of the same skeleton; for they are too large for the eye to take in at one view, unless they are placed too far from the observer for the peculiarities of each kind to be studied and recognized.

The description of *Euphysetes simus* in the paper above quoted contains some peculiarities which require to be noted, that succeeding naturalists may not misunderstand them. In plate 12 of this valuable contribution to the knowledge of Indian Cetacea are represented the side and back views of the skull. The explanation of plate 12 stands thus:—“*Euphysetes simus*: fig. 1, side view of the skull; fig. 2, back view of the skull (rather more than half the natural size).” The upper figure represents the lower as well as the upper jaw: but no lower jaw was brought to Europe; and the figure of it must have been copied from the Indian drawing, which, I think, might as well have been stated; at least its not being stated has led to an inconvenience already, as persons have come to the Museum to see the lower jaw, which does not exist there,—more especially as, at page 40, the lower jaw is described at considerable length, and not a word is said that the description was taken from an Indian drawing, and not from the real bones.

Plate 11. fig. 2 represents the outline of the body, containing a shaded drawing of a skeleton; the plate is lettered “*Physeter simus*,” and the explanation of plate 11 runs thus: “fig. 1, side view of male (to same scale as female, plate 10); fig. 2, outline of ditto, with skeleton.” The figure really represents the outline of the *Euphysetes simus* of Owen, from India, and the skeleton of *Euphysetes Grayi* of Macleay, from Australia, combining two most distinct species in one figure and under one name. At page 42, under “Bones of the Trunk and Fins (plate 11. fig. 2),” occurs the following observation:—“Having been favoured with photographs of these bones in *Euphysetes Grayi* by the present able Curator (Mr. Krefft) of the Australian Museum, I have thought it might be useful to add the following notes.” Then follow the details of the skeleton, preceded, not by “*Euphysetes Grayi*,” but simply by the generic name “*Euphysetes* (plate 11. fig. 2).” I feel assured that most readers of both the text and the explanation of the plate will believe that

the skeleton figured and described is that of *Euphysetes simus* of India, and will not have the least idea that the outline belongs to one species and the skeleton to another, which are admitted by Professor Owen to be distinct, and are so regarded all through the paper.

Since the above was written I have been informed of a much more serious mistake in the paper. The account of the *Euphysetes simus* begins thus:—"The Cetacean which I have next to describe is represented by drawings of the adult *male* (side view, plate 11, to scale) and *female* (side view, plate 10. fig. 1; upper view, fig. 2; to scale). It is noted as 'a kind of Porpoise' in Mr. Elliot's MS., and is known to the Telugu fishermen of the coast by the name of 'Wonga.' The *male*, measuring 6 feet 8 inches in length, was taken at Waltair, February 28, 1853. The *female* was taken on the 1st of March, 1853, at the same part of the coast; she measured 6 feet in length" (p. 30). "According to the figures, the pectoral fin becomes free 1 foot 1 inch behind the snout in the *male*, and 1 foot 4 inches in the *female*; but there may be some inaccuracy here" (p. 31). The comparison is continued, and terminates as follows:—"The *vulva* is 3-inches in advance of the vent; the *prepuce* of the *male* is 9 inches in advance" (p. 32).

Now, after all these details, I am assured that both the drawings above referred to were taken from the same specimen, the only example of the "porpoise" recorded as taken on the Indian shores, that that specimen was a *female*, and, further, that the drawings and bones were accompanied by accurate admeasurements taken from the animal itself when in a fresh state.

XLII.—On the Temperature of Geological Periods, from indications derived from the observation of Fossil Plants. By the Count GASTON DE SAPORTA*.

IT is by the aid of facts derived not only from the study of ancient organisms, but at the same time from all sorts of observations, that we may hope one day to solve the complex question of the temperature of the globe at periods anterior to that in which we live.

We are still very far from any such result; but, in order to approach it, we must endeavour to apply to the problem a series of partial researches, so as gradually to bring together the elements of a complete and definitive solution. I shall therefore confine myself exclusively within the limits of the vegetable

* Translated from the 'Bibliothèque Universelle : Archives des Sciences,' tome xviii. pp. 89-142.

kingdom, by displaying what we may learn, by the study of plants alone, as to the degree of temperature of the periods to which they belonged. The field, when thus limited, is still immense, and can only be very imperfectly traversed; moreover I have neither the time nor the power to explore it otherwise than for the purpose of placing in it a few landmarks.

For the sake of clearness I shall divide this memoir into three parts:—

In the first I shall enumerate the views of which the examination of fossil plants had led to the most general adoption, until lately, as to the ancient and successive states of the temperature. In a second part I shall take up these same notions, to complete and rectify them, as there may be occasion, by means of the most recent researches. Lastly, in the third I shall establish the legitimate consequences of these observations.

I add this preliminary reflection—that, as we have to do with investigations relating to temperature, the examination of the vegetable kingdom is the more important because, in the present state of things, plants constitute so many delicate instruments, graduated with precision, capable of marking the smallest thermometric variations; this must likewise have been the case in past times, of which the laws appear to have been in constant harmony with those which prevail at the present day.

I.

When, during the first twenty years of this century, fossil plants were first observed, and a certain regularity was found to occur in their mode of living and succeeding each other, the divisions which constitute the scale of strata were still few in number and imperfectly limited. A. Brongniart, who brilliantly inaugurated this science in France, was the immediate disciple of Cuvier; that is to say, he was inclined to assume a certain number of epochs, at the conclusion of which the organisms were completely renewed, whilst within each of these epochs the changes were only partial, relative, and local. However, with the imperfect materials which geologists had then at their disposal, it was impossible for them to determine either the duration or the mode of termination of these biological periods—although they were tacitly inclined to reduce towards unity phenomena of various orders, and consequently to make them coincide with the successive faunas established by Cuvier, each of which they supposed to have characterized exclusively one of the intervals favourable to the development of life, called periods of calm, in opposition to the violent catastrophes which must have separated them.

As regards plants alone, they could already specify a certain

number of facts which A. Brongniart had indicated in his earlier works, and subsequently extended and coordinated in his 'Tableau des Genres de Végétaux fossiles,' in which the views adopted by the author are marvellously condensed. This remarkable work shows clearly what, previously to the investigations of the last twenty years, was the state of the question with which we are now occupied.

At that date, on starting from the existing epoch to penetrate into the past, there were observed, first, in the newest portion of the tertiary age, the arborescent genera which still characterize the northern temperate zone, represented by species not very different from ours, but still so far distinct from these that the idea of attributing them to an order of things different from ours might be adopted without inconvenience. This first totality underwent but little change in passing from one place to another; and, in examining a deposit slightly older or more recent, there was always nearly the same repetition of forms. However, the observations were still recent, the concordance very vague, and the number of undetermined species very considerable; and it is evident that the presence of the indigenous genera was more easy to seize and verify than that of the exotics, which were most frequently left in the shade for want of the power to determine them. It was therefore very natural to draw, from the preponderant existence of the former, the conclusion that the temperature of the period at which they lived did not differ sensibly from that which still prevails under the same latitudes. In this respect the first observations presented a coincidence sometimes due to chance. It will be sufficient for me to cite Armissan, where M. Brongniart, in 1829, indicated a birch, a witch-elm, several pines, a *Smilax*, a moss, and the fructification of a fern similar to that of *Osmunda*—a result which certainly did not denote any diversity in the nature of the climate of that locality in comparison with what it is at present, but a result very different from that to which I have since been led by the profound study of the same flora.

Thus, towards the middle of Tertiary time, the changes observed in the vegetation were easily explained by means of examples derived from certain parts of North America, where there was still to be seen an assemblage of most of the genera which could then be indicated in ancient Europe. The aspect of affairs was changed, however, on quitting the middle for the lower Tertiary times. Palms were then met with, at first rarely, then in increasing number. The impressions of the fronds of these plants early attracted attention by their well-marked character; and at an early period, also, they were regarded as the indication of a climate hotter than ours. The European genera not being

absent, but only less numerous, in the localities where these plants are met with, the idea of a gradual diminution of temperature sprang from their presence the more naturally, as the European genera which still showed themselves side by side with the palms were principally *Smilaces*, pines, *Thuia*, and laurels—that is to say, genera which, both in Europe and North America, inhabit especially the southern parts of the two continents, from which the palms themselves are not entirely excluded.

The most ancient Eocene times were then very little known; indeed they are scarcely known now. Certain deposits, such as that of Sheppey, in the London Clay, were ascribed to peculiar causes, such as the action of a current proceeding from the equatorial seas. Nothing, therefore, was opposed to the assumption that the temperature of the Tertiary epoch, at first rather hotter than at present in Europe, had then become lowered in such a manner as gradually to exclude the southern types from this region, and to resemble that which prevails under the same latitudes at the present day.

With the chalk observers passed at once to the unknown, not only in consequence of the strangeness of the forms and their confused occurrence, but also of their rarity, the incompleteness of their series, and the vagueness of the classifications adopted. The Chalk was regarded as a sort of intermediate period, in which the vegetable kingdom, in becoming renewed, had completed itself by the addition of the Dicotyledons, like the animal kingdom by that of the Mammalia; nevertheless the observations were too scanty and too confused to give rise to very precise conclusions; and I must say that the investigations with regard to this epoch do not yet enable us to foresee any solution of the difficulties which pertain to it.

Already, however, some great facts had come to light, which still serve as the basis of our present researches. Before the Chalk the Dicotyledons do not make their appearance, and the Monocotyledons become rare and uncertain; the Cycadeæ and Coniferæ, on the contrary, increase, and the ferns in their turn become a necessary element of the vegetation; the forms, in general, depart more and more from those of the present epoch, even under the tropics, and it is amongst the most restricted of existing groups that we have to seek for similitudes; these points themselves are at last wanting, and towards the base of the Jurassic series the vegetation no longer presents anything but analogies, becoming more and more distant, with those of the actual world.

At the date that I have selected (that is to say, about 1840) the flora of the Secondary formations and those of the Trias and Carboniferous formations were already well known; notwith-

standing the progress since made, the general result has not sensibly varied.

When compared with that of the existing world, this vegetation showed differences so strongly marked that one could hardly help being struck by them. After having observed plants specifically different from those now existing, others were found generically distinct, then others separated from ours even as to their family, and consequently having nothing in common with them but the more and more distant affinities of the class and subkingdom.

It is one of the glories of our times (and this glory belongs almost entirely to M. A. Brongniart) to have collected the scattered elements of a vegetable world so different from our own, to have brought them to light and life, and to have done this with such accurate ideas that they have not since been superseded.

In endeavouring to form an idea of the temperature proper to these most ancient periods of the earth's history, we naturally had recourse to the least singular plants, such as the ferns, then to the Calamites regarded as Equisetaceæ of large size, and to the *Lepidodendra*, arranged among the Lycopodiaceæ; and it appeared to follow, from the exclusive presence of plants belonging to the class of Vascular Cryptogamia, that certain islands at once hot and moist, certain tropical valleys bathed in tepid vapours and immersed in a dense shade, furnished a notion of what Europe must have been like during the period which corresponds with the formation of coal.

In the different composition of an atmosphere more charged with carbonic acid, in the extension of the seas, in the arrangement of the emergent land in the form of low islands, and in the still sensible action of the central heat, conditions were also sought which, when once admitted, accounted for the supposed elevation of the temperature and for that uniformity of climate which permitted the same vegetation to extend uniformly over very large regions, from Spitzbergen to the East Indies, and thence to Australia. Thus the preponderance and the great size of the Vascular Cryptogamia and the abundance of arborescent ferns were amongst the principal arguments invoked in support of a great elevation of temperature, which was afterwards explained by different causes.

Nevertheless, without thinking of it, those who argued in this way placed themselves in a vicious circle, in some respects, when they invoked the influence of the central heat upon the temperature to explain its elevation and the presence of arborescent ferns in Europe, whilst these same plants appeared to other geologists an evident proof of this action of the central heat.

Nor did they consider that, in making the vegetable combinations peculiar to this epoch dependent on the existence of a very elevated temperature, the important fact was left out of consideration, that the other categories of plants not having yet appeared, their absence was a negative phenomenon which deprived the exclusive predominance of Cryptogamic groups of a great part of its significance.

In reality nothing was evident except the existence of a more genial and more uniform temperature than at present—the only rigorous deduction from the facts observed.

But, by assuming for the Carboniferous period a very high degree of heat, a starting-point was established in harmony with the supposed progress of vegetation, since this appeared to have been gradually modified in proportion as the temperature was continually lowered by an insensible gradation.

To sum up. A great initial heat combined with a great climatic uniformity; a diminution at first not very marked, but becoming very sensible towards the commencement of the Tertiary period, still more marked towards its middle, and completely established towards the end of this period; a progress starting from a state very different from our own, and approaching the latter gradually from epoch to epoch: such, it appears to me, is a faithful representation of the most rational inductions that science had formulated. We must now see whether this view is in accordance with the most recent observations.

II.

The domain of fossil botany has been enormously enlarged of late years. One of the most interesting results of this recent progress is, that we can trace the course of a considerable number of genera through several successive stages; and where the species belonging to these genera, as is almost always the case, show a close affinity to those which correspond with them in the present state of things, we are justified in assuming that the fossil species lived under the rule of the same conditions as its living homologue, or at least under very similar conditions.

Thus the existing genera the ancient existence of which it is possible to prove must assist us in the investigation of the temperature proper to the times and places which they seem to characterize; whilst the extinct genera can only furnish us with such information in a very indirect fashion, according to the more or less distant relationship which they bear to those of our own day. On the other hand, when we have to do with a species which closely resembles a living congeneric species, the

analogical conclusions derived from the study of this plant will have the more probability in proportion as the affinity is more evident and the genus of which it forms part has more exclusive adaptations and better-defined habits.

One condition, however, is necessary to make sure of reaching the truth by this course—namely, that the generic affinity of the ancient species be supported by actual proofs, or, at least, that there be very little uncertainty about it. By adopting too readily a multitude of determinations indicated by palæontological botanists during the last few years, we should inevitably be exposed to the risk of building a superstructure without firm bases.

There is another important remark, of which, indeed, we shall have to make immediate application—namely, that certain determinations, although apparently doubtful, are in reality much less so. If, instead of being considered isolatedly, they relate to genera of which the repeated and successive presence is so well established that the fact of their ancient existence cannot be made a matter of doubt, there is then established between the various members of a series of graduated stages a sort of solidarity which causes the eyes and the mind to habitually recognize without hesitation impressions the true nature of which would escape them under other circumstances. The smallest indications are sometimes sufficient to reveal this to practised eyes. It is, moreover, certain that the types which continue characteristic of a region reappear almost always with great persistency in the fossil state in the strata of that region. This is one of the most settled general phenomena that can be appealed to in geology, not only in the world of plants, but also in that of animals of all classes. It is the case with the ancient European flora; and the types of vegetation which now characterize exclusively the northern temperate zone in the two hemispheres are reproduced in the fossil state, not only in the period immediately preceding our present one, but also through a long series of stages, until we reach the point where, discoveries being deficient, the investigation of these types is of necessity interrupted. These types are not the only ones that we can determine with certainty and with advantage to the question before us. Without speaking of those which have decreased in Europe, or which have since abandoned this continent to maintain themselves elsewhere, there exist others which are now observed only in the vicinity of the tropics. The more the affinities of the species of this category can be rigidly defined, the more possible is it to fix the probable degree of temperature which their presence in ancient Europe must lead us to accept for the period at which they lived. Here I find a difficulty

which must not be passed over in silence. What must we conclude if the two series of genera to which I have just referred combine, instead of mutually excluding each other? The examination of this question, one of the most curious of those suggested by the study of the European fossil floras, would be best placed at the end of my notice, when I shall discuss the legitimate consequences of the facts that I may have established; however, as the objection has presented itself, I shall state my opinion on this point, in order that, by at once getting rid of what has a specious appearance, the course that we have to follow may be cleared in advance of all obstacles.

There are, in my eyes, some truths so clear that they cannot, without paradox, be questioned. It follows incontestably, from the totality of the facts known in geology, that the temperature was higher formerly than at the present day in the zone of which the continent of Europe forms a part. The phenomenon of initial elevation of temperature is therefore not under discussion: what we have to seek are the successive degrees of this temperature, the period and the mode of its decline. As regards the fact of its definitive diminution, its results are before us. There were formerly in Europe palm trees, screw-pines, arborescent ferns, Laurineæ, and other exotic forms, which have disappeared to give place to the plants which we have before our eyes, and of which we know the organization to be adapted to the action and periodical return of cold seasons. Thus the fact of the lowering of the ancient temperature evidently follows from the elimination of these first types: therefore this elimination must be regarded as its true sign; and whenever, in a fossil flora, we observe a mixture of European with truly tropical forms, the presence of the latter will be to us a sufficient indication of the maintenance of a high temperature. When the European climate became decidedly too cold, these forms must have disappeared from the middle portions of this continent, and have left only faint traces of their former existence in its southern parts: this, in my opinion, is a certain proof that their coexistence with the forms which have continued indigenous had been possible previously only by the aid of climatic combinations which did not exclude the maintenance of at least a part of the ancient heat.

Thus, to my eyes, the elimination of the tropical genera is the great fact which reveals the moment when the temperature decreased, and even the proportion of this decrement. To us, therefore, the time when this elimination became complete will be that in which, the latitudes being constituted nearly as at the present day, the differences observed no longer depend upon any other than certain purely local causes.

We have now to apply these principles to the kind of investigation that I wish to attempt; and the following is the method that I shall follow. The end proposed being to collect among the fossil floras the indications of the temperature of the various periods, I shall rely upon two groups or series of plants, of which the completely opposite aptitudes alone can give rise to decisive inductions. These two series are, on the one hand, that of the genera now proper to the boreal zone, and, on the other, that of the types of which the homologues are now met with exclusively in the vicinity of the tropics. For the former, of which the date of appearance is still uncertain, but which did not show themselves in Europe until a comparatively recent date, the starting-point to be selected for observing their progress is best placed in opposition to the direction of this progress—that is to say, in the present epoch. On departing from this starting-point, we shall see this group, at first very complete, diminishing gradually, and lastly losing itself in a past state of things which is still very obscure. Must we follow the same course in the observation of the tropical types? I think not. In fact when, ascending the course of ages, we meet with them for the first time, these types are easily misunderstood; their very importance renders it necessary that they should be rigorously defined. Instead of being connected, like the European types, with an order of things still existing in the land, they are directly related to those of previous ages, and the latter, by a train which becomes more and more visible, are themselves connected with antecedent types. On the other hand, we are certain *à priori*, notwithstanding differences of detail, of the comparative elevation of the temperature during the most ancient period of vegetable life; and consequently, by starting from the most ancient stages, and neglecting the genera without any direct analogy with those of the present day, we are certain of arriving at a moment when, the divergences becoming less, genera identical with those now existing will necessarily make their appearance, and furnish us with an approximate scale of the temperature of these distant ages.

Thus we obtain a double starting-point; and the courses to be followed for one and for the other are in inverse directions, since, in order to ascertain the existence of tropical types, we shall descend the course of ages, whilst, on the contrary, we shall ascend it when we have to study the progress of the European types. In both courses of investigation I shall abstain from mentioning any genus the existence of which does not seem to me to be demonstrated, and which would not be identical with existing generic divisions; and I shall always take the latter in the most extended Linnean acceptation.

§ 1. *Examination of the Groups, Genera, and Forms with Tropical Affinities observed in the Ancient Floras.*

The vegetation of the Palæozoic strata does not with certainty include any of the existing genera. The attempts made in Germany by some palæontologists to assimilate to the living ferns a portion of those of the Carboniferous formation seem to be more specious than well founded*. They depend upon a superficial affinity of form rather than upon identity of structure. Moreover the positive analogies which this investigation has sometimes brought out would tend rather to lead us to range the ferns of this early age among the most exceptional tribes of the existing order. It is thus, according to M. Brongniart †, who is so cautious in his determinations, that the genus *Scolecopteris*, Zenk., observed in the same state of chalcidonic petrification as the species of *Psaronius*, and, like them, probably contemporaneous with the coal-measures, resembles in the mode of grouping of its capsules of fructification the genus *Angiopteris* among the Marattiæ, and that several species of *Asterocarpus* resemble *Kaulfussia*, or only *Gleichenia* and *Mertensia*. Other species of the same group seem to be allied to *Matonia* in the tribe Cyathææ. Lastly, the genus *Senftenbergia*, described by Corda, appears to denote the existence of a Schizeacean.

The much smaller proportion than was supposed of arborescent species has weakened one of the arguments most frequently appealed to in favour of the supposed elevation of temperature at this epoch. This applies also to the persuasion still entertained by many geologists that a constant temperature of 25°–30° C. (77°–86° F.) is necessary for the vegetation of tree ferns. This cannot be supposed when we observe that under the tropics it is principally in the hearts of mountain-forests and in the bottom of elevated valleys that most of these plants grow; their region is situated between 400 and 600 metres, and extends even to an elevation of 1000 metres. Moreover, according to the testimony of Humboldt ‡, the arborescent ferns depart from the equator towards the south as far as the forty-sixth and even the fifty-third parallel; they attain to an admirable development in Van Diemen's Land, at Hobart Town (lat. 42° 53'), with a mean temperature of 11°·3 C. (= 54°·34 F.)—that is to say, in an isothermic band of which the temperature is 2°·3 C. (= 4°·14 F.) below that of Toulon. It is true, as is remarked

* See especially 'Die Farnkräuter der Jetztwelt zur Untersuchung und Bestimmung der innern Formationen, &c.' von C. Ritter von Ettingshausen. Vienna, 1865.

† Tableau des Genres de Végétaux fossiles, p. 27.

‡ Tableau de la Nature, tome i. p. 166 (Galusky's translation: Paris, 1851).

by this celebrated author, that the difference between the extreme seasons is much more strongly marked in Europe than in Australia, and the climate is less uniform even within the limits of each season*. At Dusky Bay, in New Zealand, according to Dr. Hooker, arborescent ferns grow under a latitude of $46^{\circ} 8'$; and in the Auckland and Campbell Islands they are met with as far as 53° .

It can no longer be asserted that the temperature of the tropics is necessary for the existence of these plants; and therefore it is not to their presence alone that we can appeal for the admission of a high temperature during this first epoch, but must rather consider the general character of the vegetation. The types of this age, of which there still exist some representatives, diminished in size and generically distinct—the Lycopodiaceæ and Equisetaceæ—as well as the ferns themselves, flourish nowhere so much as within the tropics; and it cannot be denied that this neighbourhood is favourable to them, as their number, dimensions, and comparative importance increase in proportion as we advance in this direction. It is from the combination of these indications that we must believe in the existence during this first period of a warm temperature, a dense and cloudy atmosphere, and a permanent and tepid moisture.

The continents were then but slightly varied in surface-features (*accidentés*); the flow of water on the surface of the soil gave rise neither to rivers nor torrents, but to lagoons fed by a multitude of brooks which descended from all the slopes and traversed the bottom of the undulations, as we still see in granitic countries, which, better than any others, have retained the features of this ancient configuration of the surface of the earth. But the vegetation of the Carboniferous period has been pictured too often to render it necessary for us to dwell longer upon it.

On penetrating into the Trias, we meet with the genus *Equisetum*, still diffused throughout all latitudes, although its species now, even in hot countries, are far from attaining the dimensions of its ancient forms. In fact *Equisetum arundinaceum* (Bory), from the shores of the Mississippi, one of the largest of the group, does not approach *E. arenaceum* (Heer), from the Keuper, or even equal some Tertiary species.

In the Jurassic epoch is developed the group of the European Cycadeæ, probably generically distinct from those of the present day; it is, however, to the Cycadeæ growing in the southern parts of the eastern hemisphere, such as *Dion*, *Macrozamia*, and *Ence-*

* At Hobart Town the hibernal and æstival means are represented by $5^{\circ}6$ and $17^{\circ}2$ C., whilst at Rome, about 1 degree further from the equator, the annual temperature being $13^{\circ}3$ C., the hibernal mean descends to 8° , and the æstival reaches 30° C.

phalartos, that the *Zamites*, *Ctenis*, *Pterophyllum*, and *Nilsonia* of the secondary strata most closely approach. And as there is no reasonable doubt that these various genera really formed part of the same group as the existing Cycadææ, the habits and distribution of the latter in the world of our day may furnish us, by analogy, with valuable details as to the state of Europe at the period when these plants grew there, especially if we take care to select as examples those which most faithfully reproduce the ancient fossil types.

We must therefore compare these principally with *Encephalartos* and *Macrozamia*. The species of the former genus inhabit Southern Africa from 20° to 30° S. lat.; those of the second grow in South-western Australia, about 30° S. lat., and extend as far as 35°. These, therefore, as M. A. Brongniart has pointed out*, are rather subtropical and austral genera than really proper to the equatorial regions; the same remark is applicable to the species of *Cycas* and *Ceratozamia*, which advance in Japan and Mexico far beyond the tropics, to 32° N. lat. The habits of the plants of the group which seem best to reflect those of the fossil Cycadææ are indicated by M. Miquel in his monograph of the Cycadææ†. He tells us that the species of *Encephalartos* grow at a considerable distance from the Cape region properly so called, and beyond the limits of the flora characterized by the presence of Proteaceæ and Ericaceæ, under the shelter of a chain of mountains, in a country exposed to the calorific influences of the torrid zone, *but without precisely making part of it*. The first plants make their appearance about Uitenhage, in very limited stations separated by great intervals. Further on the individuals become more numerous, especially towards Amatymbis and Tambookis; they are never met with in the plains, but frequent the mountainous districts. Some prefer stony soils; others seek a rich vegetable mould; lastly, they do not appear upon naked slopes, but in the midst of thick copses of spiny shrubs. They are nowhere abundant, but disseminated in groups; the mountains which they inhabit attain an altitude of 2000 feet, and are dependent on a chain of which the elevation is not less than 1000 feet, and of which the slope directed towards the east and north pours its waters towards Delagoa Bay. Such is the physiognomy of these plants: a faithful image of a world that has disappeared, they carry us back irresistibly towards the Europe of Secondary times, of which they explain to us the vegetation and the aspect; nothing is altered, if we replace with Conifers the Leguminosæ and Rhamnææ of this part of Africa; but nothing compels us to assume for this epoch a temperature

* Tableau des Genres de Végétaux fossiles, p. 59.

† Monographia Cycadearum, p. 40.

higher than that of Africa about the twentieth degree of south latitude—that is to say, an annual mean of 22° C. ($=71^{\circ}\cdot6$ F.), the elevation, which rises to 2000 feet, moderating, in the station inhabited by *Encephalartos*, a climate already hotter than that of the Cape.

By the side of the Cycadeæ of the Lias we have to place some other indications, derived from other classes, which must not be neglected. Two species from the Lias of Bayreuth, described by M. Göppert under the names of *Asterocarpus heterophyllus* and *lanceolatus*, resemble the *Kaulfussiae* belonging to the family Marattieæ, according to M. A. Brongniart; whilst the *Teniopteris Münsteri* of Göppert, from the same locality, denotes a type very analogous to *Angiopteris*, and certainly belonging to this same group of the Marattieæ. Göppert also indicates *Hemitelites polypodiioides* as very analogous to *Hemitelia speciosa* (Kaulf.) from Peru.

The exceptional tribes of the existing state of things, of which we have thus already seen the dawn, consequently reappear with great persistency, and continue to show themselves: they now preferably dwell beneath the tropics; but they pass these limits towards the south, as in the case of the Cycadeæ, and are therefore not exclusively confined to them.

In descending the series, the Oolite of Charmouth presents us with the first important indication of the existence of the Pandanææ, in the genus *Podocarya* of Buckland, established upon a remarkable fruit, the relations of which with the existing Pandanææ appear, according to M. Brongniart, to prove that this family had already made its appearance at that epoch.

Above the Oolites, towards the Neocomian, I must indicate the true *Araucariæ**, of which I have seen fruits in a perfect state in the collection of M. Hébert, Professor of Geology at the Sorbonne. The character presented by the union of the seed with the base of the ovuliferous scale cannot deceive us, and establishes the presence of the genus, also indicated by numerous impressions of the twigs figured by M. Dunker in his monograph of the Wealden flora of North Germany.

The *Araucariæ* of the section *Eutacta* form now-a-days a perfectly natural subtropical group, confined to New Holland and some of the islands of the Pacific, advancing towards the north but little beyond 15° S. lat., attaining 29° towards the south in Norfolk Island, and capable of becoming adapted to a temperate

* Besides the *Araucariæ*, we must refer to true species of *Pinus*, of which the cones and seeds have lately been indicated in the fluvio-marine beds of the Neocomian stage of the basin of Paris by M. Cornuel, who has described and figured these organs in the 'Bulletin de la Soc. Géolog. de France, 2^{me} sér. tome xxiii. p. 628, pl. 12.

climate, as is proved by the introduction in our southern districts of *A. excelsa*, which, at Hyères and Nice, bears an annual mean of only 15°–16° C. (=59°–60°·8 F.).

Hitherto, therefore, most of the genera, with one exception, that we have met with do not seem to have required a completely tropical temperature—that is to say, above a mean of 20° C. (=68° F.).

In advancing towards the Chalk, we shall observe at first nearly the same types at the base of this great formation; but in proportion as we ascend this curious and still imperfectly known period, the vegetation insensibly acquires a new character. Dicotyledons make their appearance in an incontestable manner; the Cycadeæ, on the contrary, diminish in number and importance; and when, finally, we reach the richer and better investigated floras of the Upper Chalk, we observe a combination of the following genera:—

- FERNS: *Gleichenia*, Sm.—*G. protogæa*, Deb. (Aix-la-Chapelle.)
Lygodium, Sw.—*L. cretaceum*, Deb. (Aix-la-Chapelle.)
Cyatheites, Göpp.—*Bonaventurea cardinalis*, Deb. (Aix-la-Chapelle.)
- CONIFERS: *Araucaria*, Juss.—*Dammarites albens*, Göpp. (Chalk of Bohemia.) *Araucaria*, sp. Deb. in litt. (Aix-la-Chapelle.)
Sequoia, Endl.—*Geinitzia cretacea*, Ung. (Quadersandstein.)
Cycadopsis aquigranensis, Göpp. (Aix-la-Chapelle.)
- PALMS: *Palmacites*, Sternb.—*P. varians*, Corda. (Quadersandstein.)
Flabellaria, Sternb.—*F. chamæropifolia*, Göpp. (Silesia.)
- PANDANÆ: *Pandanus*, L.—*P. simildæ*, Stiehl. (Quadersandstein.) *P. austriacus*, Ett., *P. pseudo-inermis*, Ett., and *P. trinervis*, Ett. (Chalk of Gosau.)
Nipadites, Bow.—*Carpolithes provincialis*, Sap. (Fuveau.)
- MYRICEÆ: *Myrica* and *Comptonia*.—*Comptonites antiquus*, Nilsson. (Chalk of Scania.) *Myrica*, sp., Deb. in litt. (Aix-la-Chapelle.)
- PROTEACEÆ: *Anadenia*, *Leucospermum*, *Grevillea*, *Hakea*, *Dryandra*, &c.—A very great number of species reproducing the characteristic forms of these various genera and of several others. (Chalk of Aix-la-Chapelle.)

In this series the Pandanæ, and probably the Ferns also, alone betray clearly tropical aptitudes; the other groups advance at the present day to the north and south far beyond these limits; but the presence of the Pandanæ is an important fact, which must be taken into account, as in the present epoch their species (which are particularly numerous in islands, such as

Madagascar, Bourbon, and the Moluccas, do not in any case quit the intertropical zone. Strictly speaking, some doubt may attach to certain of these determinations considered separately; but the coexistence of such numerous indications can hardly fail to render it nearly certain that true Pandaneæ existed in Europe during the Cretaceous period, and consequently at the same epoch a mean temperature of at least 20° C. (=68° F.).

To give a better notion of the progress and ultimate decline of tropical types in the Tertiary epoch, which I now approach, I shall divide it into eight successive horizons, conceived chiefly from the point of view of the fossil floras. I shall arrange them as follows, proceeding from the lowest to the highest:—

1. The *Suessonian* of D'Orbigny, including Rilly and the lignites and sandstones of the Soissonais.

2. The *Parisian*, properly so called, including the "Calcaire grossier" and the London Clay.

3. The *Upper Eocene* or *Ligurian* of Swiss authors, including the middle freshwater beds of the basin of Paris and the sands of Beauchamp, with beds of *Cyrena semistriata*,—that is to say, the age of *Palæotherium*.

4. The *Tongrian* or *Oligocene*, corresponding to the age of the sandstones of Fontainebleau.

5. The *Lower Miocene*, corresponding to the limestone of La Beauce and the *Aquitanian* of Swiss authors.

6. The *Upper Miocene*, including the Marine Mollasse of Switzerland and Provence, up to and including Eningen.

7. The *Pliocene*, from Eningen to the close of the Tertiary period.

8. The *Quaternary*.

The following is an enumeration of the tropical genera belonging to each of these horizons, starting from the oldest:—

First Horizon: Travertins of Sézanne and sands of the Soissonais.

FERNS, CYATHEÆ: *Alsophila*, Bronn. *Polypodites thelypteroides*, Brong. *Pecopteris Pomelii*, Brong. *Cyatheites*, sp. plurimæ. (Sézanne.)

PALMS: *Flabellaria*, Sternb.—*F. Goupili*, Wat., *F. suessionensis*, Wat. (Soissonais sands.)

PANDANÆ: *Carludovica*?, R. & P.—*C.* sp. nov. (Sézanne.)

AMPELIDÆ: *Cissus*, L. *Vitigene cissoïdes*, Sap. (Sézanne.)

STERCULIACEÆ.—*Sterculia*, L., *S.* sp. nov. (Sézanne.)

The genus *Alsophila* being indicated with certainty for the
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first time in Tertiary formations, and even in the fossil state, I dwell upon this determination. This genus, with only a single exception, includes only arborescent species: in this case more especially it denotes a truly tropical type, because the species from Sézanne are closely allied to the most tropical forms of the genus in both hemispheres, whilst they differ from those which advance furthest towards the south, such as *A. pruinata*, Kaulf. (Chili), and *A. australis* (Tasmania).

The repeated presence of palms in the Soissonais sandstones, and that of a frond at Sézanne too conformable to the bifid type of *Carludovica* not to denote the persistence of the type of the Pandanææ, constitute a combination of tropical forms which is further increased by a *Cissus* formed upon the model of *C. ferruginea*, Poir., *indica*, Roxb., *tomentosa*, Lam., *repens*, Thw., *adnata*, Wall., and *capensis*, Thunb. (all perfectly tropical forms), by a *Sterculia*, several *Tiliacææ* and *Laurinææ*, &c.

The *second* of our horizons presents, of tropical types,—

PALMS: *Flabellaria*, Sternb.—*F. parisiensis*, Brong. (Calcaire grossier.)

Sabalites, Sap.—*S.* sp. (*Flabellaria maxima*, Ung., Brong.). (Oise, Crisolle.)

PANDANÆÆ: *Nipadites*, Bow.—Several species observed in the London Clay, in Belgium, and in the Calcaire grossier of Paris.

SAPINDACÆÆ: *Cupanioides*, Bow.—Several species in the London Clay.

TILIACÆÆ?: *Apeibopsis*, Heer (*Cucumites*, Bow.). London Clay.

The fossil fruits described by Bowerbank under the name of *Nipadites*, and of which that author was able to examine the structure in the pyritous specimens of Sheppey, differ in no important character from those of *Nipa*, a curious genus which seems to form the connexion between the Palms and the Pandanææ: it is reduced at present to a single species, *Nipa fruticans*, which inhabits the banks of the Ganges and the marshy parts of Java. The *Nipadites*, first observed in the London Clay and afterwards in Belgium, have lately been met with in the Parisian Calcaire grossier. The working of the mound of the Trocadero has enabled a great number of impressions to be collected in a sandy clay bed, in which there are also observed monocotyledonous leaves analogous to those of certain *Carludovica*, but entire, which should, perhaps, be combined with these organs.

The *Cupanioides* of the London Clay reveal the existence of

the Sapindaceæ, which we shall meet with again in the succeeding stages; they are there combined with Palms, Leguminosæ, and Tiliaceæ, of which the generic affinities are still obscure, but their physiognomy is that of corresponding plants under the tropics.

On the *third* horizon, which is known by the rich floras of Monte Bolca, Skopan, Alum Bay, the sands of the Sarthe, and, lastly, the gypsums of Aix, we may indicate, among many others, the following genera:—

- CONIFERÆ: *Araucaria*, Juss.—*A. Duchartrei*, Wat. (Middle sands).
 PALMS: *Flabellaria*, Sternb.—*F. Lamanonis*, Brong. (Gypsum of Aix.) *F. bolcensis*, Mass. (Monte Bolca.)
Sabalites, Sap.—*S.* sp. n. (Sands of the Sarthe.)
 MUSACEÆ: *Musophyllum*, Ung.—*M. speciosum*, Sap. (Gypsum of Aix.)
 LILIACEÆ: *Dracæna*, L.—*Dracænites sepultus*, Sap., *D. Brongniartii*, Sap. (Gypsum of Aix.)
 EBENACEÆ: *Diospyros*, L.—*D. rugosa*, Sap. (Gypsum of Aix.)
 ARALIACEÆ.—*Aralia*, L.—*A. primigenia*, Heer. (Bolca, Alum Bay.) *A. multifida*, Sap. (Gypsum of Aix.)
 STERCULIACEÆ: *Sterculia*, L.—*S. labrusca*, Ung. (Monte Bolca, Skopan, Alum Bay.) *S. tenuiloba*, Sap. (Gypsum of Aix.)
Bombax, L.—*B. sepultiflorum*, Sap. (Aix.)
 SAPINDACEÆ: *Sapindus*, L.—*Sapindus pristinus*, Heer. (Monte Bolca.)
 JUGLANDEÆ: *Engelhardtia*, Lesch.—*E. decora*, Sap. (Gypsum of Aix.)
 PAPILIONACEÆ: *Brachypterum*, Benth.—*B.* (*Micropodium*) *oligospermum*, Sap. (Gypsum of Aix.)
Drepanocarpus, C. Mey.—*D. Dechampii*, Mass. (Monte Bolca.)
 MIMOSEÆ: *Mimosa*, Ad.—*M. deperdita*, Sap. (Gypsum of Aix.)

Most of these genera, especially the more important ones, are determined with certainty:—the genus *Bombax* by the observation of the corollas; the *Aralia primigenia* by that of the fruits. The genera *Engelhardtia*, *Brachypterum*, and *Drepanocarpus* show theirs. *Diospyros rugosa* presents flowers and detached calyces. All these forms (leaving out of consideration those which are not exclusively tropical, such as the Laurinææ, Myrsinææ, Rhamnææ, Anacardiaceæ, &c.) serve to characterize the hottest regions of India, Africa, America, and Australia.

Upon this horizon a true *Araucaria* makes its appearance for

the last time; the original specimen is in the collection of M. Hébert at the Sorbonne. The other *Araucariæ* or *Araucarites* indicated in the Tertiary formation, and especially *A. Sternbergii*, Ung., are in reality *Sequoia*.

The following or *fourth* horizon is one of the most perfectly explored; we place here the floras of Hæring, Sotzka, Saint-Zacharie, Saint-Jean-de-Garguier, Armissan, and even that of Radoboj, in Croatia. The last two localities appear to be more recent than the others; but they are united to the former by too many ties to allow of their advantageous separation. The tropical genera which must be indicated in them are the following:—

FERNS: *Lindsæa*, Dryand.—*L. Cussolii*, Gerv. (Armissan.)

PALMS: *Sabalites*, Sap.—*S. major*, Ung. (Hæring, Radoboj, basin of Marseilles, Armissan.)

LILIACEÆ: *Dracæna*, L.—*D. narbonensis*, Gerv. (Armissan.)

ARALIACEÆ: *Aralia*, L.—*A. Hercules*, Sap. (Radoboj, Armissan.)

STERCULIACEÆ: *Sterculia*, L.—*S. labrusca*, Ung. (Sotzka.)

JUGLANDÆÆ: *Engelhardtia*, Lesch.—*E. decora*, Sap. (Saint-Zacharie.) *E. sotzkiana*, Ett. (Sotzka.) *E. macroptera*, Sap., *E. detecta*, Sap. (Armissan, Radoboj.)

PAPILIONACEÆ: *Calpurnia*, E. Mey.—*C. europæa*, Sap. (Armissan.)

Copaifera, L.—*Casalpinites copaiferinus*, Sap. (St. Zacharie, St. Jean-de-Garguier.) *Copaifera armissanensis*, Sap. (Armissan.) *C. radobojana*, Ung. (Radoboj.)

MIMOSEÆ: *Acacia*, Neck.—*A. sotzkiana*, Ung. (Sotzka.) *A. Bousqueti*, Sap. (Armissan.)

Mimosa, Ad.—*M. Pandora*, Ung. (Radoboj.)

These types, selected from among many others as the most certainly determined, are also clearly tropical. The genus *Lindsæa*, for example, scarcely possesses any species beyond the tropics; and the species from Armissan is very nearly allied to a Javan form, *L. javensis*, Bl. The *Dracæna* and Palms continue to give the mass of plants a very strongly marked equatorial physiognomy. The *Araliaceæ* reproduce the forms of the genus *Areopanax* of Central America. The genus *Engelhardtia*, then at its apogee in Europe, does not now quit the limits of tropical Asia, where, however, it ascends a little upon the mountains both in Nepaul and Java. Lastly, the genera *Calpurnia*, *Copaifera*, *Acacia*, and *Mimosa* are directly allied to types or forms now peculiar to intertropical Africa and Brazil.

The *fifth* stage of our series is a continuation of the preceding; the tropical types which we shall indicate in it are derived from the floras of Manosque and Bonnieux in Provence, of Monod, Hohe-Rhonen, and Eriz in Switzerland, of Brognon near Dijon, of Bovey-Tracey in Devonshire, &c.

FERNS: *Lygodium*, Sw.—*L. Gaudini*, Heer. (Monod, Manosque.)
L. acutangulum, Heer, *L. Laharpei*, Heer, *L. acrostichoides*,
Heer. (Monod.)

CYCADÆ: *Zamites*, Brong.—*Z. epibius*, Sap. (Bonnieux.)

PALMS: *Flabellaria*, Sternb.—*F. latiloba*, Heer. (Vevay, Brognon.)

Sabalites, Sap.—*S. major*, Ung., *S. hœringiana*, Heer.
(Switzerland.)

PAPILIONACEÆ: *Pterocarpus*, L.—*P. Fischeri*, Gaud. (Monod.)
Brachypterum, Benth.—*B. (Micropodium) lignitum*, Sap.
(Manosque.)

Campsiandra, Benth.—*C. (Pycnolobium) tetrasperma*, Sap.
(Manosque.)

MIMOSEÆ: *Acacia*, Neck.—*A. sotzkiana*, Ung. (Monod, &c.)

We must remark here, in the first place, the persistence of certain types which might have been thought to have been long before extinct. The *Zamites epibius*, collected at Bonnieux by M. E. Arnaud and described by me two years ago, is proved to be perfectly authentic by the finely schistose structure of the lamina, of lacustrine origin, which contains it; but it is hardly to be distinguished from its predecessor, *Zamites Feneonis*, Brong., from the Corallian. As regards the *Lygodia*, which we have previously indicated in the Chalk, and which are frequent in Switzerland, their presence at Manosque at the same epoch is attested by a fine impression; and even beyond this genus the ferns of that period present a great number of forms of tropical physiognomy, the strict determination of which is prevented by the absence or bad state of their fructification. I may cite, as forming part of this category, the *Pecopteris lignitum*, Heer (*Aspidium lignitum*, Gieb.), which occurs in Germany, England (Bovey), Savoy, and Provence (Manosque), the *Pecopteris Lucani*, Sap., from Brognon, the *Lastrea dalmatica*, Ett., from Promina and Switzerland, and, finally, the *Lastrea stiriaca*, which is distributed through a great number of Tertiary localities. All these ferns are evidently analogous to those of the hottest countries of the existing world.

The Leguminosæ also include several well-characterized tropical genera. One of the most remarkable that I am acquainted

with comes from the schists of the valley of Larguer, near Manosque; it consists of a coriaceous fruit of large size, dehiscent, with the valves open and spread out, and the resemblance of which to those of *Campsiandrã angustifolia*, Benth. (a scarcely known Brazilian species), is truly surprising. The genus *Brachypterum* reappearing, the Swiss *Pterocarpus Fischeri*, and several *Acaciæ*, besides various *Cæsalpinieæ* and *Dalbergieæ*, form a total the tropical physiognomy of which cannot be overlooked.

The *sixth* horizon is principally represented by the rich floras of Parschlug and Eningen. Here the lowering of the temperature begins to be sensible; but we can still indicate the following as tropical types:—

PALMS: *Calamopsis*, Heer.—*C. bredana*, Heer. (Eningen.)

CONVOLVULACEÆ: *Porana*, Burm.—*P. eningensis*, Al. Br.,
P. macrantha, Heer, *P. inæquiloba*, Heer. (Eningen.)

SAPINDACEÆ: *Sapindus*, L.—*S. falcifolius*, Al. Br. (Eningen.)

MIMOSEÆ: *Acacia*, Neck.—*A. eningensis*, Heer. (Eningen.)

A. parschlugiana, Ung. (Parschlug.)

Mimosa, Ad.—*A. palæogæa*, Ung. (Parschlug.)

The tropical element was therefore far from being banished from the middle of Europe at the epoch of Eningen, the temperature of which has been approximately estimated by M. Heer at 18° C. (=64°·4 F.). Nevertheless, starting from this time, the depression must have been rapid and continuous. In fact our *seventh* horizon, corresponding to the Pliocene, and well known by the floras of Gleichenberg in Styria, of Senegaglia and the Val d'Arno in Italy, and of Schlossnitz in Silesia, no longer contains any really tropical types. I can hardly cite the *Oreodaphne Heerii*, Gaud., nearly identical with *O. foetens* of the islands of Madeira and the Canaries, where the latter species is now isolated, whilst the rest of the genus is American and prefers the tropical regions of that continent.

Moreover, the subtropical types had declined with almost equal rapidity; the laurels, figs, Ebenaceæ, and Myrsineæ had likewise diminished in number and importance. Of these, however, the Pliocene period still presents some examples; but our *eighth* and last, or quaternary horizon, no longer includes any genera but those belonging to the northern temperate zone.

[To be continued.]

XLIII.—*Observations on Argyroneta aquatica.*

By Dr. FÉLIX PLATEAU*.

AMONG the numerous species of the group of *Aranéides Tubifétes* of Latreille, the Diving Spider (*Argyroneta aquatica*, Walck.) possesses a peculiar interest, both as regards its singular habits and the modifications induced by these habits in the physiological functions of the animal. After being investigated in 1749 by the Abbé de Lignac, who, unfortunately, was not a very good naturalist, and observed a little later in Sweden by Clerck, this spider afterwards fell into a sort of neglect; in fact the authors who have since paid attention to the Arachnida only say a few words about this species, or if they describe its habits, they all recur to the same sources, the memoirs of De Lignac and Clerck. But these two observers, although very skilful for their time, had missed some important facts, and were far from having always given satisfactory explanations of those which they had witnessed; lastly, the embryonic development had still to be worked out. These various gaps I propose to fill in the present memoir.

The embryonic development, which I shall not here describe in detail, presents the following peculiarities:—the germinal vesicle instead of enclosing only a single spot contains several, sometimes as many as ten, grouped in a variable manner. Wagner has already indicated this exception in the genera *Epeïra*, *Chubiona*, and *Salticus*. The enigmatical dark body observed by many authors beside the germinal vesicle in the ova of *Tegenaria*, *Lycosa*, *Salticus*, and *Thomisus* is wanting in those of *Argyroneta*. After the disappearance of the germinal vesicle, which takes place early, the formation of the proligerous disk is accompanied by oily drops like those seen by Kölliker in *Lycosa saccata*.

The eggs when laid are not spherical as in most of the Arachnida, but slightly ovoid. The development of the embryo follows the well-known course; but nevertheless I must dwell a little upon the development of the limbs, in consequence of the difference of opinion existing upon this subject among the authors who have studied other species. At each of the lateral extremities of the five transverse projections which exist on the ventral lamina of the embryo a dark point appears and increases rapidly in size, taking first of all the form of a hemispherical excrescence, and then that of a tube, which, gradually elongating, penetrates into the zone formed by the albumen, and only then recurves towards the ventral lamina; the free

* From the 'Bulletin de l'Académie Royale de Belgique,' 2^{me} série, tome xxiii. 1867. Abstract communicated by the Author.

extremities of these rudiments of palpi and legs thus finally cross upon the median line. The transverse projections, therefore, do not, as has sometimes been asserted, produce the limbs by dividing in the middle; but the limbs, in the *Araneida*, seem to have an independent origin.

I shall pass over some observations relating to the habits of the young animals after hatching, and come to the second part of my memoir, in which I deal with the adult *Argyroneta*.

The nest in which the *Argyroneta* deposits its eggs has long been known; but I have ascertained that the animal constructs for itself another kind of dwelling, in which it resides habitually. This is a spherical or ovoid cell, with delicate, almost transparent walls, presenting only a small opening at the bottom. Instead of being situated at the surface of the water like the nest, it is placed at a considerable distance from the surface, and concealed by masses of aquatic vegetation, in which the animal hollows out a small cylindrical horizontal canal, making a communication from the aperture of the cell into the surrounding water; at least this is what I observed when the habitation was constructed by an *Argyroneta* in captivity in a glass vessel.

According to De Lignac, Clerck, and those who have copied them, the spider first of all completely builds its cell, and then fills it with air. According to my observations this is not quite correct; and the following is what I have ascertained with regard to the submerged dwelling (two of the *Argyronetæ* that I kept in captivity having by chance commenced their cells between the aquatic plants and the glass wall of their bottle):—The first steps of the construction are difficult of observation; but we may conclude, from the sort of dragging undergone by the *Algæ* and *Confervæ*, that the animal commences by fixing to these plants a comparatively small number of threads arranged so as to intercross nearly at the same point. The tenuity of the threads and their immersion in the water render the network at first invisible; but it soon betrays itself in the following manner:—the *Argyroneta* comes to the surface to procure a certain quantity of air, which it throws off under the network of which we have just spoken; in consequence of its lightness the air ascends in the form of a bubble, and meeting the threads adheres to them and pushes them upwards, giving them the form of a little dome. From this moment the imprisonment of the bubble of air, the increase of the dragging by which the *algæ* are affected, and, finally, other threads which the *Argyroneta* successively adds to the meshes surrounding the bubble leave no longer any doubt as to the existence of the network, which we even begin to see. Fresh quantities of

air brought in, and great numbers of new threads added to the preceding ones by the animal, gradually give the cell its definitive form and solidity. I have not seen the construction of the superior dwelling, or the nest properly so called; but I think we may assume that the *Argyroneta* proceeds in it as in the first case; only it would fix the threads but little below the surface of the water, and give the walls a much greater thickness. The air accumulated in the nest by the spider would soon raise the top of the habitation a few millimetres above the surface, the aquatic plants, which serve as points of attachment, yielding more or less to the pulling of the threads.

The *Argyroneta*, having no tracheal branchiæ like *Hydrachna*, must respire the free air; for this purpose it surrounds itself, as every one knows, with a stratum of air enveloping the abdomen and clothing the lower surface of the thorax; this stratum of air adheres firmly, notwithstanding all the movements of the animal.

De Lignac and, after him, Latreille were puzzled as to the cause of this adherence, and assumed that a grease or varnish secreted by the spider covers the portions destined to receive the gaseous envelope. Some experiments having enabled me to demonstrate that neither grease nor varnish exists at the surface of the body of the *Argyroneta*, I sought the cause of the phenomenon in the fine short hairs with which the animal is clothed. Professor Duprez, of Ghent, has shown, in a most interesting memoir "On a peculiar case of Equilibrium of Liquids" (Mém. de l'Acad. Roy. de Belg. tomes xxvi. & xxviii.), that the surface of contact between the air and a liquid presents very great stability when the extent of this surface is sufficiently small; on the other hand, I have ascertained, by experiments detailed in my memoir, that the hairs of the *Argyroneta* are easily wetted. My observations have also shown me that these hairs become entangled in groups, forming little closely placed bundles, which project, in the living animal, beyond the general stratum of air. These bundles themselves, containing air which is in continuity with this stratum, constitute so many points of adherence for the surrounding water; the points in a manner subdivide the surface of the gaseous envelope into portions of small extent, and thus give it stability.

A great number of experiments have shown me that any hairy surfaces, fragments of skins of mammalia, wadding, velvet, &c. are covered, when immersed in water, with a stratum of air of greater or less thickness, which continues permanent whenever it is divided into sufficiently small portions by suitable points of adherence, and which, on the contrary, soon detaches in the form of bubbles when this condition does not

exist, or exists only in an insufficient degree. The description of these experiments being too long to find a place in a summary, I shall conclude with a statement of the process which I have seen employed by the *Argyroneta* when it wished to convey from the surface a supplementary mass of air, destined either for the formation of its dwelling, or for the renewal of the air in the latter. When the *Argyroneta* is examined with the lens, we easily see that its posterior femora are furnished with thick hairs. If, now, we surprise the animal when it is in search of a supplementary mass of air, we find that at the moment when it is about to quit the surface of the water it separates its posterior femora pretty widely, and that, when it dives, a comparatively large gaseous mass on each side of the abdomen unites the ordinary stratum of air to the inner surface of the femora. In swimming to regain its dwelling, the animal only employs the movements of its anterior limbs. What then takes place in the cell or in the nest I have been unable to ascertain; but we may suppose that the spider applies the femora to its body, and thus throws off the portions of air of which I have just been speaking. In any case, when the *Argyroneta* again quits its cell or its nest, its posterior legs are in their normal position, and the quantity of air entangled between them and the abdomen is insignificant.

BIBLIOGRAPHICAL NOTICE.

Contributions towards a Cybele Hibernica, being outlines of the Geographical Distribution of Plants in Ireland. By D. MOORE, Ph.D., and A. G. MORE, F.L.S. Dublin, 1866, pp. 56, 399.

THE title of this work, 'Cybele Hibernica,' will at once inform our readers of its primary object. It is an attempt to do for Ireland what Mr. H. C. Watson performed for Great Britain in his 'Cybele Britannica;' and the authors have succeeded in doing this far more completely than they themselves seem inclined to allow. The country is divided into twelve botanical districts in such a manner as to mark, as far as possible, the peculiarities of the flora: three are central and do not touch the seacoast at all; the others all contain a considerable extent of coast: two are western, so as to include the peculiar *Atlantic* plants of Kerry, Galway, and Mayo. These districts were first proposed by Prof. C. C. Babington in a paper read to the Dublin University Zoological and Botanical Association and published by it; but he has there, perhaps unadvisedly, attempted to divide these "provinces," as he calls them, into more minute districts. Apparently our authors have done well in making his provinces their districts and neglecting, at least for the present, the smaller subdivisions pointed out in that paper.

In the Introduction we have a table of the mean temperature for the four seasons of the year as derived from observations made at sixteen places situated in as many different counties of Ireland, derived from Dr. Lloyd's elaborate essays to be found in the 'Transactions of the Royal Irish Academy.' From this it appears that the mean annual temperature differs very slightly from that of South Britain. But it is the temperatures of summer and winter that chiefly affect the character of the vegetation. The mean of summer heat is 2° (Fahr.) lower in Ireland, and that of the winter is about 2° higher. It results from this that many tender plants will bear the winter of Ireland, especially of the western and south-western counties, which are killed by frost in England; and a difference is even apparent between the east coast, as at Dublin, and the west: several plants indigenous to the latter suffer much from frost in the Glasnevin Garden. On the other hand, the lower summer temperature and the damper climate render wheat a precarious crop in many parts of Ireland. The mean rainfall is shown for sixteen places: for the whole island it was 30.50 inches in the year 1851, but the difference between the least and greatest fall is very great; at Portarlinton it was only 21.23 inches, at Cahirciveen 59.37. The latter place and others which approach the same amount of rainfall are situated on the western coast and receive the full discharge of the clouds from over the gulf-stream when they first touch the mountains.

The distribution of the native plants depends greatly upon these peculiarities of climate, and the character of the flora is also much affected by them. On the western coast several plants abound which point to the south-west of Europe as their proper home: the Robertsonian Saxifrages, *Erica Mackaiana*, *Arbutus Unedo*, *Dabeocia polifolia*, and *Pinguicula grandiflora* may be mentioned. Plants included under Mr. Watson's Atlantic type are numerous, 41 out of 70 species being found; on the other hand, only 18 out of 127 of his Germanic type are natives of Ireland. The Alpine flora is poor; scarcely more than a third of Watson's Highland species have been found. Indeed we have observed in Ireland, as in the Hebrides, that the vegetation scarcely alters as we ascend a lofty mountain, and that it is unusual to find any plants peculiar to its upper part or to notice the deficiency of the lowland plants at high elevations.

After the Introduction a valuable table, showing the distribution of each plant through the districts, is given. It shows at a glance the absence or presence of the plants from the several parts of the country. It is similar to the tables drawn up by Mr. Watson for Great Britain.

The bulk of the work is formed of a detailed account of the distribution of each species. We can best point out the mode and fullness with which this is done by a short extract taken from the second page of the book.

"2. *Thalictrum minus* (Linn.)—*Lesser Meadow-Rue*.

"Districts 1 - 3 4 5 6 7 8 9 - - 12
 "Lat. 51° – 56° . From South to North of Ireland.

“Type in Great Britain, Scottish, inclining to British.

“Stony places and sandhills; local. *Fl.* June to August.

“1. Ross-wood, Killarney; *Wade Rar.* Cliffs at Gap of Dunloe, near Killarney; *Flor. Hib.* Mangerton; *I. C.* On Sugar-loaf Mountain, Glengariff; *I. C.*—3. In a meadow near Mountmellick; *Wade Rar.*—4. Shore near Rockfield, Wicklow; *D. M.*—5. Baldoyle! Portmarnock! Ireland’s Eye! *Flor. Hib.* Shore between Clontarf and Raheny; *Wade Rar.*—6. In many parts of the limestone district of north Clare and Galway; *A. G. M.*—7. Shores of Lough Ree in Westmeath and Longford; *Mr. F. J. Foot.*—8. In various parts of Mayo, especially near the large lakes; *A. G. M.*—9. Ben Bulbin, Sligo (*T. calcareum*); *Mr. J. Ball* (*Bot. Gaz.* i. p. 312).—12. Newcastle and Dundrum Bay, Down; Belfast Bay; Portmore Park and Lough-Beg, Antrim; *Flor. Ulst.* On basaltic rocks at Glenariff; *D. M.*

“Ranges from sea-level to 1500 feet or more.

“*T. flexuosum* (Bernh.) *T. majus* (Flor. Hib.)

“Districts - - - - - 6 - 8 9 - - 12

“Rocky and bushy places; rare.—6. On a hill south of Black Head, in Clare; *Mr. F. J. Foot.* On the shores of Lough Derg, near Portumna; *D. M.*—8. Near Headford, Galway (*Mr. Shuttleworth*); *Flor. Hib.* On an islet called Canova, in Lough Corrib; *A. G. M.* Near Pontoon, by Lough Conn! *Ir. Flor.*—9. By Lough Carra, Mayo; *Mr. J. Ball*, who mentions a large form of *Thalictrum* growing here (*A. N. H.* vol. ii. p. 35).—12. At the base of Slieve Donard, on the ascent from Kilkeel; *Flor. Hib.*

“This is considered by *Mr. Boswell Syme* as a ‘subspecies,’ and placed under *T. minus* in his edition of English Botany.

“3. *T. flavum* (Linn.)—*Marsh Meadow-Rue.*

“Districts - 2 3 4 5 6 7 8 9 10 - 12

“Lat. 52°–56°. Throughout Ireland, but local.

“Type in Great Britain, English.

“River-sides and marshy places; rather rare. *Fl.* June, July.

“Quite a local plant, though recorded from nearly all the districts.”

An Appendix contains lists of plants which, there is reason to believe, were recorded erroneously by *Dr. Smith* in his histories of Kerry, Cork, and Waterford; and by *Dr. Wade* as seen by him in the west.

It will be seen from what we have said that this is really a new and carefully revised Flora of Ireland. Such a book was very much wanted, for thirty years have passed since the publication of *Mackay’s ‘Flora Hibernica,’* thirty years of much more active research than those that preceded the preparation of that work. It had therefore become nearly obsolete. The authors have wisely omitted descriptions of the genera and species, as they are to be found in the “excellent and portable Floras in the hands of British

botanists," and given in their place a very complete account of the geographical distribution of the plants.

We have made much use of this volume, and can recommend it confidently to all botanists as being a very complete and critical flora of Ireland. Much care has been taken and sound judgment exercised in deciding upon what species are to be considered as native and what as introduced into Ireland; and the authors have stated their reasons for the exclusion or omission fully in each case.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

February 21, 1867.—Dr. W. A. Miller, Treasurer and Vice-President, in the Chair.

"A brief Account of the 'Thesaurus Siluricus,' with a few facts and inferences." By J. J. BIGSBY, M.D.

I have been led to attempt the preparation of a general view of Silurian life, as far as now known, by my own frequent want of such a record or muster-roll of the constituent members of this great initiatory division of palæozoic zoology,—a task which has been made pleasant by some personal knowledge of two countries rich in the earlier formations.

I have been further encouraged by the great accumulations of the last few years, through the establishment in North America and elsewhere of numerous colleges, each of them having become the centre of more or less field-work. Far more aid still has been derived from many public surveys on a tolerably liberal scale. Nor can we forget the highly meritorious and successful labours which have been, and still are, carried on by private individuals in almost every part of Europe and North America.

As this undertaking required an exactitude and a critical skill in determining species and genera according to late improvements in classification, much beyond an ordinary acquaintance with Silurian life, after my materials were put together, I obtained the very valuable aid of Mr. J. W. Salter, late Palæontologist at the London Museum of Practical Geology.

I was then, through the kindness of Sir Roderick I. Murchison, Bart., allowed to submit my manuscript to Robert Etheridge, Esq., F.R.S.E., the present Palæontologist to the Institution over which Sir Roderick presides.

To the careful superintendence of these two eminent naturalists I am indebted for corrections and suggestions of the greatest importance, and particularly as relates to Britain and to Europe generally.

My matter has been principally found in the voluminous and truly priceless writings of Murchison, Sedgwick, Barrande, Sowerby, De Verneuil, James Hall, McCoy, Salter, Billings, Angelin, Eichwald,

Shumard, and Davidson—together with those of other authors, some of whom are scarcely of inferior merit*.

I have been favoured with many unpublished contributions from my friends Mr. Billings (the learned Palæontologist of the Canadian Survey) and Principal Dawson, F.R.S., of McGill College, Montreal, —also, through the kindness of Mr. Salter, from the Himalayas (Colonel Strachey, R.E.), from West Tasmania (Dr. Milligan), from South Wales (Henry Hicks, Esq.), and from the late Mr. Wyatt-Edgell.

I propose to give to this effort the name of “Thesaurus Siluricus.” Besides its use for general reference in the closet and in the quarry, the ‘Thesaurus’ provides a high station from which the student may obtain a broad survey of the Silurian populations of the whole earth. It will assist in tracing the extent, shape, and varying depths of areas, in discovering regional affinities, differences, and those great zoological severances which we call breaks. By its aid we may compare horizons remote from each other, and, moreover, note the frequent changes of many kinds which take place while the epoch is working out its long history. It will place under our examination numberless communities of life, their constituents, habits, rise, and decline.

The ‘Thesaurus’ points to the universality (as defined) at times proximate everywhere, brings into prominence the riches, magnitude, and wide diffusion of the Primordial stage; illustrates the power of locality over life, and opens out the wonderful march of geographic dispersion through obstacles innumerable.

For a long period naturalists have been arranging the life of the globe into species, genera, orders, &c., with a view to the establishment of types as standards of comparison. It is from such data, well considered and generally acknowledged, that this ‘Thesaurus’ has been compiled.

As long as an individual mollusk remains unregistered it is deprived of its full usefulness; but even then it may reveal an important fact—as the trilobite speaks of the Palæozoic period, and a nummulite of the Tertiary.

Until some such record as the present is available, the labours of many living investigators (whose names rise to the lips spontaneously) will rest comparatively fruitless. It has hitherto not been possible to consider widely scattered existences in an aggregate form. Facts (many) have been stored up separately; but generalized truths have been rarely attained. This has not yet been done in a satisfactory manner, not even by Bronn or Goldfuss for any one epoch, and scarcely for the cretaceous period by the American geologist Mr. Gabb, although he has done well.

* Agassiz, Beyrich, Bronn, Brongniart, Conrad, Dalman, D’Orbigny, Vicomte d’Archiac, Dawson, Emmerich, Emmons, Fischer, E. Forbes, Goldfuss, Green, Harkness, Hisinger, Haime, Honeyman, Rupert Jones, Ketley, Kutorga, Lawrow, Linnaeus, Lovén, Lonsdale, McChesney, Meek, Meneghini, Milne-Edwards, Morris, Owen, Pander, Phillips, Portlock, Rømer, Rouault, Sars, Sharpe, Safford, Swallow, Triger, Vanuxem, Von Buch, Volborth, Wahlenberg, Winchell, &c. &c.

This 'Thesaurus' contains 7553 species, and therefore gives abundant scope for profitable study; but probably it does not give the title of the whole Silurian life yet lying buried in the wilds of the Arctic Circle, of Hudson's Bay, Labrador, the two Americas, Scandinavia, Australia, India, &c. &c. The more accessible countries frequently, to this day, yield new forms, although the search for them is capriciously and idly conducted, and is dependent often on the accident of a new public work or the presence of a competent observer. Many undescribed species are lying in local museums, still more in the great collection at Prague in the possession of a high Ecclesiastic in that city. Owing to the enlightened perseverance of M. Barrande, a few small parishes close to Prague have yielded nearly one-third of the whole earth's Silurian remains within present knowledge; and the greater part of these are not met with elsewhere. How wonderfully rich must be the universal Silurian fauna! What a splendid promise to the future explorer!

The 'Thesaurus' is in the form of a Table. After mentioning the genus (taken alphabetically), its author, and the date of its establishment, the species are successively named, and treated of under four or more heads, along one and the same ruled line. First comes the part of the stage in which it occurs, then, in a given order, its author and locality, or localities, in the column indicative of its proper stage.

More information is thus conveyed, it is believed, than by any other form of Table. The summary which is appended to each order shows some of the organic relations of the Silurian system in Europe and in America to each other; it shows, too, how very little we know as yet of this epoch in Asia and Africa; and, among other things, it tells us the numerical strength of the genera.

Permit me now to lay before the Society a few facts drawn from the mere surface of the 'Thesaurus,' and only in the way of summary or brief remark, in order to suit the purpose of this evening. Much more than this the careful registration of more than 50,000 facts has prevented me from doing.

The Table A gives the numerical amount of the Silurian flora and fauna as known in the years 1856 and 1866 respectively.

TABLE A.—Comparative number of species known in 1856 and 1866.

	Plantæ.	Amorphozoa.	Foraminifera.	Annelida.	Hetero- Pteropoda.	Polyzoa.	Cœlenterata.	Echinodermata.	Trilobitæ.	Entomostraca.	Brachiopoda.	Dimyaria.	Monomyaria.	Gasteropoda.	Cephalopoda.	Pisces.	Class uncertain.	Total.
Prize Essay	18	19	..	10	63	76	108	93	425	8	579	113	14	151	299	10	9*	1995
Thesaurus ...	76	125	25	132	241	389	496	479	1400	247	1408	446	136	721	1192	34	6	7553

This Table, taken from Bronn's Prize Essay published in 1856, and from the 'Thesaurus Siluricus,' shows that within the last ten years the number of known species has more than trebled.

* Morris, Catal. p. 362.

Universality.

In the spirit of the following definition, it would appear that the Silurian system is universal—that is, it overspreads the whole earth more or less completely,—and that its component parts were laid down in a proximate time,—statements approved by M. Barrande, Bull. n. s. xii. 361. Definition:—“*A formation may be considered to be universal when it occupies large and small areas in very many parts of the earth, often remote from and even antipodal to each other, when it is always of like stratigraphical relations, is composed of like materials, and contains numerous genera in common, together with some representative and some identical species.*”

In support of our application of this definition to the Silurian system, the ‘Thesaurus’ exhibits the widest possible distribution of its fauna—a fauna, it must be remembered, which is pure from admixture with that of any other epoch which might possibly have been progressing at the same time.

The ‘Thesaurus’ contains many examples of the same species being in twenty to twenty-five different countries, large and far apart—the same creature or creatures marking the route from land to land.

Table B, drawn up under the inspection of Mr. Salter, presents 195 species common to regions very remote from each other, some of them being antipodal—a fact which tells the more forcibly from the tenacity with which a large part of Silurian life clings to locality as well as to horizon. 179 species are common to Europe and America. Sixty Silurian genera have been brought from South

TABLE B.

Kingdom or Order.	No. of Species.	America and Europe.	America, Europe, and Australia.	America and Australia.	Europe and Australia.	Total.
Plantæ	74					
Amorphozoa	120	5	.....	.....	.....	5
Foraminifera	25					
Annelida	132	4	.....	.....	.....	4
Hetero-Pteropoda	239	16	.....	.....	.....	16
Bryozoa	383	6	3	6	5	20
Zoophyta	432	18	.....	.....	.....	18
Crinodea }	7	7	.....	.....	.....	7
Cystidea }	456	1	.....	.....	.....	1
Asteriada }	1	1	.....	.....	.....	1
Trilobitæ	1414	21	2?	.....	.....	23
Entomostraca	242	1	.....	.....	.....	1
Brachiopoda	1372	64	.....	.....	.....	64
Monomyaria	123	2	.....	.....	.....	2
Dimyaria	439	9	.....	.....	.....	9
Gasteropoda	715	9	.....	.....	.....	9
Cephalopoda	955	15	.....	.....	.....	15
Pisces	34	.....	.....	.....	.....	...
	7155	179	5?	6	5	195

Australia by Mr. Selwyn, the chief Geological Surveyor of that colony; and Professor McCoy has met with in that country a *Siphonotreta*, a *Phacops*, and eighteen species of *Graptolites* absolutely identical with those of North America and of Europe. The Professor loudly expresses his surprise and delight. According to M. Barrande, *Orthoceras bullatum* (Sowerby) is at Melbourne (Australia) and in Ireland, Bohemia, Germany, and Russia. *Conocoryphe depressa* is both in Wales and Texas, one of the American States. Western Tasmania, the Himalayas, Russia, North and South America, and many other regions offer ample fossil evidence of the general presence of the constituents of this period.

The Silurian beds, it must be borne in mind, are usually visible in mere shreds and remainders, met with in any one place only as a stage or a part of a stage, the other portion being covered for perhaps thousands of square miles by more recent deposits, or removed by denudation; or it may be that certain stages have never existed, as we see in Arctic America with respect to the Lower Stage; while in the South, as in Sardinia, France, and Spain, it is the Upper Stage that is wanting, or very nearly so.

But the visible geographical spread of these strata is often very great. So extensive are the Silurian areas of North America (2000 miles across) that it only needs a short and easy step to induce a belief in a former universal prevalence and domination of this system.

Sufficient territory resting on Silurian rocks has been spared from oscillatory action to enable us to trace it in one or other of its parts over a large part of the earth. We follow it circuitously from England to Australia, or to America—the interspaces being filled up either by sea, by newer rocks, or by kindred palæozoic strata, which themselves irresistibly bespeak its frequent continuous existence near at hand.

This is only a fragment of the argument in favour of the doctrine of Universality of epochs, as just defined.

Locality.

The 'Thesaurus' brings conspicuously into view the great influence of locality on the nature and amount of life, in the same way as we observe at the present time. As each region yields up its fauna to the collector, much of that fauna is found to be new, the bond of connexion with other Silurian districts being in great measure generic.

The physical conditions of sea and land being necessarily local, produced as they are from time to time by agencies limited in space, the dwellers among these conditions must in a certain measure be local too, and typical—subject at any moment to removal. The first occupants of any spot who shall point out?

The maximum of life, meaning by that expression the largest combination of abundance, variety, and rank, is local. It may take place at the beginning of a stage, or of an epoch, in the middle;

or at the end, being governed principally by the nature of the sediment. The rich Primordial beds of Western Newfoundland and of Quebec, the crowded Pleta beds of Russia and of Esthonia, the Trenton Limestone of America, the Mid-Silurian rocks of Bohemia * (*E. e.* 1, 2), some of those of Wales, the Lower Helderberg group of New York, are conspicuous examples of this. Parts of the Llandovery stage of Wales and of New York (U. S. A.) present a great dearth of life, and for a well-known reason. How barren are the vast accumulations of Lower Silurian in Bolivia, as at present believed! The Potsdam Sandstone of the valleys of the St. Lawrence and the Mississippi shows no signs of life for hundreds (and perhaps thousands) of square miles, save in small oases peopled chiefly by *Lingulæ* in incalculable millions of individuals.

Nearly equal areas of Central North-east America (N. latitudes 50°–32°) and Europe may have received about the same attention; but the latter, so far, has proved the richer by above a thousand species, as we see in the subjoined Table C.

TABLE C.—Known species of America and Europe compared.

Orders.	Species.		Orders.	Species.	
	America.	Europe.		America.	Europe.
Plantæ (kingd.)	56	20	Carried forward...	964	931
Amorphozoa	58	64	Asteriada	29	29
Foraminifera .....	.....	25	Crust. { Trilobites	396	1008
Annelida	36	98	{ Entomostraca ...	75	170
Hetero-Pteropoda	96	144	Brachiopoda	678	721
Polyzoa (Bryozoa)	203	177	Monomyaria	78	56
Cœlenterata (Zoophyt.)	262	245	Dimyaria	181	241
Crinoids	193	93	Gasteropoda	421	274
Cystidea	56	63	Cephalopoda	321	861
Sedis incertæ	4	2	Pisces	2?	34
	964	931		3145	4325

The Cephalopoda, Crustacea, Brachiopoda, and Annelida of Europe appear to largely exceed in number of species those of North America, while in nine Orders (see Table C) the two hemispheres hold nearly equal quantities. America greatly surpasses Europe in the number of its Crinoids, and to a smaller extent in Plantæ and Gasteropoda. I am not prepared with any inference from these facts. We know that the mineral constitution, and the past external influences in these several parts of the earth are different—not that the first is as influential as has been supposed.

Many species are marked as undefined in the 'Thesaurus,' because they are often only known by simple fragments.

About a thousand species have never been seen but in one locality.

* The extraordinary abundance of Trilobites, Cephalopoda, &c. here is accounted for by the beds being calcareous and overlain by trappose masses, in place of the sand and gravel more commonly seen.

At least 200 *Cyrtocerata* are huddled together in the two contiguous parishes of Lockhov and Kozorz, near Prague, and, with other mollusks there, are unknown elsewhere. Other instances of this might be cited.

The two Silurian districts of Sardinia, with not a few fossils in common with Spain, although tolerably well examined by La Marmora and Meneghini, have not hitherto produced a Trilobite; nor has Spain given up a *Pentamerus*, as far as can be learnt. Out of our sixty species of *Asaphus* only one is known in Bohemia. Silurian fish are only mentioned as existing in Britain, Bohemia, and Russia; but doubtless they are in other Silurian areas.

The Trilobite genus *Dikelocephalus* of D. D. Owen contains thirty species. Only three are found in two places. Twelve species are near Quebec, and there only. Nine others are Minnesotan, on the Upper Mississippi; while the States of Texas and Vermont, on Lake Champlain, have each one, and Wales three—all distinct species. Western Newfoundland, although primordial, is thought to be without this remarkable genus.

Each of the twenty-seven known species of the Heteropod *Mac-lurea* is confined to one spot; twenty are American; and of these eleven are confined to Newfoundland West.

Of the forty-five species of the genus *Trochoceras* (Cephalopoda), forty-three are restricted to the vicinity of Prague; and of these twenty-seven inhabited the very small space of 4-6 square miles, in company with many other mollusks. The Brachiopoda of Bohemia are mostly in the Fauna F, and in the two small districts of Konieprus and Mnienian.

Out of 270 species of *Orthis* only two are believed to be in Nova Scotia, and of the 109 species of the Gasteropod *Murchisonia*, again, two, but not one of the elsewhere most abundant genus *Pleurotomaria*.

On the other hand, Nova Scotia holds one-half of all our Cleidophora; and Tasmania is singularly rich in *Palæarca*, while the Point Levi shales are crowded with the Graptolite family, of extreme beauty, and rarely found in other countries. We further observe that, as it is with the horizontal disposition of Silurian life, so it is with the vertical: only twelve per cent. leave their native horizon, as we shall see.

These few facts have been selected from many, to show the strong tendency to localization inherent in the Silurian fauna.

Primordial Stage.

The 'Thesaurus' amply manifests the great extent of this stage, and the high significance of its teachings; but we shall here only speak of a few leading facts relating to Canada, extracted from the 'Thesaurus' itself.

While waiting for the results of field-work now in progress, Mr. Billings has treated this subject with his usual great ability in the first volume of the work entitled 'The Palæozoic Fossils of Canada.'

The Primordial stage of Barrande (Taconic of Emmons) is truly Silurian, and forms the base of that epoch.

In the valley of the St. Lawrence it may average 8600 feet in thickness.

Resting horizontally in America on the inclined Laurentian rocks, the lower break is complete in every respect; while the upper break is very nearly so, although purely organic.

It divides naturally into *Lower* and *Upper* Primordial,—Potsdam sandstone constituting the former, and calciferous sandstone, with the enigmatical Quebec group, the latter, with a few layers of chazy limestone superadded.

The whole flora and fauna of the Primordial stage, American and European, amount to 919 species, while those of the St. Lawrence Valley alone are 560. The western, therefore, seems to be the richer of the two hemispheres; and this comes out still more distinctly in stating the fact that the Primordial genera at present known in America are 134, and those of all Europe 83.

Table D (below) has been constructed from the 'Thesaurus.' It exhibits numerically the zoological contents and the zoological relations of the several parts of the Primordial stage; and we see that the differences are great.

TABLE D.—The American Flora and Fauna of the Primordial Stage (principally Canadian).

		Plantæ.	Amorphozoa.	Annelida.	Hetero-Pterop.	Bryozoa.	Zoophyta.	Crinoidea.	Cystidea.	Asteriada.	Dimyaria.	Monomyaria.	Gasteropoda.	Brachiopoda.	Cephalopoda.	Trilobitæ.	Entomostraca.	Pisces.	Total.
UPPER	Quebec Group .....	...	4	21	19	44	2	...	...	...	5	...	57	42	34	96	3	...	327
	Calciferous Sandst....	6	5	3	5	...	1	...	...	...	1	...	39	6	19	6	2	?	93
LOWER	Potsdam Sandstone ...	16?	2	4	2	1	...	...	1	...	...	...	3	31	...	74	6	...	140
Total		22	11	28	26	45	3	...	1	...	6	...	99	79	53	176	11	...	560

Great interest attaches to every part of this stage, but especially to the Quebec group and its ill-understood connexion with the immediately contiguous strata.

An intimate acquaintance with this group near Quebec leads me to believe that there, at least, it is a displaced, crumpled, and fractured mass of schist, with thin beds of limestone and calcareous conglomerate interleaved, the last crowded with molluscan and crustacean life.

It is above the Potsdam Sandstone, and on or near the horizon of Calciferous sandstone and the lower layers of Chazy Limestone (Logan and Billings, Report, 1863). Into these (with a distinct tendency still higher), in other parts of North America, the Quebec

group probably becomes fused, and assumes their horizontal position, mineral character, and many of their organic contents.

The fauna of the Quebec group, consisting of 327 species at Point Levi (Quebec) and in Western Newfoundland, is peculiar, and, of course, is only found there, with the exception of thirteen species found elsewhere in Calciferous sandstone, and eight in Chazy Limestone. They are one-sixteenth of the whole, and are as follows:—

Calciferous Sandstone:—*Lingula Mantelli*, *L. acuminata*, *L. Irene*, *Camerella calcifera*, *Helicotoma gorgonia*, *H. uniangulata*, *H. perstriata*, *Pleurotomaria calcifera*, *P. postumia*, *Holopæa dilucula*?, *Ecculiomphalus Canadensis*, *Murchisonia Anna*, *Piloceras Canadense* (Billings).

Chazy Limestone:—*Ecculiomphalus Atlanticus*, *Maclurea Atlantica*, *Stromatopora compacta* (running into B + BL), *Climacograptus antennarius*, *Ptilodictya fenestrata*?, *Leperditia amygdalina*, *Camerella varians*, *Cheirurus prolificus* (Billings).

This group contains, besides the thirteen species just enumerated, 174* allied to those of the Calciferous Sandstone of Central North America, or more or less westward of Montreal. It is this which connects it closely with the sandstone. However, 140 remain typical.

The fossils of Chazy Limestone met with in the Quebec group only belong to a few of the basement beds of the former, because these almost immediately, upwards, change into a compact mass of crushed Crinoids, Cephalopoda, Gasteropoda, &c. (143 species)—all quite new, and alien from the life below.

The Calciferous Sandstone, always truly primordial, has in the Canadas and the United States of America 375 species, overspreading vast areas. They may be separated into three sets:—

1. Thirteen enter the Quebec group.
2. One hundred and seventy-four are the allies of that group.
3. One hundred and eighty-eight are foreign to it, and for the most part typical.

Like its two sister groups, the Calciferous Sandstone is shown, in the middle line of Table D, to display a remarkable tendency to abound in complex and powerful existences, and to paucity in the simple species, individuals nevertheless being prodigiously numerous. Trilobites are here very few.

Potsdam Sandstone is rich in Trilobites, Brachiopoda, and Fucoids, but in every other form is very poor; and yet it possesses a Cystid.

In the Primordial group, therefore, we find numerous representatives of nearly every marine Invertebrate; and we have a startling example of the sudden development in very early times of the highest types of molluscan life,—Nautili, Lituities, Trilobites, Protichnites, &c. dwelling, even then, in well-adjusted communities.

Most of these facts are taken from the 'Thesaurus;' but this interesting portion of the 'Thesaurus' itself is the gift of Barrande,

* These numbers are for the present only approximate, and may be altered.

Emmons, Hall, Logan, and Billings*, and is the fruit of their unwearyed study in the city, and of their toil in the field.

Recurrence.

A few words on the subject of recurrence, or the vertical range of Silurian life.

What can be more unexpected, or more wonderful, than the upward passage by a filial succession, through stages and epochs, of a mollusk during centuries inconceivably numerous! What an almost interminable series of posterities must have followed the first ancestor! The doctrine of limited duration in species must have its exceptions.

The 'Thesaurus' enumerates 803 recurrents, or 12 per cent. of the whole known life of the epoch—a very notable proportion,—still leaving 6200 species faithful to one horizon.

The synoptical Table E, compiled from the 'Thesaurus,' exhibits many details, and may be trusted approximately, although about 400 species have been passed by for want of sufficient information. It numbers separately the species typical of *one* horizon, and the species frequenting *more than one* horizon (being recurrent). It also introduces some of the greater genera, such as *Orthis*, *Murchisonia*, &c.

The species are arranged under the heads "Primordial," "Lower," "Middle," and "Upper Silurian;" and in the case of the recurrents the number of horizons occupied by them is shown by the figures 2, 3, 4, 5. Thus we find that 69 Lower Silurian Trilobites occupy two horizons, 15 three, and 2 five horizons.

The percentage is stated in the last column, next to that containing the total recurrence of each Order.

The Primordial stage only gives	2·7	per cent. of recurrency.
The Lower Silurian	16	„
The Middle	20	„
The Upper	8	„

The Orders vary greatly in respect to recurrency. There is none among fossil fish. In Cystidea it is only 3 per cent., in *Gomphoceras* 5 per cent., and is greatest in *Strophomena*, 31 per cent.

Although a considerable number of inferences have been prepared, I shall only venture now to introduce a few.

1. Recurrence is universal, both as to time and place.
2. Recurrences seem to be most numerous in the lower stages of the epoch; but further research may teach otherwise.
3. Species do not often change their horizon, not even when placed in countries far apart.
4. The same species may be typical of a single horizon in one country and recurrent in another.
5. Recurrency shows that a mollusk is not necessarily confined

* It is well to note that, under Sir William E. Logan's able superintendence, we owe the splendid Primordial harvest gathered in Newfoundland and Anticosti to the diligence and skill of Mr. Richardson, an explorer in the employ of the Canadian Geological Commission.

to any one community, but may find a home and flourish in several successively.

6. The number of recurrents measures the amount of change in conditions.

7. Communities, genera, and species disappear sporadically, except in the rare case of a catastrophe.

8. Recurrency is a measure of viability.

Extra-epochal Recurrence.

Few things demonstrate more plainly the sterner discipline now prevailing than the reduction by Mr. Salter to 133 of the 439 palæozoic species which I had tabulated as extra-epochal, although they had the sanction of the best palæontologists of the last fifteen or twenty years.

My Table, as originally made out, deals with the five palæozoic epochs, but in this place only with the forty-two Silurian species which leave for the higher periods. To these, recently, several interesting additions have been made.

TABLE F.—Geographical Summary of Silurian Life.

Orders.	America.	Europe.	India.	Africa.	S. Australia.	Tasmania.	Common.		
Plantæ	56	20	...	...	...	...	...	* Tibet.
Amorphozoa	62	63	4*	...	...	1	6	To America and Europe.
Rhizopoda .....	...	?25	...	...	...	...	...	Not definitely accepted.
Cœlenterata	262	245	1	...	2	1	27	To America and Europe.	
Echinoder- mata.	{ Crinoidea	193	93	2	...	6	" "
	{ Cystidea	56	53	20	...	3	" "
	{ Asteriada	29	29	1	" "
Annelida	36	98	...	...	1	...	7	" "
Crus- tacea.	{ Trilobitæ	396	998	10	...	11	...	30	Various.
	{ Phyllopora } { Ostracoda }	77	170	...	...	2	...	5
Polyzoa	203	177	2	...	20	...	23	Various.	
Brachiopoda	678	721	22	...	19	...	65	Various.	
Monomyaria	78	56	...	...	2	...	5	To America and Europe.
Dimyaria	181	241	3	...	8	19	12	" "	
Pteropoda & Heteropoda	103	145	1	...	3	1	15	" "	
Gasteropoda	421	274	9	...	9	13	10	" "	
Cephalopoda	321	861	5	...	...	8	16	" "
Pisces .....	...	34	...	...	...	...	...	...
Incertæ Sedis.....	4	2	...	...	...	...	...	...
	3156	4305	57	...	100	43	231		

3156 + 4305 = 7461 species.

I. These recurrents are mostly distinct from the intra-epochal, owing to their first appearance being in the Upper Silurian stage.

II. With the exception of *Chonetes sarcinulata*, they all stop within the Devonian Period.

III. The greater part of these recurrents are of low rank; 20 are Brachiopoda; 11 Zoophytes, 1 an Amorphozoa; 7 are Gasteropoda; 3 Cephalopoda; and 1 Trilobite. *Manon deforme* and *Orthis rugosa*, Lower Silurian fossils, reappear in Devonian, but not in Upper Silurian, where they are "presumably"—to use an expression of Mr. Etheridge.

IV. These species are very migratory—few being found in two epochs in the same country, but in different countries.

V. Opportunities of escape into a new epoch have been common; but the ways and means are frequently concealed by denudations &c.

VI. Acclimatization must have been necessary.

VII. The length of individual life in proportion to specific extra-epochal life is almost as a unit to infinity.

Geographical Distribution of Silurian Life.

The 'Thesaurus' tends to show that North America, east of the Rocky Mountains, may probably be divided into two areas,—the one to the north of 57° (or of Lake Superior) being chiefly Upper Silurian, resting on crystalline rocks, the one to the south of that line, down to the Gulf of Mexico, on the contrary, being fully developed in some part of this great space.

It exhibits the regrettable fact that Asia, Africa, and Australia, taken together, have hitherto yielded only 200 species of Silurian remains; but this arises from the absence of exploration.

I have not yet had opportunity to bring together, harmonize, and compare the Silurian life of the several countries of Europe. The accomplishment of such a task might produce some definite truths, and many more probabilities. Either this vast region would prove to be one great Silurian area, with barriers here and there, and with certain channels of communication, and to be the result of many operations throughout a long interval of time; or it might turn out that the Silurian deposits and their fossils occupy three separate areas:—(1) the Britanno-Scandinavian, which has all the three stages, and the Primordial; (2) the Bohemian, at present of peculiar interest; and (3) the middle and southern area, found in France, Spain, and Sardinia, almost wholly Lower and Mid-Silurian.

Under this head of geographical distribution we have to deal with some curious phenomena—such as concern birthplace or first appearance, generic and specific, the duration of life, tolerance of conditions, mineral habitats. Migration possesses great interest, with its marks, causes, and modes, with its power, direction, and rate of progress, &c.

The transport or removal of dead organic matter from place to place, the "*remaniement*" of French geologists, is an important

agency under several aspects, especially in the formation of extensive sheets of rock.

It now has become proper to bring to a close these few observations, or rather this enumeration of heads of Natural-History subjects, by expressing a confident hope that this compilation will find many and well-qualified interpreters, and will be useful to geologists in general.

MISCELLANEOUS.

On some Points in the Anatomy of the Genus *Fistulina*.

By J. DE SEYNES.

THE species of the higher Fungi in which several forms of reproductive bodies have been indicated are still few in number. Three years ago I pointed out, in *Fistulina buglossoïdes*, Bull., some small sporiform bodies analogous to those to which, in many species of Fungi, M. Tulasne has ascribed the part of spore-producers and given the name of *conidia*. Further investigations on this subject have enabled me to make several observations, which I request permission to lay before the Academy.

The parenchyma of a *Fistulina* is composed of elongated cells of different calibre, increasing in size towards the interior. This tissue is traversed by some very long and generally narrower cells, filled with a red and not granular liquid, which becomes solid and brittle when dried. The transverse septa are so far apart that these cells might be taken for true vessels. I have every reason to believe that it is the same system of organs to which the name of laticiferous vessels has been given in the milky Agarics; I shall call them simply *reservoirs of proper juice*. I have observed them in many not milky Agarics and in a *Clavaria* (*C. aurantia*, Pers.). In *Fistulina* the cells which form them do not originate entirely in the intercellular spaces. Upon an ordinary cell of the parenchyma, or at its extremity, a cæcal process makes its appearance, filled with a yellow granular substance more abundant than that which also occurs in the mother cell; this substance appears to condense into a red liquid, which occupies the bottom of the cæcal cell. The latter elongates, and soon a transverse septum is formed near the point where it springs from the mother cell. This septum of course interrupts all direct communication with the mother cell, and it is even probable that subsequently there is a solution of continuity between these two cells; for when the reservoirs of proper juice are examined after they have arrived at their full development, they can no longer be found in direct connexion with the ordinary cells of the parenchyma. Near the upper surface of the pileus of *Fistulina*, these reservoirs, which are sometimes ramified, take a tortuous and rather spiral direction, which does not extend to the cells of the surrounding tissue; they are very numerous at this part, and in the dry fungus give to this subepidermic portion of the parenchyma the appearance of a black line.

Beneath this line there is a zone of 1–2 millims. in thickness, which, under a low magnifying-power, appears finely speckled with spots of a darker tint than the rest of the tissue. These spots correspond with the foci of development of the rounded, oval, or sometimes baculoid corpuscles which I have already described, and which I had only regarded as having arrived accidentally, or in consequence of the old age of the fungus, at the surface of the pileus. The zone that I have indicated as being the centre of their formation is prolonged into the pedicle; but none of it is found in the middle of the parenchyma, or in the vicinity of the lower surface which bears the hymenophorous tubes, or among these tubes.

All the *Fistulinae* that I have examined hitherto have presented this curious arrangement, whether they came from the Cevennes, the environs of Paris, or even the Himalaya, as I have ascertained from a specimen from the latter region, which is preserved in the Museum, in Montagne's herbarium. These conidia, far from reaching the outer surface, as if they were the product of a foreign parasite, only show themselves at the surface of the fungus after the destruction of the most external cellular layers; thus their dissemination can only be effected, as in the case of the spores of truffles, at the moment of the putrefaction of the fungus.

The cells which bear these conidia or sporiform bodies are more delicate and transparent than the others; but it is easy to prove that they have issued from the parenchyma itself. Sometimes they are long and bear a bunch of these little bodies; sometimes they are seen to detach themselves from a cell of the parenchyma in the form of a pedicle bearing only one such body, and not exceeding in length the longest axis of the latter.

Iodized chloride of zinc does not give the characteristic reaction of cellulose, either with the cells of the parenchyma, or with the spores, or with the conidia or pseudospores just mentioned. This reagent embrowns the reservoirs of proper juice, and reddens or renders yellow the cells of the parenchyma, according as they contain more or less plasmatic fluid. The conidiophorous cells, the fineness of which M. de Bary says he perceived when they were brought into contact with alcohol, and which, for this reason, he supposes not to originate directly from the parenchyma, become yellow under the influence of iodized chloride of zinc, and have a very pale tint, which distinguishes them from most of the surrounding cells; but in this they behave exactly in the same way as many other cells of the same fungus, either subhymenial cells, or cells of large diameter which, like the latter, have exhausted all the juices which they contained for the benefit of new formations.

Each of the observations that I have just cited contradicts the assertions made by M. de Bary in opposition to me (*Handbuch der physiologischen Botanik*, 1866, Bd. ii. p. 193); and although I regret that I thus disagree with that learned mycologist, my observations, often repeated and varied, leave no doubt in my own mind.

It remains for me to indicate in the organization of the *Fistulinae*

a fact which, if I am not mistaken, has not yet been pointed out, and the investigation of which might certainly be extended to the *Poly-pori* and other Fungi.

It has long since been observed (Geoffroy, 1711 ; Turpin, Vittadini, 1831 ; Tulasne) that the truffles present veins the white tint of which is due to the presence of air in the tissue composing them. Their arrangement, which at the first glance seems confused, is nevertheless sufficiently regular to allow them to be traced, either from a central point (*foveola*), whence they radiate towards the periphery, or in series starting from the surface of the truffle, where they open. These veins, according to M. Tulasne, are not circumscribed by a double membrane, as was supposed by Vittadini ; they are not, however, accidental, but are limited by elongated cells of the fructiferous pulp ; and in the young truffles it may be ascertained that these cells are arranged close together in ranks like paraphyses, in a direction perpendicular to that of the canal which they line.

Fistulina buglossoides, Bull., presents white lines which traverse its tissue in a definite direction ; now these narrow lines or veins also present this tint only in consequence of the air which is intercalated between their cells. There is no ready-formed canal bounded by a proper membrane ; the air insinuates itself (*se faufile*) between the cells, always following a determinate direction, from the base of the pedicle towards the periphery of the mushroom. It arrives in this way at the exterior, in part through the pilose tufts scattered over the non-fructifying surface, in part by traversing the length of the hymenophorous tubes. The presence of air seems to be connected, if not with the formation, at least with the maturation of the spores and conidia or pseudospores that I have indicated. Perhaps it is for this reason that the truffles, which fructify when protected from the atmosphere, are so abundantly furnished with air-passages. But until we have more numerous and extended investigations it would be imprudent to formulate a general law upon this subject. In any case it is interesting to find in low plants destitute of vessels a lacunar aerial circulation, which recalls the lacunar circulation of the blood in a great number of the lower animals destitute of, or only partially provided with, circulatory vessels.—*Comptes Rendus*, March 4, 1867.

ZIPHIUS SOWERBIENSIS.

A fine male specimen of *Ziphius Sowerbiensis* has been cast ashore on the coast of Kerry. Unfortunately the peasantry had cut it to pieces before it was seen by any person interested in the subject. The head, with the teeth, has fortunately been preserved in a perfect state ; and Mr. Andrews has read a paper on the specimen before the Royal Dublin Society. A fuller account, with plates, will be published in the 'Transactions of the Royal Irish Academy.' This is only the second male specimen that has been obtained.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 113. MAY 1867.

XLIV.—*On the Genus Plectostoma, H. Adams, and on the Animal of Diplommatina, Benson.* By WILLIAM T. BLANFORD, A.R.S.M., F.G.S.

1. *On the Genus Plectostoma.*

IN the 'Natural History Review' for 1864, p. 599, there appeared a letter from Mr. DeCrespigny, of Labuan, briefly describing a minute land-shell which he considered a living representative of the Triassic genus *Scoliostoma*. In an editorial note it was stated that the specimens accompanying the letter had been submitted to Mr. H. Woodward, of the British Museum, and were considered by that naturalist to be "closely allied to, if not identical with, *Opisthostoma*," described and figured by my brother in our joint paper published in the 'Journal of the Asiatic Society of Bengal' for 1860.

In the March Number of the 'Annals' for 1865, p. 177, a shell, evidently the same as that referred to in the 'Nat. Hist. Review,' was described by Mr. H. Adams as the type of a new genus belonging to the Helicidæ, and named *Plectostoma DeCrespignii*. In neither of the two notices is any mention made of the animal. I recently called attention, when describing a second species of *Opisthostoma* from Western Africa, in the 'Proc. Zool. Soc.,' to the great similarity of external form between *Plectostoma DeCrespignii* and the Burmese Helicidous genus *Hypselostoma*. I had then only seen a photograph copy of a drawing of the *Plectostoma*, for which I was indebted to Mr. Benson. Within the last few days I have received specimens of this most interesting form from Mr. Damon; and from an examination of them I am convinced that Mr. H. Woodward's opinion of the affinities of the species is correct, and that it differs in no essential characters from *Opisthostoma*. In the paper just referred to as sent to the Zoological Society of London, I have shown, from an examination of the animal and operculum,

that the latter genus belongs to the *Cyclostomacea*, as was at first inferred by my brother from the form of the aperture and the sculpture, and that its nearest ally appears to be *Diplommatina*.

Plectostoma DeCrespignii closely resembles the two Indian species of *Opisthostoma* in the mode of flexure of the very remarkable last whorl, in the form of the aperture, and in the texture of the shell. There is a slight constriction at the spot where the last whorl is first deflected, though this is less marked than in *Opisthostoma*. The sculpture, though coarser, is smaller in character. The most important distinction is in the form of the spire, which is conical in *Plectostoma*; and the apical whorls are not excentric to the axis of the lower whorls as they are in the ovate spire of *Opisthostoma*. I scarcely think, however, that these distinctions will be regarded by any conchologist as generic; at the most they are subgeneric.

As I have but two specimens of the Labuan shell, I do not like to sacrifice one for the purpose of searching for the operculum, especially as the search amongst these minute shells of the *Diplommatina* group, in consequence of the small size and extreme tenuity of the operculum, is by no means always successful. I had to break open three or four specimens of *Opisthostoma Fairbankii* before I could obtain a glimpse of the operculum, and then I failed in isolating it. If any one more fortunate than I am, in the possession of specimens of *Plectostoma*, will carefully break back the last whorl to the point where it is deflected, or a little beyond, he will, I doubt not, find an operculum; and it will probably be horny, thin, and obscurely spiral, with rather few whorls, as is usually the case with *Diplommatina* and its allies.

2. On the Animal of *Diplommatina*.

I have more than once, within the last few years, called attention to the circumstance that, in the two supplements to Dr. Pfeiffer's admirable monograph of the living operculated land-shells, the position assigned to the genus *Diplommatina*, close to *Acicula*, and in a suborder distinguished by the position of the eyes *above* the base of the tentacles, is not in accordance with the structure of the animal. For some years past I have not had an opportunity of reexamining the animal of any typical species of the genus. I am indebted to Captain Godwin-Austen for the accompanying outline sketch of the animal of a species of *Diplommatina* inhabiting the Western Himalayas near Masúri, and apparently a variety of *D. pullula*, Benson, which was first found by myself near



o, operculum.
s, lip of the aperture
of the shell.

Darjiling. This species is a typical *Diplommatina*, with strong costulation and a well-developed columellar tooth.

The animal is sketched as it appears just emerging from the shell. The eyes, as will be seen, are distinctly lateral, as in *Cyclophorus*. I can trace no difference between the animal of this form and that of the smooth or spirally ribbed species of the Indian peninsula, which are by Pfeiffer classed as *Arinia*, in the neighbourhood of *Pupina*, in a different family, and even a distinct suborder from their nearest allies the typical *Diplommatinae*.

Central India, Feb. 1867.

XLV.—*Characters of some new Genera of the Coleopterous Family Cerambycidae.* By FRANCIS P. PASCOE, F.L.S., F.Z.S. &c.

THE eighth volume of the great work of Prof. Lacordaire being nearly ready for the press, I am desirous of publishing the following descriptions of some new genera of the family to which that volume will be, with the Prionidæ, entirely devoted, in order that they may take their place in that work, the plan of the author not permitting him to notice any genera which have not been published. These genera do not include several new forms discovered by Mr. Wallace in the Malayan Isles, which must unavoidably stand over for the 'Longicornia Malayana' publishing by the Entomological Society.

CHOROTHYSE.

- (♀). *Antennæ* breviusculæ, 12-articulatæ, scapo perbrevis.
Elytra abbreviata, intra excavata.
Tibiæ posticæ elongatæ, curvatæ, compressæ.
Abdomen breve, segmentis duobus basalibus multo majoribus.

Head exerted, transverse anteriorly; clypeus broadly emarginate. Eyes large, reniform. *Antennæ* rather short, 12-jointed, a little thickish, distant at the base; scape very short, obconic; the third joint twice as long, the following gradually shorter, the last smaller and ovate. Palpi short, cylindrical. Prothorax transverse, broader than the head, rounded at the sides. *Elytra* short, hollowed out along the sutural margin, rounded at the apices. Legs unequal, anterior and intermediate short; posterior *tibiæ* elongate, curved, and compressed; tarsi short, narrow. Anterior *coxæ* exerted, contiguous. Pro- and mesosterna very narrow. Abdomen short, the two basal segments much larger than the rest, the second and following excavated, the excavation filled with hairs.

In a nearly allied genus, *Psebiium**, the male has the abdominal segments nearly equal in length, and the antennæ a little longer than in the female, in which they are about the length of the body; in the latter sex these organs appear to be twelve-jointed; the last joint, however, is simply notched in the middle; or perhaps it would be more correct to say that the last joint is ankylosed to the preceding one. But in the present genus the twelfth joint is as distinct as any other, although smaller and somewhat differently formed. In other respects this genus differs from *Psebiium* in its rounded prothorax, elytra hollowed out at the suture, and shorter antennæ. With regard to the peculiar excavation of the abdomen in the females of this and some other genera of Longicorns, nothing is known; patches of hairs and other modifications of this structure are found also in some genera of the subfamily Oabriinæ, in *Megaproctus* (an anomalous African genus), in *Cartallum*, *Pentheia*, and *Symphyletes*; in the latter the peculiarity is sometimes found in both sexes, but not always in the same species. The unique example of the curious insect described below was recently taken at Cape Town by Mr. Roland Trimen.

Chorothyse vesparia.

C. nigra, annis, elytris, tibiis tarsisque læte fulvis.

Hab. South Africa.

Head and prothorax black, opaque, finely and closely punctured, clothed with rather longish erect hairs; scutellum black, glabrous and shining at the apex; elytra clear fulvous, shortly pubescent, not extending beyond the posterior coxæ; abdomen and femora black, with loosely set longish hairs, the excavated portion of the former with close-set fulvous hairs; tibiæ and tarsi clear fulvous, the former with longish yellow hairs. Length 6 lines.

NEPHITHEA.

Frons convexa, haud sulcata, inter oculos quadrata.

Prothorax subcylindricus, postice attenuatus.

Elytra abbreviata, alæ quam abdomen breviores.

Tibiæ posticæ elongatæ, lineares.

Head exserted, the front convex and quadrate between the eyes, no groove above the epistome. Antennary tubers oblique, well marked anteriorly, contiguous at the base. Eyes narrow, roundly emarginate. Antennæ imperfect; the scape rather short, obconical; third, fourth, and fifth joints about equal, each of them twice as long as the scape; the rest wanting. Prothorax narrower than the head, subcylindrical, from about the middle

* Pascoe, Journ. of Entom. ii. p. 289.

gradually narrowing to the base. Elytra abbreviated, hollowed out along the sutural margin; the wings not extending to the last abdominal segment. Legs unequal; anterior and intermediate pair very short; posterior much longer, their tibiæ linear and twice the length of the anterior; tarsi very short, all of nearly equal length. Anterior coxæ conical, contiguous. Abdomen depressed, its segments nearly equal in length.

This remarkable insect has been for years in my collection; but, notwithstanding its imperfect condition, I am desirous that it shall find its place in M. Lacordaire's work. It is evidently allied to *Psebiium* and *Chorothyse*, especially to the former, but in the form of the head is different from either.

Nephithea necydaloides.

N. cyanea, elytris griseis; antennis, scapo excepto, pedibusque nigrescentibus.

Hab. Natal.

Dark blue, tinted with violet, the abdomen especially with short stiffish grey hairs; head and prothorax closely punctured; scutellum triangular, black; elytra pale grey at the base, darker posteriorly, scarcely extending to the end of the second abdominal segment, finely punctured, each with two slightly raised lines; body beneath violet, with a thin greyish pile; antennæ and legs blackish, the femora with a bluish tint. Length $4\frac{1}{2}$ lines.

DEMOMISIS.

Oculi integri, rotundati, laterales.

Antennæ breviusculæ, scapo vix elongato, clavato; art. tertio sequentibus (quarto excepto) haud longiore.

Elytra linearia, normalia.

Coxæ anticæ exsertæ, globosæ, approximatae.

Head nearly quadrate in front, not prolonged into a muzzle. Eyes entire, rounded, placed at the sides beneath the insertion of the antennæ. Antennæ rather short; the scape clavate, not extending beyond the middle of the prothorax; the third and following joints shorter and more or less of nearly equal length, the fourth being the shortest. Prothorax narrower than the head, elongate, constricted before the middle. Elytra very narrow, linear. Feet rather short; femora fusiform; tibiæ slender, straight; tarsi with the first joint scarcely so long as the rest together. Anterior coxæ large, exserted, nearly globose, approximate. Pro- and mesosterna very narrow.

This is a very remarkable form, allied to *Rhagiomorpha*, from which it is at once differentiated by its entire eyes,—and more remotely to *Psilomorpha* and *Syllitus*, but with antennæ essen-

tially dissimilar. In the case of the eyes, the upper lobe entirely disappears; and it is worthy of remark that in the subfamily* to which this insect belongs there has as yet been found no intermediate form of eye: it is either normal or at once reduced to a single, and always lower, lobe.

Demomisis filum.

D. rufo-brunnea; elytris costulatis, interspatiis punctis seriebus duabus instructis.

Hab. Western Australia (Champion Bay).

Reddish brown, bases of the joints of the antennæ and tibiæ paler; head finely and sparsely punctured, a groove on each side between the eye and the mouth; prothorax finely corrugated transversely; scutellum large, triangular; elytra with four elevated lines on each, the second and fourth united near the apex, the intervals with two rows of coarse punctures at the base, but uniting to form a single row posteriorly; body beneath dark brown. Length 3 lines.

ZORION.

Caput pone oculos sensim attenuatum; *oculi* parvi, profunde emarginati.

Prothorax basi apiceque constrictus, postice tenuior.

Femora abrupte clavata.

Head somewhat quadrate, transverse in front; the antennary tubers prominent, rising gradually from each side of the mesial line. Eyes small, deeply emarginate, finely granulate. Antennæ as long as the body, linear, distant at the base; the scape cylindrical and longer than any one of the other joints; the third, fourth, and fifth nearly equal, the rest gradually shorter. Prothorax narrower than the head, deeply constricted at the base and apex, the posterior very much narrower than the anterior portion, the sides angulated at the middle. Elytra short, obovate. Legs increasing in length from the anterior to the posterior; femora abruptly clavate; tibiæ slender; tarsi of nearly equal length, not dilated.

The type of this genus is *Callidium minutum*, Fab. (Syst. Ent. p. 192, 1775). Prof. Westwood has since described a second species, under the name of *Obrium guttigerum* (Arc. Ent. ii. p. 25).

* Having recently obtained a male example of *Diotima* allied to, or possibly identical with, *D. undulata*, and belonging to the same subfamily, I may mention here that the antennæ are much longer than the body, and nearly twice as long as in the female, and that they are, moreover, twelve-jointed. I have also a female specimen, from Clarence River, scarcely more than half the length of the specimen described by me, and which seems by its characters to belong to yet another species of the genus.

The former is a glossy testaceous insect, with a round bright-yellow spot on each elytron, and the bases of the femora white; it is about $2\frac{1}{2}$ lines long. Both species are from New Zealand. I refer the genus to the Stenoderinæ, which for me provisionally comprises a series of anomalous forms, mostly Australian, fragments perhaps of a once larger group, but which might, and probably will, be divided into almost as many subfamilies as there are genera. Beyond their anterior contiguous conical coxæ, they have scarcely any characters in common; but they have often a petiolate abdomen, and antennæ never inserted beyond the eyes; and these characters will to a certain extent generally distinguish them from the allied subfamily Lepturinae. The only European genus belonging to it is *Molorchus**.

OSSIBIA.

Antennæ setaceæ.

Oculi magni, infra contigui.

Coxæ anticæ globosæ.

Head transversely ovate in front, without a groove above the epistome. Eyes very large, contiguous beneath. Antennæ setaceous, 11-jointed, longer than the body; the scape short, clavate; third joint shorter than the scape, the fourth to the sixth or seventh gradually longer, the remainder equal. Prothorax elongate, subcylindrical. Elytra parallel. Anterior coxæ globose. Legs gradually longer posteriorly; femora claviform; tarsi linear, posterior with the basal joint as long as the two

* This genus was founded by Fabricius (Ent. Syst. i. 2. p. 356) on the *Necydalis major*, Linn. The name *Necydalis* was first applied by Linnæus, in his 'Iter Oelandicum,' to *N. minor*; but it was only in the 12th edition of the 'Systema Naturæ' that he characterized it, when *N. major* took precedence. We have therefore, if we take the first species of a genus, when it is first published, as the type, two generic names given to one species. But it has always appeared to me a mistake to apply such a rule to any of the Linnean species, nor has it been usually done; for example, the type, so called, of his *Leptura* is now a *Donacia*, of *Cerambyx* an *Acrocinus*; so of *Scarabæus*, *Cantharis*, *Tenebrio*, *Carabus*, *Elater*, and others, in all of which the first species has received a new generic name. Now the Linnean characters of *Necydalis* are of the most shadowy kind. Here they are:—"Antennæ setaceæ. Elytra alis minora, breviora s. angustiora. Cauda simplex." The last seems to have been intended to separate it from the earwigs. On the other hand, Fabricius's description of *Molorchus* is evidently only taken from *M. major*, the first species, as was invariably his rule in the 'Ent. Syst.' Had he had *N. minor* before him, he would not have said "antennis thoracæ longioribus" for an insect in which those organs were twice the length of the body. The formula of Linnæus, then, applying to anything (the greater part of his species are, in fact, heteromerous), and the Fabrician description applying strictly to *major* and not to *minor*, it seems to me that *Molorchus* should be confined to the former and its congeners, and that *Necydalis* should be used for the species to which the name was originally applied.

next together. First abdominal segment not twice as long as the second.

The type of this genus has long been known as the *Obrium fuscatum* of Dejean's Catalogue; but, if we except the elytra and legs, all the above characters are at variance with that genus*. I may add that the maxillary palpi are very short compared to those of *Obrium*, the second and third joints especially so.

Ossibia fuscata.

O. fuscescens, elytris viridi-piceis, sutura testacea.

Hab. Senegal.

Pale brownish, thinly pubescent, with scattered stiffish hairs; head brownish red; eyes black; prothorax vaguely punctured, a little tuberculate on each side at about the middle; scutellum small; elytra covered with shallow scattered punctures, the suture testaceous, the sides pitchy, with a greenish tinge; body beneath and femora reddish testaceous; tibiæ, tarsi, and antennæ brown. Length 4 lines.

NIDA.

Antennæ art. quarto quam tertio vel quinto brevior.

Prothorax elongatus, subcylindricus.

Mesothorax elongatus, mesosterno angustato.

Head short in front. Eyes moderate. Antennæ longer than the body, the fourth joint shorter than either the preceding or following one. Prothorax elongate, subcylindrical. Elytra narrow, nearly parallel at the sides. Legs scarcely elongate, the femora strongly clavate. Mesosternum narrow; mesothorax elongate.

The principal characters differentiating this genus from *Rhopalophora* are the greater length of the mesothorax (by which the intermediate legs are placed at a considerable distance from the anterior pair), the narrowness of the mesosternum, and the nearly cylindrical prothorax. The habitat of the genus is exceptional, all the *Rhopalophoræ* and their allies being natives of the New World, with the probable exception of *Cleomenes*, J. Thomson.

Nida flavovittata.

N. nigra, elytris vittis duabus flavis ornatis.

Hab. Pegu.

Black; head clothed with longish, white, scattered hairs; prothorax closely, and even confluent punctured, a few whitish hairs on the disk, with a somewhat semilunar or C-formed white

* For the best definition of *Obrium* at present, see Fairmaire, 'Gen. de Coléopt. d'Eur.' iv. p. 179.

mark composed of densely packed hairs on each side; scutellum also covered with white hairs; elytra finely and closely punctured throughout, and clothed with scattered stiffish hairs, a broad and very distinct pale-yellow stripe on each side of the suture from the base to the apex, but not extending to the extreme of either, nor meeting at the suture; body beneath black, with a whitish tomentum, thicker and forming a large patch on each side of the three basal abdominal segments; femora glossy black, with long whitish hairs increasing in density on the tibiæ and tarsi; antennæ with a whitish pubescence. Length $5\frac{1}{2}$ lines.

NYPHASIA.

Prothorax irregularis, lateraliter inermis.

Femora petiolato-clavata, apicibus constrictis.

Processus interfemoralis latus, antice rotundatus.

Head exerted, very short in front, the clypeus separated by a deep groove below the antennary tubercles, the latter very large and protuberant. Antennæ about as long as the body; the scape pyriform; the third to the sixth joint spinous at the apex, the fourth shorter than the third or fifth. Prothorax rather longer than broad; the disk and sides irregular, the latter unarmed. Scutellum narrowly triangular. Elytra gradually narrowing from the base to the apex, the latter mucronate. Legs rather long; femora petiolate-clavate, their apices constricted; tibiæ slender; tarsi gradually increasing in length from the anterior pair. Pro- and mesosterna depressed. Posterior coxæ not approximate. Interfemoral process broad, and rounded in front, not extending beyond the coxæ.

Although unlike *Cordylomera* in general appearance, I have been unable to find any reliable character to separate it except that of the interfemoral process, which in that genus is very narrow and pointed, and consequently the posterior coxæ are approximate and, it may be added, more than usually exerted. There is no appearance of pubescence on the specimen described below, which has evidently been in spirits, and it may therefore have been obliterated.

Nyphasia torrida.

N. rufo-fulvescens; antennis art. tertio ad sextum nigris; scutello genibusque fuscis.

Hab. Ceylon.

Reddish fulvescent, opaque; third to the sixth joints of the antennæ black, tips of the remainder, except the last two, blackish; scutellum and tips of the femora, with the bases of the tibiæ, brownish; head and prothorax closely and finely punctured, the latter with a transverse depression anteriorly and a

callosity on each side of the disk at the base; elytra covered with numerous small punctures, each elytron with two fine slightly raised lines; body beneath and legs brownish luteous. Length 7 lines.

IPOTHALIA.

Antennæ breves, incrassatæ, serratæ, art. quarto et quinto obconicis, cæteris dilatatis, ultimo ovato vel triangulari.

Prothorax lateraliter tuberculatus.

Tibiæ anticæ et intermediæ spinis duabus minutis terminatæ.

Head anteriorly and mandibles moderately produced. Antennæ short, gradually thickened from the third to the seventh joint, the remainder, except the last, about the same size, and, including the sixth and seventh, dilated, especially on one side; the second short, the third more than twice the length of the two following, the last ovate or triangular, flattened on one side. Prothorax rather longer than broad, stoutly tuberculate on each side. Elytra rather small, a little depressed. Posterior femora abruptly clavate. Anterior and intermediate tibiæ terminated by very short spines.

The other characters are pretty nearly the same as are common to the more normal Callichrominæ; the scutellum, however, forms a nearly equilateral triangle, with its two sides a little rounded, and its apex presenting a sort of prolonged appendage, especially evident in *I. femorata*. One of my species appears to be a male, the other (*I. pyrrrha*) a female. If so, there will be no difference in the antennæ of the two sexes.

Ipothalia femorata.

I. cyanea, nitida, prothorace viridi; femoribus, basi excepta, læte luteis.

Hab. Philippine Islands.

Rich (rather dark) blue; prothorax green; head very sparingly punctured, a deep groove in front of each eye, terminating below in the transverse groove above the clypeus; prothorax smooth, very minutely punctured; elytra finely punctured, the punctures crowded, but not coalescing; body beneath blue, meso- and metathorax covered with a silvery pubescence; femora, except at the base, bright luteous; tibiæ blue, tarsi tinged with blue; antennæ entirely blue. Length 6 lines.

Ipothalia pyrrrha.

I. cyanea, elytris viridescens, medio antennarum pedibusque læte luteis.

Hab. Pegu.

Dark blue; elytra dark bluish green; head minutely and

closely punctured, facial grooves as in the last; prothorax transversely corrugated; elytra finely punctured, the punctures everywhere coalescing and giving the surface a shagreened appearance; body beneath glossy blue, the posterior part of the prothorax, meso- and metathorax, and first abdominal segment covered with a silvery pubescence; legs entirely bright luteous; scape and second joint of the antennæ purplish-blue, the five following joints luteous, the five remaining dark brown, opaque. Length 7 lines.

BIXORESTES.

Antennæ subincrassatæ, lineares, art. muticis.

Prothorax depressus, lateraliter angulatus.

Head somewhat squarish in front, the muzzle broad and slightly produced. Eyes narrowly emarginate. Antennæ short, thickish, linear; the third joint longest, the fourth to the seventh shorter and nearly equal, the eighth, ninth, and tenth gradually shorter, the last ovate and a little longer than the preceding joint. Prothorax depressed, with a strong angle in the middle on each side. Elytra rather broad, flattish above, closely embracing the abdomen. Femora fusiform; posterior tibiæ and tarsi elongate.

The type of this genus is *Clytus doctus*, White (Cat. Long. Brit. Mus. p. 267); but it differs essentially from all true *Clyti* in the form of the prothorax. Mr. White says that it is allied to *Clytus Hardwickii*, from which nevertheless he separates it by ninety species. To me it is thoroughly distinct from anything I know. *Bixorestes doctus* is a reddish-ferruginous species, roughly punctured above, with six very bright yellow spots on the elytra, besides two less highly coloured spots at the base. It is probably from the Cape, as a nearly allied species in M. Chevrolat's collection in the British Museum is so labelled. My specimen was obtained from a Paris dealer, who was ignorant of its habitat; nor was Mr. White acquainted with the locality of his type. *Cerambyx interruptus*, Olivier (Coléopt. iv. no. 67. p. 35, pl. 17. fig. 133) appears to belong to this genus. Its locality is also unknown.

THRANODES.

Caput antice tricarinatum.

Antennæ breves, claviformes.

Prothorax globosus.

Elytra planata, abdomen haud tegentia.

Head rounded in front, three vertical carinæ between the eyes, the latter prominent, slightly emarginate. Antennæ not half so long as the body, claviform; the scape short, not so thick as the

terminal joints, the second half as long as the third, and from this they gradually increase in thickness to the eighth or ninth. Prothorax globose. Elytra flattish above, narrowing posteriorly, not bent down at the sides except at the base. Legs of moderate length; femora fusiform.

Separated from *Clytus* and allied genera by the form of the elytra, which, consisting mainly only of the disk without the deflected sides, except a little near the shoulders, do not embrace the abdomen. The claviform antennæ are less peculiar, being found also in *Mecometopus* and *Rhopalopus*, and in a much less degree in *Neoclytus*, *Calanthemis*, &c. The type is *Clytus stenothyreus* (Pasc. Journ. of Ent. i. p. 359), from Batchian. I have another species from Tondano. In this the female differs only in having a more globose prothorax.

The following genus was proposed by myself in the 'Journal of Entomology,' ii. p. 246. As the characters by which it is differentiated from *Aridæus*, J. Thoms., were alone given, I take this opportunity of repeating them, with additions, in a more formal manner.

CREMYS.

Antennæ muticæ, setacææ.

Prothorax globosus, basi constrictus.

Femora haud clavata.

Head transverse in front, a slightly elevated line between the eyes terminating in an arched groove above the epistome. Eyes of moderate size. Antennæ setaceous, unarmed, the fourth joint shorter than either the preceding or following. Prothorax globose, strongly constricted at the base. Elytra short, rounded at the apices. Legs, except the anterior pair, elongate, the femora slightly fusiform. The rest as in *Aridæus*.

The type, *Cremys diophthalmus*, Pasc., *op. cit.* i. p. 358 (*Clytus*), is of a rich reddish-brown colour, with the apical half of the elytra black and covered with a shot-silky pubescence, and two black spots on the prothorax. It is from Queensland.

Note.—I have been sharply criticised in a foreign work for declining to adopt the new genera formed at the expense of the old Fabrician genus *Clytus*. Whilst admitting that I have since gone with the stream, my objection was grounded on the fact that a few species only were selected as the types of new genera out of numerous others, many of which it then became very difficult to locate. I have some fifty unpublished species, and, so far as I can see at present, many of them have such neutral characters that it will be very difficult to assign them to well-defined genera. The three Clytoid genera described above have very marked and, in the first two of them, isolated characters.

THORIS.

Prothorax oblongus, irregularis, lateraliter tuberculatus.

Femora petiolato-clavata; *tarsi* breves, longitudine fere æquales.

Head exerted, short in front; upper lip very small; eyes broadly emarginate. Antennæ (♀) shorter than the body; the third joint nearly twice as long as the fourth and fifth together, these three with a short spine at each of their apices. Prothorax oblong, somewhat depressed, irregular, the sides tuberculate. Elytra rather short, parallel, the apex of each emarginate, with the outer angle spined. Legs gradually increasing in length to the posterior; femora petiolate-clavate; tibiæ slightly compressed; tarsi short, nearly equal in length. Pro- and mesosterna simple.

In habit this genus bears only a very slight resemblance to *Callirhoë*; nevertheless I have found it difficult to differentiate it by any important character, except that of the short and nearly equal tarsi. It is probable that the antennæ of the male, which is unknown to me, will afford other characters; those of the female are shorter than the body, the apical spine, which is very small, disappearing at the sixth joint, and all the joints beyond the third are unusually short. The puncturation of the elytra is quite different from that in *Callirhoë* or *Phoracantha*.

Thoris eburifera.

T. rufo-lutea; elytris maculis flavis impunctatis decem ornatis.

Hab. Rockhampton (Queensland).

Reddish luteous, with scattered erect hairs; head finely punctured, a sharply impressed longitudinal line in front terminating in an arched groove above the clypeus; prothorax opaque, minutely punctured, the disk with five nearly obsolete tubercles, the central one excepted; scutellum hairy, rounded behind; elytra thickly punctured at the base, the punctures passing indefinitely into the surrounding derm, and gradually becoming less frequent posteriorly; on each elytron five round well-marked yellow spots, a little raised and entirely without punctures, the first, fourth, and fifth spots on the same median line, the third nearer the suture, the second smaller and towards the side; body beneath, legs, and antennæ chestnut-red, shining, covered more or less with greyish hairs. Length 5 lines.

BROTOTYCHE.

Prothorax subquadratus, lateraliter inermis.

Coxæ anticæ approximatae; *prosternum* carinatum.

Processus interfemoralis obtectus.

Head small; antennary tubers prominent, the upper margin

produced into a short tooth. Eyes broadly emarginate, incurved behind. Antennæ (♀) about as long as the body; the scape subpyriform; third joint nearly twice its length, the remainder much shorter than the third, and of nearly equal length. Prothorax subquadrate, small, the sides slightly rounded and unarmed. Elytra parallel, the apices rounded. Legs rather slender; femora moderately clavate; tarsi unequal, the anterior with the three basal joints broad and of nearly equal length viewed from above, the intermediate and posterior with the basal joint longer, especially the latter. Anterior coxæ approximate; the prosternum narrow, crowned with a raised longitudinal line. Posterior coxæ large and approximate, concealing the interfemoral process.

This genus appears to be allied to *Anoplistes*, Serv., but is clearly distinguished by its narrow prosternum and large exerted and approximate posterior coxæ, entirely concealing the interfemoral process. The elytra are also costulate, as in the cognate genus *Tragidion*. I am indebted for my specimen to Arthur Adams, Esq., R.N., who procured it during the surveying expedition of H.M.S. 'Actæon.'

Brototyche Adamsii.

B. nigra; elytris sanguineis, singulis tricostulatis.

Hab. Chosan (Japanese Sea.)

Black; head and prothorax crowded with small punctures and sparsely clothed with a loose rusty-grey pubescence; scutellum triangular, black; elytra finely pubescent, pure blood-red, each with three well-marked raised lines, terminating before the apex; body beneath, legs, and antennæ black, with scattered rusty hairs; tarsi beneath silvery white. Length 8 lines.

THEPHANTES.

Antennæ in medio incrassatæ.

Prothorax ovatus, subdepressus.

Femora abrupte clavata; *tarsi postici* art. basali triangulari.

Head very transverse in front. Eyes large, broadly emarginate. Antennæ shorter than the body; the scape rather short, clavate; none of the succeeding joints longer, but the third, fourth, and fifth nearly as thick as the scape. Prothorax shortly ovate, scarcely broader than the head, a little depressed, the sides irregularly rounded. Elytra parallel, depressed, rounded at the apex. Legs nearly equal; femora abruptly clavate; tarsi somewhat dilated, the basal joint of each short and more or less triangular. Pro- and mesosterna declivous.

I am unable to say whether my specimen of this insect be

male or female; if the latter, the antennæ of the male may differ considerably; but it is, without doubt, allied to *Phacodes*, Newm., in which genus the variations in the characters furnished by those organs are very disagreeable to the systematist.

Thephantes clavatus.

T. fuscus, pube grisea, albescente vage intermixta tectus; capite prothoraceque subferrugineis.

Hab. Darling Downs (Australia).

Dark brown, covered with a rather coarse and loose greyish pubescence, indefinitely mixed with small spots of whitish; the head and prothorax somewhat ferruginous, the upper surface with small dispersed punctures, those on the elytra nearly disappearing posteriorly and furnished each with a stiffish erect hair; second and third joints of the antennæ equal, shorter than the scape, the succeeding about the length of the scape; femora exceedingly clavate; legs with longish hairs. Length 7 lines.

ZOODES.

Scapus brevis, pyriformis.

Prothorax convexus, transversus, postice angustior, lateraliter haud excavatus.

These characters appear to me to cut this insect off from *Stromatium*, to which Mr. White has doubtfully referred the only known species, *Stromatium? maculatum* (Cat. Long. Brit. Mus. p. 301, pl. 8. fig. 4). The name adopted is a manuscript one, under which it stands in M. Chevrolat's collection.

The following names applied to genera of the Cerambycidae I have changed, as they had been previously used in other groups:—

Trichophorus, *Serv.*, non *Temminck* (Turdidæ): name proposed, *Crocidastus*.
Petalodes, *Newm.*, non *Wesmael* (Braconidæ) „ *Anatasis*.
Conothorax, *J. Thoms.*, non *Seckel* (Curculionidæ) „ *Massicus*.

XLVI.—On the Menispermaceæ.
 By JOHN MIERS, F.R.S., F.L.S., &c.

[Continued from p. 197.]

45. PACHYGONE.

The existence of several genera among Menispermaceæ with exalbuminous seeds was not known to botanists until I first indicated the fact in this genus, which was established in 1851; for it was then doubtful whether the genus *Spirospermum*

really belonged to the family. Gaertner, however, in 1791, figured a seed, called by him *Koon Zeylanicus*, which no one had recognized, though Schreber had erroneously referred it to *Ochna*. At the time above mentioned I defined several genera whose seeds were destitute of albumen, which I classed with this genus in a distinct tribe: in this list some errors existed, owing to the want of sufficient materials; but among the many that are still valid is *Pachygone*, the type of which is the *Cocculus Plukenettii*, DC. The authors of the 'Flora Indica' and of the 'Genera Plantarum' fully acknowledged this genus, confined, as I had proposed it, to plants of Asiatic origin; but Dr. Eichler, in his monograph of the Brazilian *Menispermaceæ*, has quite misunderstood the structure of *Pachygone* in amalgamating with it the South-American genus *Hyperbæna*. He has suppressed the many species I have particularized of the latter genus, making of them two species of *Pachygone*, establishing as a third species a Columbian plant which also belongs to *Hyperbæna*. Misapprehensions of this nature are to be regretted, because they make confusion and create many useless synonyms. The genus may easily be distinguished from *Hyperbæna* by the shape of its petals and of its stamens, by its more osseous putamen having a cochleiform condyle with external apertures, by the shape of its seed, by the general habit of the plants, and more especially by the venation of its leaves, which is always a character of primary importance. In its floral structure, both ♂ and ♀, there is scarcely any difference between it and *Cocculus*; and in the shape of its osseous putamen, as well as in its condyle, there is also a great resemblance.

PACHYGONE, nob.—*Flores* dioici. *Masc.* *Sepala* 6, alternatim disposita, interiora majora, obovata, submembranacea, concava, apice eroso-denticulata, æstivatione imbricata. *Petalata* 6, sepalis interioribus minora, oblonga, concava, apice incurva, rotundata et denticulata, imo 2-auriculata, lobis crassis, filamentum amplectentibus. *Stamina* 6, petalis opposita, et ad unguem iis affixa; *filamenta* 6, libera, æqualia, tenuia, apice vix crassiora, petalis subbreviora; *antheræ* globoso-4-lobæ, subpeltatim affixæ, 2-loculares, utrinque rima transversali 2-valvatim dehiscentes. *Ovaria rudimentaria* 3, punctiformia.—*Fœm.* *Sepala* et *petala* ut in masc. *Stamina sterilia* 6, petalorum dimidia longitudine, iis opposita. *Ovaria* 3, gibboso-ovata, glabra, gynæcio centrali insita, 1-ocularia, *ovulo* unico faciei internæ appenso. *Stylus* brevissimus, excentricus, subito incurvus. *Stigma* teres, breve, horizontale, superne subsulcatum. *Drupæ* 3, ovatæ, carnosæ, stigmatate persistente basin versus signatæ; *putamen* osseum,

reniformi-orbiculatum, subcompressum, utrinque interrupte et curvate sulcatum; *condylus* internus, excentralis, subcochleiformis, locellis parvis, 2-cameratus, utrinque foramine angustissime lunato extus perforatus. *Semen* loculum implens, cyclice curvatum, extus convexum, intus subconcauum; *integumentum* membranaceum, tenue, *chalaza* incrassata *raphe* que prominente ad condylum affixum: *embryo* omnino exalbuminosus, cyclicus, *cotyledonibus* magnis, crassis, accumbentibus, *radicula* parva brevissima supera et ad stylum basalem spectante multoties longioribus.

Frutices in Asia intertropica et insulis scandentes; folia ovata vel oblonga, sæpius glabriuscula, petiolata; racemi simplices, extra-axillares, subpubescentes.

The characters of the following species will be given in the third volume of my 'Contributions':—

1. *Pachygone Plukenettii*, nob. Ann. Nat. Hist. ser. 2. vii. 43;—*Pachygone ovata*, Hook. & Th. in parte, Fl. Ind. i. 203;—*Cocculus Plukenettii*, DC. Syst. i. 520, Prodr. i. 97; *Wight*, Icon. tab. 824, 825;—*Cocculus Wightianus*, Wall. Cat. 4959;—*Cocculus officinarum*, Pluk. (non Bauh.) Mant. 52, tab. 345. fig. 7;—*Koon Zeylanicus*, Gaertn. ii. 486, tab. 180. fig. 11.—In India orientali: v. s. in herb. variis (Wall. Cat. 4958, hb. Wight. 48, 49); in herb. Hook., Ceylon (Thwaites, 1057); in herb. De Cand., penins. Ind. (Leschenault).
2. — *ovata*, nob., Hook. & Th. in parte, l. c. i. 203;—*Cissampelos ovata*, Poir. Dict. v. 11; DC. Syst. i. 537, Prodr. i. 102.—In India orientali: v. s. in herb. Hook., Penins. (Hook. & Th.).
3. — *concinna*, nob.—In India orientali: v. s. in herb. Hook., Courtallam (Thwaites), Ceylon (Thwaites, 1050).
4. — *adversa*, nob.—In Zeylania: v. s. in herb. Hook., Ceylon (Thwaites, 1054).
5. — *hebephylla*, nob.—In Java: v. s. in herb. Mus. Brit. ♂, Java (Horsfield); in herb. Hook. ♂, Java (Horsfield, 304).
6. — *odorifera*, nob.—In Tenasserim: v. s. in herb. Hook. ♂ et ♀, Moulmein (Parish, 276); in herb. Mus. Brit. ♂ (Roxburgh).
7. — *brachystachys*, nob.;—*Cocculus brachystachys*, DC. Syst. i. 528, Prodr. i. 99.—In ins. Timor: v. s. in herb. Lindl. (ex Mus. Paris.).
8. — *leptostachys*, nob.;—*Cocculus leptostachys*, DC. Syst. i. 528, Prodr. i. 99.—In ins. Timor.

46. PLEOGYNE.

This genus was proposed by me in 1851 (*huj. op.* 2 ser. vii. 43) for an Australian plant of Cunningham's collection. With a habit resembling that of a *Pachygone*, it has oblong, coriaceous leaves with about five pairs of alternate nerves, which are arcuately connected together, with prominent reticulations; they have very short petioles: it has a fructiferous axillary raceme, less than half the length of the leaf. In the only specimen I have seen, the floral envelopes had fallen away; but Cunningham has noted upon it that the flower consists of three sepals, six stamens, and six ovaries: the ovaries which I have seen are seated in a single series upon a raised hairy receptacle; they are gibbously oval, very pilose, terminated by as many curving, somewhat erect, subulate styles, all connivent in the centre. The drupes are very small, pubescent, gibbously oval, subfleshy; each has a somewhat coriaceous putamen, with a small internal rounded condyle, and contains an exalbuminous seed, with large, fleshy, lunately curved, accumbent cotyledons, and a small superior radicle inclining towards the remnant of the style, which is not far from the point of attachment of the fruit: this structure is quite that of *Pachygone*.

Mr. Bentham, in 1862, established his genus *Microclisia* (Nov. Gen. i. 435) upon an Australian plant very similar in its aspect to Cunningham's species; but he afterwards cancelled this (*Flor. Austr.* i. 59), making his plant not only congeneric, but specifically identical with Cunningham's plant. They are certainly very much alike, especially in the venation of the leaves; but in one these are more acuminate. There is, however, this difference between the plants,—that in the former the flowers have eighteen sepals and six petals; in the latter, Cunningham only mentions the existence of three sepals, without any allusion to the presence of petals: the three interior sepals in *Microclisia* are long, acute, and almost lanceolate; in *Pleogyne* they are short and triangular. In *Microclisia* there are only three stamens, corresponding with the number of the ovaries; in *Pleogyne* there are six stamens, according with the number of the ovaries.

It may be urged that Cunningham overlooked fifteen of the smaller sepals, and did not notice the presence of the petals, on account of their minute size; but we have no right to assume this as a fact, and, upon that assumption, affirm the identity of the two genera. We have this consideration in favour of Cunningham's statement: if the calyx had consisted of the number of sepals found in *Microclisia*, we ought to see on the summit of

the pedicel as many cicatrices, in six alternate series, at the spots from which they had fallen; but we find no such indications; the turbinated, thickened apex of the pedicel, forming a broad torus, is covered with hairs externally, and on its sharp margin we see only interrupted spaces, the cicatrices of the three larger sepals, and the spots where the three small bracteform sepals have been fixed: had there been twelve other sepals exterior to these, the points of their attachment ought to be visible. Additional evidence is afforded by the circumstance that I found in one of the withered flowers examined a triangular sepal pilose outside, and another extremely minute and less than half its size; so that I conclude the calyx must really consist of six sepals in two alternate series, the outer one of which was either not noticed by Cunningham or considered by him to consist of minute bracts. Among the hairs of the gynæcium, between two of the ovaries, I found a process very like a sterile stamen; it was slender, glabrous, with two separated glands on its apex. We may also notice the fact mentioned by Mr. Bentham, that in *Microclisia* he found only three carpels, while in Cunningham's plant we perceive constantly six or more; he also adds that, in his genus, the thick fleshy cotyledons are nearly conferruminated, and the radicle is scarcely distinguishable. I did not find this to be the case in *Pleogyne*, where the cotyledons are quite distinct, flat, subfoliaceous, and the conical radicle is well developed.

In the view of these facts, I have regarded *Microclisia* as distinct from *Pleogyne*—a conclusion strengthened by the great difference in the geographical distribution of the plants, which are found at two opposite sides of the Australian continent.

PLEOGYNE, nob.—*Flores* dioici. *Masc.* ignoti.—*Fœm.* *Sepala* 6 in ordine ternario alternatim disposita, triangularia, acuta, extus valde pilosa, exteriora minutissima, interiora duplo majora. *Petala* invisæ aut nulla. *Stamina* sterilia 6, minuta. *Ovaria* 6 (vel interdum 7), gibboso-ovata, lateribus valde compressa, in stylum oblique attenuata, sericeo pilosa, gynæcio piloso crebriter insita, 1-locularia, *ovulo* solitario, angulo interno appenso. *Styli* totidem, simplices, longiusculi, subulati, glabri, acuti, subdeflexi, dein curvatim adscendentes et in centrum conniventes. *Drupæ* 6 vel abortu paucioræ, gibboso-ovatæ, subcompressæ, pilosæ, styli vestigio pedicello proximo notatæ; *putamen* (vix maturum) reniformi-ovatum, valde compressum, 1-loculare; *condylus* internus, sinum versus intrusus, parvus, subglobosus. *Semen* loculum implens, lunatum; *integumentum* membranaceum, condylo affixum: *embryo* exalbuminosus, *cotyledonibus* amplis, valde compressis,

carunculosis, accumbentibus, falcatis, *radiculam* parvam subsuperam ad stylum fere basalem spectantem multoties superantibus. Frutex *Australiae septentrionalis scandens*; ramuli teneri, teretes, pubescentes; folia obovata, coriacea, nervosa, reticulata, subglabra, subtus pubescentia, petiolata: racemi ♀ axillares, solitarii, pilosuli, folio breviores, pauciflori.

The following species will be described in the third volume of the 'Contributions to Botany:—

Pleogyne Cunninghamsi, nob.—In Australia boreali: v. s. ♀ in herb. Heward, Cambridge Gulf (A. Cunningham, 469).

47. MICROCLISIA.

This genus was established by Mr. Bentham (Nov. Gen. i. p. 435) upon an Australian plant from Moreton Bay; subsequently, in his 'Flora of Australia,' he united it with my genus *Pleogyne*, considering it to be the male plant of Cunningham's species, on which the latter genus was founded. I have lately seen the Moreton-Bay plants, and examined their floral structure, which I find somewhat at variance with the diagnosis above cited. According to my observations, the ♂ flower of *Microclisia* has distinctly fifteen sepals, six petals, only three stamens; and the ♀, according to Mr. Bentham, has only three carpels; while, on the other hand, *Pleogyne*, in the ♀ flower, has only six sepals, no petals (according to Cunningham), six stamens, and six carpels. The one plant is found in Moreton Bay, the other in Cambridge Gulf, on the opposite side of the Australian continent. Under *Pleogyne* I have mentioned other reasons besides these for urging the retention of *Microclisia* as a distinct genus.

I found only ♂ specimens in the Hookerian herbarium; but Mr. Bentham describes the seed as being exalbuminous, with very thick, fleshy cotyledons, almost agglutinated together: consequently I have placed this genus among the *Pachygoneæ*. It presents a considerable degree of analogy with the African genus *Triclisia* in its seemingly conferruminated cotyledons, its much larger and more elongated inner row of three subvalvate sepals, and in having only three stamens. The three inner sepals, four to six times the length of the twelve more external bracteiform scales, are almost valvate in æstivation, with the margins slightly involuted; the six petals are one-third their size, equal, cuneately unguiculated at base, with a suborbicular crenated limb, with its margins subinvoluted, and they are marked by two irregular fleshy glands; they are also somewhat pellucido-punctate; the three stamens are free, seated in the

centre, somewhat longer than the petals, with subglobose four-lobed anthers, dorsally attached to the apex of the terete filaments, bursting introrsely by transverse sutures. I have not seen the ♀ flowers or the fruit, and on these points, in the following diagnosis, I have borrowed the details from Mr. Bentham.

MICROCLISIA, Bentham.—*Flores* dioici. *Masc.* *Sepala* 15, imbricatim et ternatim disposita, quorum 12 minima, triangularia, bracteiformia, extus gradatim paululo minora, 3 interiora reliquis 4–6-plo longiora, lanceolato-oblonga, subacuta, æstivatione subvalvata, cum marginibus involutis, apice demum patentim reflexo. *Petala* 6, biseriata, sepalis dimidio breviora, imo cuneato-unguiculata, limbo suborbiculato, marginibus subcrenatis et subinvolutis, glandulis 2 carnosulis irregularibus notata, subpellucido-punctata, glabra. *Stamina* 3, centralia, libera, petalis paulo longiora; *filamenta* teretia, incurvatim erecta; *antheræ* subglobosæ, sub-4-lobæ, 2-loculares, dorso affixæ, introrsæ, utrinque transversim et 2-valvatim dehiscentes.—*Fl. Fem.* ignoti. *Drupæ* 3, reniformi-globosæ, stylo persistente basin versus notatæ; *putamen* conforme, 1-loculare; *condylus* omnino internus, umboniformis, parvus, sinui ventrali adversus. *Semen* loculum implens, condylo affixum, exalbuminosum: *embryo cotyledonibus* magnis, crassis, subcurvatis, fere conferruminatis, *radicula* minima, vix distincta.

Frutex Australasiæ orientalis, scandens: ramuli *pubescentes*; folia *oblonga, subcoriacea, e basi 3-nervia, reticulata, subtus pubescentia, petiolata*: racemi ♂ *axillares*.

The only species yet known will be described in the third volume of my 'Contributions to Botany:—

Microclisia Australis, Benth. Nov. Gen. i. 436;—*Pleogyne Australis*, Benth. *Fl. Austral.* i. 59.—In Australia orientali: *v. s. in herb. Hook.* ♂, Moreton Bay and Fitzroy Range (F. Müller), Moreton Bay (Oldham).

48. SCIADOTENIA.

This very interesting genus was proposed by me in 1851, the typical species being a Cayenne plant, remarkable for the peculiar development of its fruit. The plant has much the habit of *Elissarrhena* or *Anelasma*, having large polished leaves with five elongated nerves springing from the base, which form only a small angle with the midrib and are therefore somewhat parallel, all arcuately anastomosing with two superior pairs of shorter lateral nerves, and all connected by many straight transversely

parallel veins. The petiole is slender and not exceeding one-fourth or one-fifth of the length of the leaf. The inflorescence is axillary and borne upon a single very elongated peduncle, as long as, or longer than, the leaf. At the period above mentioned I had seen only a solitary specimen, in which all the floral envelopes had fallen away, leaving no indication of their position; the summit of the peduncle bore nine immature drupes, each supported by its own long apparent pedicel; so that I then naturally concluded that the inflorescence was umbellate, each pedicel bearing its fruit. Shortly after the printing of my paper, I met with another specimen with more mature seeds; and in one of its axils I observed, to my surprise, eight ovaria sessile on the summit of the peduncle, and a single seed borne upon a lengthened pedicel-like support, as in the case before mentioned: this at once afforded a key to the real structure, making it evident that the supposed umbel is a development proceeding from a single flower. Ten years subsequently Mr. Bentham noticed the same fact (Proc. Linn. Soc. v. Suppl. 51), and explained this development as a separate growth of each ovary, considering each support to be a "podocarp"—that is to say, an expansion of the fruit or ovary. But this is not the case: its true nature was shown in my explanation of the analogous growth in *Tiliacora* (*huj. op.* xiv. p. 253), where the clavate torus spreads into many short forks, which vary from three to twelve, according to the number of drupes perfected. In that genus these forks do not exceed the length of the torus (2 lines), and they are not united at base, as in the very elongated carpophora of *Sciadotenia*, which are nearly an inch long, in shape like a 4-angular, 8-grooved puberulous pedicel, and united at the base inside by a membranaceous web, leaving a hollow space in the centre. The number of these supports corresponds with that of the ovaries perfected; they are prolonged in the ratio of the growth of the fruit, and are wholly suppressed whenever the ovary is not fertilized. Each drupe has its own peculiar fleshy carpodium, by which it is attached and articulated upon the summit of the long carpophorum; but the latter is in no degree articulated with the torus, being evidently a growth of its substance.

Mr. Bentham describes the female flower, which he had seen, as having nine sepals in three series, those of the inner whorl being much larger; it had no petals; no mention is made of staminodia; and the ovaries are said to be from nine to twelve (I think I have seen as many as sixteen), all in a single whorl; they are pubescent and seated upon an elevated gynæcium; the style, rising excentrically from the inner angle, is subulate, channelled above, and somewhat reflected over the summit of

the ovary. The drupe is somewhat puberulous, very fleshy, reniformly globose, with the remnant of the style below the middle of the side facing the axis; the putamen consists of a thin coriaceous shell, reniformly oval, subcompressed, with a rather deep sinus on the ventral side, where it is somewhat thickened, forming an obsolete condyle, which intrudes a short way within the cell, where it is convex, and to which the integument of the seed is attached: the embryo, which fills the cavity of the cell, is exalbuminous, lunate in shape, the cotyledons being accumbent, very thick and fleshy, conjoined at their upper extremity by a minute conical radicle, which points to the vestige of the style.

From the foregoing evidence it is clear that the genus *Sciadotenia*, of which the female flower only is known, belongs to the *Pachygoneæ*, and offers some analogy with *Pleogyne* in having an unusual number of pubescent ovaries arranged in a single whorl upon a raised gynæcium. Whether *Elissarrhena* has any relationship with it cannot be known till its female flower or fruit be discovered; but it is worthy of note that both are from Guiana, and that their branches are fistulous and filled with pith.

SCIADOTENIA, nob.—*Flores* dioici. *Masc.* ignoti.—*Fæm.* *Sepala* 9, in ordine ternario disposita, gradatim minora, exteriora bracteiformia, interiora intermediis 2-plo majora. *Petala* nulla. *Ovaria* 8 ad 16, gibba, uniserialiter supra gynæcium paulo elevatum insita, 1-locularia, 1-ovulata. *Stylus* excentricus, angulo interiore ortus, supra ovarium inflexus, subulatus, superne sulcatus. *Drupæ* 9 vel abortu pauciores, gibboso-ovatae, paulo compressæ, carnosæ, *carpopodio* carnosobreviter stipitatae et singulatim ad carpophorum proprium articulatae: *carpophora* tot quot drupæ, sub-4-gona, 8-sulcata, puberula, elongata, e toro orta, suberecte, umbellam mentientia, intus tubo membranaceo imo coalita, persistentia; *putamen* reniformi-ovatum, paulo compressum, tenuiter coriaceum, 1-loculare; *condylus* subobsoletus, lateralis, intra loculum intrusus, convexus, paululo incrassatus et placentaris. *Semen* loculo conforme, lunatum; *integumentum* membranaecum, *chalaza* laterali ad condylum affixum: *embryo* exalbuminosus, *cotyledonibus* magnis, crassis, incurvis, accumbentibus, *radicula* minima supra ad stylum spectante multoties longioribus.

Frutices Guianenses, scandentes; folia elliptica, apice attenuata, 5-nervia, nervis rectis subparallelis, intra marginem arcuatim nexis, transversim venosa et reticulata, utrinque glabra et nitentia, petiolo subbrevis: pedunculus ♀ supra-axillaris, solitarius

(*vel e ramulo novello brevissimo plures approximati*), folio æquilongus vel longior, suberectus, ebracteatus, apice 1-florus, tomentosus: flos parvus.

The characters of the two following species will be given in my 'Contributions to Botany' (vol. iii.):—

1. *Sciadotenia Cayennensis*, nob., in Ann. Nat. Hist. 2 ser. vii. 43; Benth. in Proc. Linn. Soc. v. Suppl. 51.—In Guiana Gallica: *v. s. in herb. Mus. Brit. et Hook.*, Cayenne (Martin).
2. — *clathrata*, nob.—In Guiana: *v. s. in herb. Hook.*, Demerara.

49. TRICLISIA.

This genus was established by Mr. Benthiam, in his 'Genera Plantarum' (i. 39), for some plants from western tropical Africa, some of them with very large, oblong, shining, 5-plinerved leaves with very divaricated branching nervures. The ♂ inflorescence is in two or more short panicles, fasciculated in the axils; the flowers have nine to seventeen sepals in ternary series, decreasing externally in size, the outer ones bracteiform and minute, the three innermost being always valvate in æstivation: in two of the species the flowers are globular in bud, the three inner sepals being very little larger than the others, very concave and orbicular; in two other species the flowers before opening are pyriform, the three inner sepals being three times as long as the others, cuneately oblong and acute: one species has no petals and only three stamens; another has three petals and three stamens, the two others having six petals and six stamens: the petals are squamiform, very minute, and might easily be overlooked, being affixed upon the andrœcium at the foot of the stamens: the stamens are of the length of the inner sepals; the filaments, erect or much incurved, are thickened gradually upwards into an almost clavate connective, which terminates in a more or less elongated excurrent point, as in *Chondodendron*; the separated oblong anther-cells are half imbedded on each side of the connective; they are all glabrous and seated around the summit of an elevated andrœcium, which is surmounted by a dense fascicle of long, stiff, erect hairs, quite as long as the stamens. The ♀ flower has similar sepals and petals, no stamens, six or more ovaries, which are stipitated, gibbous, incurved, oblong, diminishing gradually into an elongated style, very pilose, all the styles connivent in the centre, as in *Pleogyne*. The receptacle of the flower finally grows to a large size and becomes covered with a number of hairy drupes, about the size of a pea, which are almost globular, straighter on the ventral side, with the remains of the style somewhat below the summit, and the

point of their attachment on the same side above the base; the putamen is reniformly globose, thin and testaceous in texture, marked on the dorsal side by three slight carinal ridges, and by a small sinus in the middle of the ventral side: the condyle is small, and intrudes a short way into the cell at the point of the sinus, and there the integument of the seed is attached to it. The seed, which nearly fills the space of the cell, is exalbuminous, and is corrugated over its surface, into the shallow clefts of which the integument is insinuated. Mr. Bentham states that the embryo consists of two cotyledons so closely conferruminated together that the radicle is not distinguishable: on a slight examination it certainly bears this appearance; but if it be kept soaked in water a sufficient length of time, the seed swells to its full size, all the corrugations become obliterated, and the real structure becomes very apparent: the radicle is now seen to be of extraordinary dimensions, being half the size of the whole embryo; it is solid, fleshy, conical, somewhat attenuated at its extremity, where it is contracted into a small point which is suddenly inflected and directed towards the place of the persistent style, thus assuming the appearance of a small inflected radicle: the cotyledons, which occupy the lower moiety of the seed, are not at all agglutinated together; they are semi-oval in their transverse section, lunately curved, with their extremity turned upwards, so as nearly to touch the bottom of the radicle, thus leaving a cleft between them, where the integument is attached to the intruding condyle. This form of embryo is quite unique in the *Menispermaceæ*.

TRICLISIA, Benth.—*Flores* dioici. *Masc.* *Sepala* 12–18, in ordine ternario disposita, plerumque alternatim imbricata, externe gradatim minora, carnosula, orbiculari-acuta, extus pilosa, 3 interiora æstivatione valvata, reliquis aut vix majora, suborbicularia et concava, vel 3-plo longiora, cuneato-oblonga et subacuta. *Petala* rarius nulla, aut 3 vel sæpius 6, staminibus opposita, iis multoties breviora, squamiformia, carnosula, cuneato-oblonga vel orbiculata. *Stamina* 3 aut sæpius 6, libera, longitudine sepalorum, subbiseriata, alternatim paulo minora; *filamenta* intus sulcata, sursum gradatim valde incrassata, erecta vel arcuatim incurva, circa *andræcium* paulo elevatum fasciculo pilorum staminum longitudine munitum enata; *antheræ* 2-lobæ, lobis discretis, imo divaricatis, connectivo lateraliter subintrorsus semiimmersis, utrinque rima obliqua hiantibus, connectivo sæpius longe excurrente apiculatæ.—*Fœm.* *Sepala* 9, suborbicularia, concava, extus pilosa, quorum 3 interiora paulo majora, æstivatione valvata. *Petala* nulla. *Stamina* desunt. *Ovaria* perplurima, gibboso-ovata,

trigonoideo-compressa, pilosa, *gynæcio* piloso insita, apice latere interno in stylum sensim attenuata; *styli* subulati, in centrum horizontaliter conniventes. *Drupæ* paucae vel plurimæ, toro amplificato aggregatæ, gibboso-ovatæ, subsiccæ, velutinæ, styli vestigio infra apicem notatæ; *putamen* reniformi-ovatum, dorso convexum et 3-carinatum, ventre rectiusculum et medio sinu parvo exsculptum, tenuiter testaceum; *condylus* parvus, sinum versus intra loculum paulo intrusus et convexus. *Semen* loculo conforme, exalbuminosum, siccum corrugatum, humectum læve; *integumentum* tenuiter membranaceum, in rugas insinuatum et ad condylum affixum: *embryo* ovatus vix compressus; *radicula* supera, macropoda, dimidium loculi implens, solide carnosæ, obtuse conica, summo apiculatim constricta et hic subito adpresse et incumbentim inflexa, apiculo ad stylum spectante; *cotyledones* loculi reliquum farciens, distinctæ, crasse carnosæ, accumulantes, basin versus subito incumbentim uncinato-curvatae, extremitatibus radiculam fere attingentibus.

Frutices *Africae tropicæ occidentalis scandentes*; folia *petiolata*, sæpe *majuscula*, *oblonga vel ovata*, imo *cordata aut rotundata*, e basi 5- vel 5-pli-nervia, *supra glabra*, *subtus pubescentia*: paniculæ ♂ *axillares*, sæpe *fasciculatæ*, *petiolo breviores*, *sericeo pubescentes*: inflorescentia ♀ *in ramulo axillaris*, *brevissime corymbulosa*; flores *in capite subsessili*, *hinc approximati*.

The characters of the following species will be fully detailed in the third volume of my 'Contributions to Botany:—

1. *Triclisia macrophylla*, Oliv.—In Africa æquinoctiali: v. s. in herb. Hook. ♂, Fernando Po (Mann, 197).
2. — *patens*, Oliv.—In Africa æquinoctiali: v. s. in herb. Hook. ♂, Bagroo River (Mann, 797).
3. — *coriacea*, Oliv.—In Africa æquinoctiali: v. s. in herb. Hook. ♂, Fernando Po (Mann, 174).
4. — *subcordata*, Oliv.—In Africa æquinoctiali: v. s. in herb. Hook. Nupè, Niger River, ♂ et ♀ (Barter, 1146 et 3397).

[To be continued.]

XLVII.—*Notulæ Lichenologicae*. No. XIV.

By the Rev. W. A. LEIGHTON, B.A., F.L.S.

THE following New British Lichens are described by Dr. Nylander in the 'Flora,' Sept. 22 and Oct. 15, 1866:—

1. *Lecidea holomeloides*, Nyl.

Thallus obscurus vel nigricans, tenuis, discontinue effusus, sub-

granulatus; apothecia nigra, convexula (latit. 0·4–0·5 millim.), immarginata, intus obscura; sporæ 8, incolores, oblongæ vel subbacillares, 1-septatæ, variabiles, long. 0·010–0·017 millim., crass. 0·0030–0·0035 millim.; paraphyses haud discretæ; epithecium nigricans; hypothecium subincolor vel leviter sordide fuscenscens. Gelatina hymenea iodo (saltem leviter) cærulescens, dein lutescens.

Supra terram schistoso-micaceam in alpe Scotiæ Ben Lawers (Admiral Jones).

Accedit ad *L. globulosam*, sed faciem habet *melænæ*.

2. *Lecidea circumpallens*, Nyl.

Thallus pallide cinerascens, tenuis, rimosus; apothecia fusconigra (latit. circ. 0·5 millim.), margine (perithecio) pallido demum excluso et sæpe tum tota fusco-rufescentia, plana vel convexiuscula, intus incoloria; sporæ 8, fusiformes vel fusiformi-aciculares, rectæ (1–)3-septatæ, long. 0·018–0·025 millim., crass. 0·0020–0·0035 millim.; epithecium vage nonnihil nigrescens aut subincolor; hypothecium incolor; paraphyses crassiusculæ, non bene discretæ. Gelatina hymenea iodo vinose rubens (præcedente cærulescentia levi).

Supra terram argillaceam in Hibernia prope Ross (Mr. I. Carroll).

Vix nisi varietas *L. bacillifera*.

3. *Lecidea consentiens*, Nyl.

Thallus albidus, mediocris, rimoso-diffractus; apothecia nigra, innata (latit. 0·9–1·5 millim.), plana, nonnihil sæpius impressa et inde quasi margine obtuso sæpe cincta; sporæ 8, incolores, ellipsoideæ, simplices, long. 0·027–0·038 millim., crass. 0·016–0·022 millim.; paraphyses graciles (crass. 0·0010–0·0015 millim.); epithecium fuscenscens; hypothecium fuscum. Gelatina hymenea iodo cærulescens, dein nonnihil sordide vinose rubescens (fulvescens).

Ad saxa micaceo-schistosa cacuminis Ben Lawers (Admiral Jones).

Facies *Lecanoræ cinereæ* formæ.

Differt *Lecidea consentiens* ab affini *L. rhatica*, sporis majoribus, epithecio fuscenscente (in *L. rhatica* epithecium cærulescens vel cæruleo-nigrescens), reactione iodica (nam in *L. rhatica* gelatina hymenea iodo intense et persistenter cærulescit). *L. panaola* differt cephalodiis, thallo hypochlorite calcico saltem dilute erythrinice tincto &c.

4. *Lecidea atrofuscescens*, Nyl.

Thallus cinereo-nigricans vel fusco-nigrescens, deplanatus, areolato-diffractus, subopacus; hypothallus niger hinc inde visibilis; apothecia nigra, adnata, plana (demum convexiuscula), marginata, mediocria (latit. 0·9–1·2 millim.), sæpe subangulosa, intus subincoloria; sporæ 8, incolores, ellipsoideæ, long. 0·018–0·020 millim., crass. 0·009–0·011 millim.; epithecium fuscescens; paraphyses graciles, teneræ, subirregulares; hypothecium incolor. Gelatina hymenea iodo cærulescens, dein (pro parte saltem) vinose rubescens.

Ad saxa micaceo-schistosa in Ben Lawers (Mr. I. Carroll).

Facie inter *L. fusco-atram* et *tenebrosam* quasi media, sporis majoribus inter species subsimiles mox dignota (præter alias notas).

5. *Lecidea umbonella*, Nyl.

Thallus albidus vel pallidus, sat tenuis, determinatus (maculatim vel insulatim crescens), rimoso-diffractus; apothecia nigra, parva (latit. fere 0·5 millim.), innata, marginata, sæpius subgyrosa vel centro umbonata; sporæ 8, incolores, ellipsoideæ, long. 0·011–0·014 millim., crass. 0·006–0·008 millim.; epithecium subincolor; paraphyses mediocres; hypothecium fuscum vel fuscescens (umbo et perithecium fusco-nigricantia in lamina tenui). Gelatina hymenea iodo bene cærulescens.

Ad saxa micaceo-schistosa in Benmore (Admiral Jones).

Prope *L. gyrizantem* locum habeat.

Spermatia cylindrica, recta, long. 0·006–0·007 millim., crass. vix 0·001 millim. in *L. umbonella*.

6. *Lecidea succedens*, Nyl.

Thallus albidus, tenuis, granulato-inæqualis vel subareolatus; apothecia fusco-nigra, fere mediocria, marginata, intus incoloria; sporæ 8, nigrescentes, ellipsoideæ (pariete tenui), simplices aut 1-septatæ, long. 0·011–0·014 millim., crass. 0·0045–0·0055 millim.; paraphyses mediocres, articulatæ, apice incrassato (crass. fere 0·0045 millim.), fusco vel fuscescente; hypothecium fuscum (vel rubricose fuscum). Gelatina hymenea iodo cærulescens, dein vinose rubens.

Supra saxa micaceo-schistosa in Ben Lawers (Admiral Jones).

Comparetur *L. secedens* Nyl. in 'Flora,' 1865, p. 6, arcte affinis. Locus systematicus prope *L. nigritulam*.

7. *Lecidea segregans*, Nyl.

Thallus albidus vel albido-cinereascens, verrucoso-granulosus, granulis variis convexulis, plus minus segregatis (alibi verru-

coso-confluentibus), laxe adnatis, hypothallo nigricante sæpius parum visibili; apothecia nigra, planiuscula, immarginata, demum convexa sæpeque aggregato-confluentia, sat parva (latit. 0·4–0·6 millim. vel aggregata minora), intus concoloria; sporæ 8, incolores, oblongæ, simplices, long. 0·010–0·013 millim., crass. 0·0035–0·0045 millim.; hymenium sordide tinctum; epithecium haud obscuratum; paraphyses mediocres, non bene discretæ; hypothecium fuscum. Gelatina hymenea iodo dilute cærulescens, dein mox vinose fulvescens.

Supra saxa micaceo-schistosa in Ben Lawers (Admiral Jones).

Prope *L. melanheimam*, Tuck., disponenda videtur, tamen locus non certus, nam spermogonia nondum inventa.

8. *Pyrenopsis lecanopsoides*, Nyl.

Cl. Jones in Hibernia prope Kenmare legit *Pyrenopsisim lecanopsoidem* Nyl. (*Collema pyrenopsoides*, Nyl. Syn. i. p. 103), forma gonimiis paulo minoribus, sporis longit. 0·014–0·020 millim., crass. 0·006–0·010 millim.

Ad saxa calcarea prope mare.

9. *Lecidea interjecta*, Nyl.

Thallus albidus vel cinerascens, inæqualis, sat tenuis, rimoso-diffractus, indeterminatus; apothecia nigra, fere mediocria (latit. 0·4–0·9 millim.), plana, marginata, intus obscura; sporæ 8, incolores, ellipsoideæ, simplices, long. 0·010–0·012 millim., crass. 0·006–0·007 millim.; paraphyses gracilescentes (vel non bene distinctæ); epithecium subincolor (vel vage leviter lutescenti-fuscescens vel sordidum); hypothecium fuscum. Gelatina hymenea iodo cærulescens, dein vinose rubens.

Ad lapides vel saxa arenacea in Anglia (Rev. T. Salwey).

Hanc *L. interjectam* olim perperam habui pro *L. sarcogynoides*, Krb., a qua mox differt thallo solutione hypochloritis calcici erythrinice tincto; alioquin in *sarcogynoides*, Krb. L. Sel. 47, thalamium nonnihil rubricose-violacee tinctum, sporæ minores, &c. Errore indicavi huic thallum adesse erythrinica gaudentem reactione. Conferenda *L. sarcogynopsis* (Nyl. *Armoric.* p. 409) etiam differt thalli reactione tali nulla, paraphysibus discretis crassioribus, epithecio obscurato, hypothecio medio dilutiore, &c. a *L. interjecta*. Adhuc comparari possit *L. lapicida* var. *declinata*, Nyl. (data in Lechl. Pl. Maclov. 56), sed ei thalamium fere duplo humilius et superius cærulescens, epithecium nigricans, gelatinæ hymenææ cærulescentia iodo effecta persistens, &c. (hypothecium strato medio dilutius). In *L. interjecta* hy-

menium altit. circiter 0·1 millim. (statu humido), in *L. sarcogynoides* altit. fere 0·09 millim., in *L. lapicida* var. *declinata* altit. solum 0·05 millim.

10. *Lecidea furvella*, Nyl.

Differt a subsimili *L. furvula* hypothecio atro, epithecio (et thalamio superne) cærulescente, sporis minoribus (long. 0·009–0·011, crass. 0·0045 millim.), &c.

Ad saxa micaceo-schistosa in Ben Lawers Scotiæ (Mr. I. Carroll).

In *L. furvula* hypothecium fuscum, epithecium nigricans; sporæ long. 0·012–0·017 millim., crass. 0·006–0·008 millim., thallus crassior et distinctius areolato-diffractus, &c.

XLVIII.—*List of Coleoptera received from Old Calabar, on the West Coast of Africa.* By ANDREW MURRAY, F.L.S.

[Continued from p. 180.]

Trogositidæ.

ALINDRIA, Er.

Alindria alutacea.

A. elongata valde affinis, magis opaca; elytris minus fortiter punctatis, interstitiis magis elevatis versus apicem quam versus basin.

Long. 7–9 lin., lat. $2\frac{1}{2}$ lin.

Very similar to *A. elongata*, Guér.; more opaque and dull in texture; the head has a general slight depression in the middle, whereas in *A. elongata* the depression is somewhat angular and placed towards the back of the head. In *A. elongata* the costæ between the double row of punctures on the elytra are most developed towards the base, while in this species they are more raised towards the apex; the punctures, too, are not quite so deep. The insect is also not quite so cylindrical, being a little depressed on the back, and perhaps broader in proportion; but it is obviously the representative on the west coast of Africa of *A. elongata* on the east coast (Natal).

Two specimens received.

The geographical distribution of this genus is peculiar, viz. North America and Africa. There is a species also said to be from Cachemir, which I have not seen.

MELAMBIA, Er.

Melambia striata, Oliv. Ent. ii. 19. p. 7.

A single specimen.

The geographical distribution of this genus is of a more usual character than the last, viz. Africa and the Malayan district.

Gymnocheila, Erich.

Gymnocheila squamosa, Gray, Griff. Anim. Kingd. pl. 60. fig. 3.

(*G. vestita*, Dej. Cat. p. 339.)

This species, although figured by Gray in the above work, has, I believe, never been described. I therefore give its description here:—

Oblonga, modice convexa, nigro-fusca, squamis fuscis et albidis vel ochraceis dense variegata; antennis basi, palpis pedibusque ferrugineis, femoribus saturatoribus; prothorace lateribus dense sat fortiter punctato, medio spatio longitudinali confertim et irregulariter punctato, utrinque sublævi, lateribus parum ampliatis, pone medium latiore, angulis posticis obtusis; elytris punctato-striatis, striis decem ad humeros paullo deflexis.

Long. $4\frac{1}{2}$ –6 lin., lat. $1\frac{3}{4}$ –2 lin.

Head rounded, moderately convex, front sloping rapidly downwards, brownish black, clothed with brown scales of different degrees of darkness, coarsely punctate, with a longitudinal depression in the middle, and on each side of it, about a third of the distance from the vertex, is a distinct raised papilla, and a little behind, much less distinct, a sort of small oval depression or slight scar as it were, the margins of which are smooth; behind this, again, and at the inner angle of the eye, is a patch of darker scales looking like a tuft. Eyes moderate. Palpi rufo-ferruginous. Antennæ rather short, ferruginous, with the last three articles black, thick, and forming a club. Prothorax not quite twice so broad as long, broadly emarginate in front, the anterior angles very projecting, but rounded at the apex, sides somewhat unevenly and angularly rounded, widest a little behind the middle, posterior angles obtuse, the surface coarsely punctate, except a partially smooth space on each side of the middle, which forms a depressed longitudinal line irregularly and unequally thickly punctate; there are also a number of irregular depressions on the disk, arranged in something like disordered longitudinal rows, three on each side of the middle: it is covered with dull fuscous scales, except at the posterior angles and for about a third of its length in front of these angles, which third is covered with whitish scales, and forms an oblique oblong patch; the fuscous surface seems darker in the places which are depressed, owing doubtless to the scales being less rubbed off in these depressions. Scutellum short, rounded

at the apex, opaque. Elytra twice and a half the length of the thorax, and a little broader than it at the base, which is truncate; the shoulders very slightly prominent; basal exterior angles very nearly rectangular, but slightly obtuse and with the angle itself rounded; the sides nearly straight or slightly diverging, until behind the middle, when they gradually converge, terminating when united in a rounded pointed apex; moderately convex above, punctate-striate, the striæ ten in number, slightly deflexed near the shoulder and cut like rectangular grooves, well defined, and the punctures transverse and rectangular; covered with fuscous scales variegated with whitish, or ochreous opaque dull scales running down on each side of the suture, extending outwards in a somewhat triangular shape towards the base, and also less extensively behind the middle, and again still smaller near the apex, also with a whitish patch near each shoulder; the fuscous colour is darkest and most conspicuous where it joins the whiter variegation. The body below is flat, opaque, and covered with dull cinereous scales; the thorax is coarsely and rather sparsely punctate. The legs are fusco-ferruginous; the thighs darker, at least in the middle.

The female is said to have the eyes divided. I am not sure that the males can be distinguished from the females by any other superficial character: but if the character is a good one, then I have never seen any females; for all the specimens that I have examined, whether from Old Calabar or South Africa, have the eyes unseparated.

I presume it is rare at Old Calabar; for I have only received one or two examples. Its range seems to be extensive in Africa, specimens standing in collections from Guinea, the Cape, and Natal.

PELTIS, Kugel.

1. *Peltis crenata*.

Oblongo-ovata, depressa, brunnea, punctata, breviter subsetosa; elytris crenato-striatis.
Long. $2\frac{1}{2}$ lin., lat. 1 lin.

Oblong-ovate, flat, depressed, brown, coarsely punctate, with very short whitish setæ or hair-like scales irregularly dispersed on the thorax and in lines on the elytra. Head not extending beyond the emargination of the thorax, flat, with a transverse, somewhat curved depression in front, leaving a roundish eminence behind the clypeus. Thorax deeply emarginate, widest near the posterior angles, which are turned slightly in and rounded at the tip; sides sloping to the front; anterior angles projecting and rounded at the apex; base trisinate, surface

most deeply punctate towards the sides, which are slightly reflexed in front and a little turned down behind. Scutellum less deeply punctate than the thorax, rounded at the apex. Elytra flat on the disk, with the sides nearly vertical, crenate-striate, the crenations caused by apparently two rows of punctures, the punctures separated by transverse ridges; the striæ are seven or eight, and reach to the apex, but not to the sides, where they become a confused mass of general coarse punctuation, with a tendency here and there to linear arrangement; the interstices on the disk are subrugose; the margins are reflexed, and there is a large shallow depression on the sides behind the shoulders. The scales or hairs are whitish and not erect, nor are the sides ciliated. The underside is smoother than the upper, the legs shining, the palpi testaceo-ferruginous, and the tarsi paler than the general colour of the legs.

One specimen.

2. *Peltis ciliata*.

Oblongo-ovata, depressa, brunnea, punctata, setosa, lateribus ciliatis; elytris striato-punctatis.

Long. $2\frac{1}{8}$ lin., lat. 1 lin.

Very similar to the preceding, but distinguished by the following characters:—It is of a darker brown and duller colour. The transverse line in front is straight, and separates a small ridge in front instead of a rounded prominence; the anterior angles of the thorax are slightly more prominent, and the posterior angles not so obtuse. But the chief distinction is, that the elytra are punctate-striate instead of crenate-striate, the striæ consisting of rows of punctures, each alternate row of which is stronger than the other, and all about equally distant from each other; the sides are more regularly punctate in rows, although so closely as to destroy the appearance of striæ. The whole surface is covered with stiff, short, erect, brownish bristles, a row running along each stria and one sticking out as a fringe all round the sides both of thorax and elytra.

I have only received one specimen of this; and it is possible that a series might show transition passages between this and the preceding species. It is easy to see how a little exaggeration of some of the characters might change the one into the other; but as at present advised, I keep them distinct.

These two come near in form to some undescribed Indian and Australian species.

BOTHRIDERES, Erich.

Bothrideres spleniatus.

Saturate vino-castaneus, leviter punctatus thorace splenio

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cuneato medio instructo; elytris sulcatis, sulcis punctatis; tibiis anticis et mediis externe dentatis.

Long. $1\frac{3}{4}$ lin., lat. $\frac{3}{4}$ lin.

Deep chestnut claret-coloured. Head and thorax finely, faintly, and sparingly punctate, the punctures elongate; the former hollowed longitudinally. Thorax wedge-shaped, truncate both before and behind, the anterior angles slightly projecting, the sides with three very slight angles or prominences, the most prominent not far from the posterior angle; the disk deeply excised longitudinally, with a narrow wedge-shaped patch inserted in the middle, the point of the wedge directed backwards. Scutellum small, ovate, projecting. Elytra sulcate, the sulci being rows of punctate striæ; three (or four, if we reckon the sutural line as one) alternate interstices on each side are a little more raised than those between them, the outermost the least so: shoulders somewhat prominent and paler than the rest of the body: sides turned down and in, and with the margin marked off by a fine stria. Underside finely, faintly, and sparingly punctate. Legs paler than the body; anterior tibiæ with three distinct teeth on the external side—one large one at the distal angle and two together about the middle; the middle tibiæ with two blunt teeth about the middle.

Two specimens, from the Rev. W. C. Thomson.

This is a well-marked species. The patch let in in the midst of the thorax is a distinct well-defined narrow wedge. The dentation on the tibiæ is another good distinguishing character. All the species seem to have more or less of a groove on the outer side of the tibiæ, apparently for the reception of the tarsi when at rest. In the European species this is scarcely observable. It goes no further than a slight broadening and roughening of its outer side. It is at the upper termination of this groove that the two middle teeth in this species occur. The only other species in which I have observed a tendency to this dentation is an undescribed Indian one (highly polished and with an oblong quadrangular patch on its thorax).

HECTARTHURUM, Newm.

1. *Hectarthrum gigas*, Fab. Syst. El. ii. p. 92.

Fabricius's description is too meagre to allow us to be certain whether he had a species distinct from *curtipes* in his eye when he described this; all that we can be sure of is that it was either *curtipes* or something very near it. I think there are two species which answer to his description, and which are sufficiently close to be confounded—one broader and larger than the other, and it I consider to be the *gigas* of Fabricius.

Two or three specimens received.

2. *Hectarthrum curtipes*, Newm. Ent. Mag. v. 398, and Ann. Nat. Hist. ii. 392.

This is the species which may be confounded with *H. gigas*; but on the whole, I incline to think with Mr. Newman that it differs from it. It is always small and narrower in proportion. The markings and sculpture, however, cannot be distinguished.

3. *Hectarthrum quadrilineatum*, Smith, Brit. Mus. Cat. of Cucujidæ, p. 22.

Mr. Frederick Smith, of the British Museum, described this species from a specimen from Natal. The type is in the British Museum, and is a female. The species varies a good deal in size. I have a specimen only $3\frac{1}{2}$ lines in length, and another upwards of 6 lines. The striæ on the elytra, when examined closely, show a series of faint punctures in the lines.

Several specimens received.

“Black, with two deep channels on the head originating at the basal angles of the clypeus, running upwards, meeting a little before the vertex; thence passing off at right angles, they continue, reaching the inner margins of the eyes, where, becoming narrower, they traverse the inner margins, and curve round, meeting the origin of the deep sulcation; the clypeus has a deep fossulet in the centre, the lateral margins of which are raised; and there is a sharp carina down the face, terminating in this deep fossulet. The thorax is one-third longer than broad. Each elytron has four striæ independent of the usual marginal stria, the sutural stria uniting with the marginal one; a second stria runs parallel to the sutural one, but becomes obsolete a little before the apex: a second pair of striæ run down the middle of the elytra, the inner one commencing a little below the shoulder; the outer stria commences at the humeral angle, and both become obsolete a little before the apex. The femora are red, the tibiæ and tarsi rufo-piceous. Long. 5 lin.”

4. *Hectarthrum Smithii*.

H. quadrilineato similis; dignoscitur thorace medio versus basin duabus striis parum obliquis brevibus instructo.

Long. $3\frac{1}{2}$ lin., lat. $\frac{3}{4}$ lin.

Like the smaller specimens of *H. quadrilineatum*; narrower; the head sculptured nearly as in it; but the central keel in front, which in it runs down the middle fossulet on the clypeus, is almost effaced. The thorax nearly as in it; but, besides the two faint lateral oblique lines, there are two deep, short, dorsal, slightly oblique lines near the base; they extend forwards about half the length of the thorax, and do not reach the base; they

are only slightly oblique, and the obliquity is outwards in front. The lines on the elytra are more deeply engraved.

This may be a sport of *H. quadrilineatum*; but the presence of the two deep dorsal lines on the thorax warrants one at least in regarding it as distinct until a greater series of specimens enables us to see whether there are any passages between the one and the other or not.

I have called it after my friend Mr. Frederick Smith. I have only seen one specimen.

. 5. *Hectarthrum simplex*.

H. quadrilineato affinis; elytris linea suturali et marginali apice conjunctis et lineis duabus medio.

Long. $3\frac{1}{2}$ – $4\frac{1}{2}$ lin., lat. $\frac{3}{4}$ –1 lin.

Similar to *H. quadrilineatum*; but it has not the line or stria on the elytra next the sutural stria; the sutural stria is further from the suture than in it, leaving a wider sutural space. It might be called *trilineatum*, if we were not to reckon the marginal stria, as *H. quadrilineatum* is only four-lined if we do not reckon the marginal stria; reckoning that stria, it is five-lined. Here there is first the sutural stria, next two close on the middle, and lastly the marginal stria out of sight round the corner.

The antennæ of the male are remarkably and gradually thickened in the middle—a character not peculiar to it, but present in other species.

[To be continued.]

XLIX.—*On the Temperature of Geological Periods, from indications derived from the observation of Fossil Plants.* By the Count GASTON DE SAPORTA.

[Concluded from p. 282.]

§ 2. *Examination of the Genera peculiar to the Northern Temperate Zone observed in the Ancient Floras.*

The genera to the investigation of which I now advance are for the most part those which we have still before our eyes. It is to them that our indigenous vegetation owes its character: they seem to be adapted to the conditions of our temperature; and consequently it would appear that they must have commenced at the period when this was definitively established. I shall show that this is not the case, and that, from causes which we can as yet only appreciate very imperfectly, their existence in the past ascends far beyond the time when the European climate became similar to what it is at present.

The following is an enumeration of these genera, of course restricted to the principal ones—that is to say, to those which play an important part in the general vegetation of the northern temperate zone and are at the same time most frequently observed in the fossil state in several successive stages:—

<i>Alnus</i> , Tournef.	<i>Populus</i> , Tournef.
<i>Betula</i> , Tournef.	<i>Salix</i> , Tournef.
<i>Ostrya</i> , Mich.	<i>Fraxinus</i> , Linn.
<i>Carpinus</i> , Tournef.	<i>Hedera</i> , Linn.
<i>Corylus</i> , Tournef.	<i>Cornus</i> , Tournef.
<i>Quercus</i> , Linn.	<i>Liquidambar</i> , Linn.
<i>Fagus</i> , Tournef.	<i>Liriodendron</i> , Linn.
<i>Castanea</i> , Tournef.	<i>Acer</i> , Linn.
<i>Ulmus</i> , Linn.	<i>Juglans</i> , Linn.
<i>Celtis</i> , Tournef.	<i>Cratægus</i> , Linn.
<i>Platanus</i> , Linn.	<i>Cercis</i> , Linn.

This list includes twenty-two genera, of which eighteen still grow naturally in Europe; three (*Platanus*, *Liquidambar*, *Juglans*), without being spontaneous in Europe, inhabit the neighbouring parts of Asia as well as North America; one only (*Liriodendron*) is no longer met with except in the New World. But these last only quitted our soil at an epoch very nearly approaching our own; so that, by going a little backward, one might say that all these genera equally characterize the northern temperate zone, the limits of which they overstep only exceptionally*, and solely by means of certain mountainous regions in which altitude compensates the climate. As regards their polar limits these genera show great diversities. The willows and birches advance furthest towards the north, since they reach Iceland, but certainly with repent species. The oak does not pass Stockholm, with a mean temperature of 5° C. (= 41° F.); the ash stops at Gothenburg, with 7°·9 C. (= 46°·2 F.). The chestnut and the plane do not go so far. But these differences depend rather on the inherent aptitudes of the species than even on those of the genus, especially in the frequent cases where the latter is represented by a small number of species, or even by a single one; the area of the genus then depends upon that of the species, and is confounded with it. Whatever be the nature of these diversities, they may and must relate to anterior causes, and especially to those which we now proceed to study.

In ascending the course of ages we shall pass through the same periods that we have just traversed, but inversely, and commencing with the most recent. The eighth of our horizons,

* The genus *Fagus* reappears in the southern hemisphere, but in forms sufficiently distinct from those of the boreal zone to constitute another type.

formed by the quaternary deposits, furnishes the following list, which is nearly complete:—

- Alnus glutinosa*, Linn. Travertins of Montpellier.
Betula prisca, Ett. Tuscan Travertins.
Carpinus betulus, Linn. Cannstadt.
Corylus avellana, Linn. Travertins of Provence.
Quercus pubescens, Wild. Travertins of Provence.
Fagus sylvatica, Linn. Tuscan Travertins.
Ulmus campestris, Linn. Travertins of Tuscany and Provence.
Celtis australis, Linn. Travertins of Provence.
Populus alba, Linn. Ditto.
Salix viminalis, Linn. Ditto.
 — *caprea*, Linn. Ditto.
Platanus aceroides, Göpp. Tuscan Travertins.
Fraxinus ornus, Linn. Ditto.
Hedera helix, Linn. Travertins of Tuscany and Provence.
Cornus sanguinea, Linn. Ditto.
Liquidambar europæum, Al. Br. Travertins of Tuscany.
Acer opulifolium, Linn. Travertins of Tuscany and Provence.
Juglans graviæfolia, Gaud. Travertins of Tuscany.
 — *regia*, Linn. Travertins of Provence.
Cratægus oxyacantha, Linn. Ditto.
Cercis siliquastrum, Linn. Travertins of Tuscany and Provence.

In this list only a very small number of genera are wanting. It must even be remarked that *Ostrya* is difficult to distinguish from the hornbeam without the fruits, and that the chestnut, frequenting siliceous soils, must have kept at a distance from the localities where the travertins were formed. On the other hand, among the genera which have since become extra-European, *Juglans*, *Liquidambar*, and *Platanus* show themselves in proof of their late elimination; the genus *Liriodendron* is the only one that does not make its appearance, as, no doubt, it had already disappeared from Europe.

The seventh horizon, the Pliocene, is richly represented by the floras of Schosnitz, Gleichenberg, Senegaglia, and the Val d'Arno; it furnishes the following list, which includes only the most prominent species of the period:—

- Alnus Kefersteini*, Göpp. Tuscany.
Betula macrophylla, Göpp. Schosnitz.
 — *prisca*, Ett. Tuscany.
Ostrya Prasili, Ung. Gleichenberg.
Carpinus pyramidalis, Göpp. Schosnitz, Tuscany.
Corylus Wickenburgi, Ung. Gleichenberg.
Quercus drymeja, Ung. Tuscany.
 — *lucumonum*, Gaud. Tuscany.
 — *mediterranea*, Ung. Tuscany.
Fagus Deucalionis, Ung. Senegaglia.
 — *attenuata*, Göpp. Schosnitz.
Castanea Kubinyi, Kor. Tuscany.
Ulmus Wimmeriana, Göpp. Schosnitz.

- Ulmus Bronnii*, Ung. Tuscany.
Populus balsamoides, Göpp. Schossnitz, Tuscany.
 — *leucophylla*, Ung. Tuscany.
Salix varians, Göpp. Schossnitz, Tuscany.
Platanus aceroides, Göpp. Schossnitz, Tuscany.
Liquidambar europæum, Al. Br. Schossnitz, Tuscany.
Fraxinus prædicta, Heer. Senegaglia.
Cornus Buchii, Heer. Tuscany.
Hedera Strozzi, Gaud. Tuscany.
Liriodendron Procaccinii, Ung. Senegaglia.
Acer Penzianum, Gaud. Tuscany.
 — *Sismondæ*, Gaud. Tuscany.
Juglans Strozzi, Gaud. Tuscany.
 — *nux-auri*, Brong. Tuscany.
Cratægus oxyacanthoides, Göpp. Schossnitz.

All the genera of our list consequently existed in Pliocene Europe, and most of them were represented by more numerous and varied species than at the present day.

The following horizon, the sixth, which includes the rich vegetation of Eningen, that of Bilin, Parschlug, &c., brings but few changes into our list:—

- Alnus Kefersteini*, Göpp. Bilin.
 — *Eningenensis*, Heer. Eningen.
 — *gracilis*, Ung. Bilin.
Betula Unger, Andr. Eningen.
 — *Weisii*, Heer. Eningen.
Ostrya Eningenensis, Heer. Eningen.
Carpinus Eningenensis, Göpp. Eningen.
 — *pyramidalis*, Göpp. Eningen.
Corylus insignis, Heer. Lausanne.
Quercus neriifolia, Al. Br. Eningen.
 — *drymeja*, Ung. Parschlug.
 — *elæna*, Ung. Eningen, Parschlug.
Fagus Feroniæ, Ung. Bilin.
 — *Deucalionis*, Ung. Parschlug.
 — *castaneæfolia*, Ung. Styria.
Ulmus plurinervia, Ung. Parschlug.
 — *longifolia*, Ung. Bilin.
 — *Braunii*, Heer. Eningen.
 — *minuta*, Göpp. Eningen.
Celtis Japeti, Ung. Parschlug.
Populus latior, Al. Br. Eningen.
 — *mutabilis*, Heer. Eningen.
 — *heliadum*, Ung. Eningen, Parschlug.
Salix varians, Göpp. Eningen.
 — *Lavateri*, Heer. Eningen.
Platanus aceroides, Göpp. Eningen, Schrotzberg.
Liquidambar europæum, Al. Br. Eningen, &c.
Fraxinus prædicta, Heer. Eningen.
 — *deleta*, Heer. Eningen.
Cornus Buchii, Heer. Eningen.
Hedera Kargii, Al. Br. Eningen.
Liriodendron Procaccinii, Ung. Stradella.

- Acer trilobatum*, Al. Br. Eningen, Parschlug, &c.
 — *decipiens*, Al. Br. Eningen.
 — *otopteryx*, Göpp. Eningen, Parschlug.
Juglans acuminata, Al. Br. Eningen, Parschlug.
 — *bilinica*, Ung. Eningen, Billin.
Cratægus oxyacanthoides, Göpp. Eningen.
Cercis cyclophylla, Al. Br. Eningen.

Most of these genera seem to have attained their apogee in Europe, and the more important of them unite upon the same spot forms now scattered over very different countries. This affluence begins to decrease when we quit this horizon to ascend towards the preceding one or that of the lower Miocene.

This is the fifth of our series : it includes the floras of Manosque in Provence, Ménat in Auvergne, Brognon near Dijon, Monod, Hohe-Rhonen, and Eriz in Switzerland, the plants of the Surturbrand of Iceland and of Atanekrdluk in North Greenland*, those of the Baltic amber and of several other localities.

The following is an exact list of the European genera the existence of which is proved by means of these various deposits :—

- Alnus nostratum*, Ung. Manosque, Monod.
 — *Kefersteini*, Göpp. Iceland, Monod.
Betula elliptica, Sap. Manosque.
 — *Blancheti*, Heer. Monod.
 — *macroptera*, Göpp. Iceland.
 — *prisca*, Ett. Iceland.
Ostrya Eningensis, Ung. Manosque.
 — *Walkeri*, Heer. Greenland.
Carpinus grandis, Ung. Manosque, Monod.
Corylus insignis, Heer. Hohe-Rhonen.
 — *Macquarii*, Heer, Ménat, Iceland, Greenland, Hohe-Rhonen.
Quercus Olafseni, Heer. Iceland, Greenland.
 — *elæna*, Ung. Monod.
 — *drymeja*, Ung. Greenland.
Fagus pristina, Sap. Manosque.
 — *Deucalionis*, Ung. Greenland.
 — *castaneæfolia*, Ung. Greenland.
Ulmus Fischeri, Heer. Monod.
 — *diptera*, Steenstr. Iceland.
 — *discerpta*, Sap. Manosque.
Populus Gaudini, Heer. Monod.
 — *Richardsoni*, Heer. Iceland, Greenland.
 — *Zaddachi*, Heer. Greenland, Amber.
Salix macrophylla, Heer. Eriz, Iceland.
 — *Gaudini*, Fisch. Monod.
Platanus aceroides, Göpp. Iceland, Greenland.
Fraxinus inæqualis, Heer. Manosque, Monod.
 — *denticulata*, Heer. Greenland.

* See 'Ueber den versteinerten Wald von Atanekrdluk in Nord-Groenland,' by Prof. Oswald Heer.

- Liquidambar europæum*, Al. Br. Horw (Switzerland), Sagor (Germany).
Cornus orbifera, Heer. Monod.
 — *Studeri*, Heer. Monod.
Hedera Maclurei, Heer. Greenland.
Liriodendron Procaccinii, Ung. Eriz, Iceland.
Acer trilobatum, Al. Br. Manosque, Monod.
 — *Ruminianum*, Heer. Manosque, Monod.
 — *otopteryx*, Göpp. Iceland.
Juglans bilinica, Ung. Manosque, Monod, Iceland.
 — *acuminata*, Al. Br. Greenland.
Cratægus tenuifolia, Sap. Clay of the Marseilles basin.
Cercis Tournouëri, Sap. Brognon.

The list is still complete; but some of these genera will no longer appear. Such are *Platanus*, *Fraxinus*, and *Liquidambar*; and it is to be remarked that these are not the most northern forms. The *Platani* and *Liquidambars* prefer the warm temperate zone—a circumstance which explains their exclusion from Europe by the effects of the glacial period. Here the first known traces of these genera make their appearance in the Arctic regions, which then possessed species in common with Europe, and which, although warmer than at present, were nevertheless subject to the influence of latitude, since the species with deciduous leaves already predominated there, and several of them only spread at a later period over the middle of Europe, such as *Betula prisca* and *macrophylla*, *Platanus aceroides* and *Acer otopteryx*—a phenomenon still obscure, but of great interest, if we succeed in ascertaining it with precision.

In approaching the Tongrian or fourth horizon, a decisive period in the question under examination, I find it preferable, from the rather complex affinities of the floras which I refer to it, to divide them into two partial horizons—one, more recent, nearly approaching that which we have just quitted, the other including the Tongrian properly so called. On the former I place Radoboj and Armissan (very rich localities, which present a remarkable correspondence), and we thus obtain the following list:—

- Alnus microdonta*, Sap. Armissan.
Betula dryadum, Brong. Armissan.
 — *Ungeri*, Andr. Radoboj.
Ostrya atlantidis, Ung. Radoboj, Armissan.
Carpinus grandis, Ung. Radoboj.
Quercus magnoliæformis, Sap. Armissan.
 — *oligodonta*, Sap. Armissan.
 — *sinuatiloba*, Sap. Armissan.
Castanea palæopumila, Andr. Armissan.
Fagus atlantica, Ung. Radoboj.
Celtis primigenia, Sap. Armissan.
Ulmus Bronnii, Ung. Armissan.
 — *prisca*, Ung. Radoboj.

- Ulmus bicornis*, Ung. Radoboj.
Populus palæomelas, Sap. Armissan.
 — *salerophylla*, Sap. Armissan.
 — *heliadum*, Ung. Radoboj.
Salix linearis, Sap. Armissan.
Acer narbonense, Sap. Armissan.
 — *pseudo-campestre*, Ung. Armissan.
 — *megalopteryx*, Ung. Radoboj.
 — *campylopteryx*, Ung. Radoboj.
Juglans radobojana, Ung. Radoboj.
 — *basilica*, Ung. Radoboj.
Cercis radobojana, Ung. Radoboj.

Thus at the level of Armissan and Radoboj the group of European genera no longer appears so complete as in the more recent stages; nevertheless the principal genera are still at least as richly represented as in the present epoch, and the species, generally founded on prominent organs, leave no room for any uncertainty as to their determination.

The change becomes more sensible on advancing towards the Tongrian properly so called, represented by the floras of Saint-Jean-de-Garguier near Marseilles, of Saint-Zacharie (Var), and of Haering and Sotzka in Austria. The following is this new list:—

- Alnus prisca*, Sap. St.-Zacharie.
Betula ulmacea, Sap. St.-Zacharie.
 — *pulchella*, Sap. Marseilles.
Ostrya tenerrima, Sap. St.-Zacharie.
Carpinus cuspidata, Sap. St.-Zacharie.
Quercus lonchitis, Ung. Sotzka.
 — *elæna*, Ung. St.-Zacharie.
Castanea atavia, Ung. Sotzka.
Ulmus primæva, Sap. St.-Zacharie.
Populus leuce, Ung. Sotzka.
Acer primævum, Sap. St.-Zacharie.
Juglans elænioides, Ung. Sotzka.
Cratægus palæacantha, Sap. St.-Zacharie.

The genera which no longer recur beneath this horizon are *Corylus*, *Fagus*, and *Celtis*. The absence of the others remains doubtful, more especially as we find indications of them at a far more distant period. Moreover it would be wrong to conclude, from the absence of a genus, its absolute non-existence; we may assume that in many cases its subordinate position placed an insurmountable obstacle to its passage to the fossil state. What is certain is the existence of the genera which figure in our list at a period when the vegetation was still endowed with a well-marked tropical and Australian character. Several of these genera, especially *Alnus*, *Betula*, *Carpinus*, *Ostrya*, *Acer*, and *Cratægus*, are represented by forms the analogy of which with

those corresponding to them in the present state of things is truly surprising.

The third horizon, composed chiefly of the flora of the gypsum of Aix, brings out this phenomenon still more strongly. In it we find the following European genera, taking into account the most recent observations:—

<i>Alnus antiquorum</i> , Sap.	<i>Cornus</i> , sp.?
<i>Betula gypsicola</i> , Sap.	<i>Hedera</i> , sp.
<i>Ostrya humilis</i> , Sap.	<i>Acer ampelophyllum</i> , Sap.
<i>Quercus salicina</i> , Sap.	<i>Cratægus nobilis</i> , Sap.
<i>Ulmus plurinervia</i> , Sap.	<i>Cercis antiqua</i> , Sap.
<i>Populus Heerii</i> , Sap.	

More than half the genera that figured in my list appear to have disappeared in the period extending from the Middle Miocene to the Upper Eocene. Those which remain are represented in each locality only by a very small number of species, or even by a single one. Most of these species, however, are very well characterized, and known by their fruits as well as by their leaves. The fruit of *Ulmus plurinervia*, lately found by M. Marion, indicates a species very nearly allied to our *U. campestris*. The leaves of *Cratægus nobilis* are hardly to be distinguished from those of our hawthorn. *Cercis antiqua* differs but little from our *C. siliquastrum*; but *Betula gypsicola*, from the examination of its leaf, would resemble the smallest forms of its genus; whilst *Populus Heerii* resembles *P. euphratica*, Oliv., in its fruit, and *P. laurifolia*, Leb., in its leaf. There is therefore a very considerable diversity in the mutual affinity of these types with those of the present day. In general they are remarkable rather by a sort of stunted condition of the foliaceous appendages (which leads us to ascribe to them only a moderate size) than by their differential characters, which present nothing very striking.

I had formerly thought that the flora of Aix was really the starting-point of that boreal group which we have seen reappearing with so much persistency at all the steps of the series of stages; and what confirmed me in this notion was, that the previous stages did not contain any very distinct traces of it; but during the last few months my profound study of the plants from the celebrated locality of Sézanne, belonging to the stage of the sands of Rilly, has compelled me to abandon this opinion.

In fact, in this the oldest known flora of the Tertiary epoch, I have observed, in the midst of a multitude of Dicotyledons of exotic physiognomy, and very difficult of determination, traces of a portion of the European genera the progress of which we have just followed; and among these I have even met with some

which appeared to be absent from the last floras that we have passed in review. The following would be the enumeration of these genera, assuming as well founded presumptions suggested by a nearly definitive examination:—

Alnus: two species, one modelled on the type of *Alnus cordifolia*, Ten., and the other on that of *A. glutinosa*, Gaertn.

Betula: a species analogous to *B. lenta*, Linn.

Dryophyllum, Deb.: three species analogous to certain species of *Quercus*, *Castanea*, and *Castanopsis*.

Ulmus: a very distinctly characterized species.

Populus: a species analogous to *P. heterophylla*, Desf.

Salix: two species analogous to *Salix fragilis*, Linn., and *amygdalina*, Linn.

Hedera: a species reproducing the type of *H. helix*, var. *hibernica*.

Cornus: a species analogous to *C. officinalis*, Lieb.

Juglandites: several species, one of them not far from *J. regia*.

This group is remarkable for its conformity with the preceding data. Most of the genera the existence of which in the last place was ascertained reappear; and we remark no alteration in their physiognomy, except that which results from the aspect of the vegetation of which they form a part—that is to say, a development of the foliaceous limb, peculiar to most of the plants of Sézanne. It appears from their examination that the period at which they lived, or perhaps only the locality where they grew, favoured in them this expansion of the appendicular organs, which contrasts so strongly with the stunted and coriaceous forms of the period of the gypsum of Aix. However this may be, and notwithstanding the doubts which may still attach to some of the determinations indicated by me, most of these genera appear to me at present to be legitimately determined, so much do they approach the corresponding existing types. I will indicate *Alnus*, *Ulmus*, *Salix*, *Populus*, *Hedera*, and *Cornus* as those the unexpected existence of which at so distant a period appears to me best demonstrated.

Still further on, in the Upper Cretaceous period, the existence of European genera has not been ascertained, except in a very vague manner. The investigations are too recent and the observations too rare to inspire complete confidence. I think, therefore, that the *Carpinites*, *Acerites*, and *Juglandites* of this period must be subjected to a fresh examination before they can be accepted as corresponding with types really allied to those from which their denomination has been derived. Nevertheless I have lately had in my hands some impressions from the Upper Chalk of Halden, in Westphalia, resembling the genus *Alnus* in several details of form and venation; the *Dryophylla* of Aix-la-Chapelle have too close analogies with the *Cupuliferæ* to be quite foreign to that group; and we must also mention the

Liriodendron Meckii, Heer, indicated by Dr. Heer in the Upper Chalk of Nebraska, associated with *Magnoliæ** and other Dicotyledons, among which the learned professor of Zurich thought he could recognize the genera *Populus*, *Salix*, and *Platanus*, although too doubtfully to allow their presence to be positively affirmed.

We must therefore stop at this latter limit and close this long examination. Leaving all theory out of the question, it appears, from the combined progress of the tropical and European types, that these two categories have coexisted for a long time without eliminating each other, but simply in juxtaposition. The time during which this juxtaposition lasted was much longer than has hitherto been supposed. It extends from the extreme base of the Tertiary series nearly to the close of the Swiss Mollasse. In fact it is only at this epoch that the tropical types decline and are gradually eliminated by the genera which have remained proper to the boreal zone, and of which the preponderance increases in the same proportion. Between these limits the two groups live associated together without any great variation in the physiognomy and relative proportions of the indigenous group, although its part must sometimes have diminished to such an extent as to deprive us of the traces of its existence, or at least to render them very rare.

III.

All that is necessary now is to sum up the preceding observations, so as to draw general conclusions from them.

If we consider plants alone, geological time may be divided pretty naturally into a certain number of great phytological periods.

In the first and most distant we cannot indicate with certainty any of the existing genera: Dicotyledons and Monocotyledons are absent; we observe exclusively Vascular Cryptogamia and Gymnospermia; a portion only of these plants enter into still existing families; the indications derived from the observation of these seem to announce the existence of a warm, humid, equable climate, subjected to uniform conditions all over the globe.

In the second period, which includes the Triassic, the Jurassic, and a part of the Cretaceous epochs, the character of the vegetation changes sensibly. We can already indicate a small number of genera identical with those of the existing world; the

* The persistence of the characteristic types of the present temperate regions in the secondary formations is also attested by cones of the genus *Cedrus*, in admirable preservation, observed by M. Heer in the chalk of Moletain in Moravia.

plants may be classed in still existing families; but the Dicotyledons are still absent, and the Monocotyledons scarcely make their appearance. The appreciable indices show the existence of a temperature approaching that which prevails in southern countries in the vicinity of the tropics, between 20° and 30° S. lat. This temperature may be estimated at a mean of 20° C. ($=68^{\circ}$ F.).

The Cretaceous series, starting from its middle stages, constitutes a third period, resembling the preceding in certain respects, by the persistence of the same genera. Nevertheless the Cycadææ begin to decline, the Pandanææ and the Palms are developed, and, lastly, the Dicotyledons make their appearance and multiply rapidly.

The signification, however, that must be attached to these different evolutions is still somewhat ambiguous, since plainly tropical types, such as the Pandanææ, are thenceforward associated with subtropical Australian types, such as the Proteaceæ and *Araucaria*, boreal types, such as *Sequoia* and *Cedrus*, or cosmopolite types, such as the Myricææ. All these indications combined seem to denote a tropical temperature with no excess, probably variable according to the seasons in a degree which it is difficult to appreciate.

The inferior Tertiary, including the Tongrian, forms a new period, during which the genera which have since continued characteristic of the boreal zone appear in juxtaposition with genera with tropical or subtropical affinities; but the former remain stationary or subordinate, whilst the latter do not cease to develop themselves and maintain their preponderance. According to all indications, the temperature was then that of the present tropical regions; but the climate (that is to say, the proportion of humidity and the distribution and economy of the seasons) must have varied several times—changes reflected by the vegetation, which differs from stage to stage, whilst that of each stage presents a general resemblance. It is by this means that we may explain the alternate predominance and exclusion of the Proteaceæ, and the successive enlargement and diminution of the leaf, through the Suessionian, Eocene, and Tongrian stages.

The Miocene, or Middle Tertiary, constitutes by itself a fifth period, during which the vegetation of ancient Europe attains its highest degree of development. This state of things is prolonged up to the level of Eningen, but without remaining stationary: the types characteristic of our zone are constantly being developed and completed, as well as the subtropical types; the tropical and Australian types, on the contrary, tend to depart and disappear.

The Pliocene age constitutes a last period, during which the

tropical types finally disappeared, the subtropical ones still persisting; but the predominance from that time attained by the European types tends to become more and more exclusive, while the temperature, following the same movement, gradually decreases so as to become more and more like that which we now have.

Thus, to sum up, the temperature has formerly undergone oscillations which it is difficult to define; but, notwithstanding these variations, it preserved a degree of elevation nearly equal to that which now exists under the tropics, until after the middle of the Tertiary period.

It is only after that point (that is to say, about the epoch at which the Swiss Mollasse was deposited) that it began to decline; and yet, long before this age, continual transformations had taken place in the midst of the vegetation of ancient Europe—changes correlative with a progress which may be spoken of as regular through all the periods. We must therefore be careful not to confound the effects of temperature with those of organic evolution, which brought about the first appearance and then the development of the various types of plants.

The two phenomena are far from standing towards each other in the relation of effect and cause. At the utmost the modifications of temperature have constituted occasional circumstances with which certain evolutions may have corresponded. It is impossible at this distance to conjecture the nature of the circumstances which must have occurred; but in assuming the presence of certain truly tropical genera as a proof of elevation of temperature, we see that the first ascertained types only partially correspond with this supposed elevation; whilst, on the other hand, the appearance of the European types by no means coincides with any lowering of the primitive temperature. We see also that these types, or at least several of them, were already fixed at a very distant epoch, and have not since varied, even as regards the consistence of the foliaceous tissue, which must have been membranous and caducous at that time as at present.

With regard to the progress proper to all these genera, we must distinguish two kinds of evolution,—one peculiar to such genera as *Alnus*, *Carpinus*, and *Ulmus*, of which the physiognomy is uniform, and which include a rather small number of species. The species of these genera, similar in time to what they are now in space, occur from their origin with their present physiognomy; they are only scarcely diversified impressions of a not very variable type. The other kind of evolution applies to more numerous and heterogeneous groups, which, like *Quercus*, include species of very diverse forms and aptitudes. Here the

evolution has rather been successive; that is to say, certain sections have preceded others which have come more slowly upon our ground: this more or less regular progress consists in a sort of elaboration in which the notion of specific individuality is much weakened. In the genera with a fixed physiognomy this notion disappears still more; so that in vegetable palæontology everything concurs to increase the importance of the type to the detriment of the species, since the former does not cease to manifest its action during a very long period, whilst the species issuing from this type resemble each other, notwithstanding the diversity of the epochs to which they belong, to such a degree that they are sometimes not very distinguishable.

In Palæozoic times the heat may have been greater than it is now even under the equator; nevertheless we have no direct proof of this by means of plants, since the number of arborescent ferns has been found to be less than was at first supposed. We know only that the temperature of the terrestrial surface was then more uniform, more equable than at present; and that the polar regions themselves, participating in this uniformity, possessed plants like those of other countries.

This is a noteworthy fact, but one the importance of which must not be exaggerated, since the same fact existed again towards the Miocene period. The polar forms of the Carboniferous formation, which, in part at least, are specifically distinct from those of other contemporaneous regions, may have been capable of supporting a temperature relatively colder than that which governed the coal-vegetation of the rest of the world. It is therefore by no means impossible to conceive a certain gradation of climates in this primitive period.

The absence of any classes of plants except the Cryptogamia and the Gymnospermia cannot be an argument in favour of an excessive elevation of temperature during this primitive age, since the organic development from which the vegetable kingdom has issued has operated in a gradual and determinate order, which, so to speak, implies the anteriority of certain classes. This anteriority must have depended at least as much on the mode of evolution proper to the vegetable kingdom as on the degree of elevation of the initial temperature. The most we can say is, that, organisms having been in all times adapted to the external circumstances in the midst of which they are produced, we may deduce, by analogy, from the examination of these organisms the determination of the circumstances themselves; and it is in fact at this point that we must stop.

Whatever may have been the initial elevation of the temperature, the data that we obtain from fossil botany for the Coal period are reduced to the following, namely, its greater uniformity, its

warm humidity, the probable density of the atmosphere, and a much less influence of latitude. It is for the stratigraphical geologist to determine whether, as is generally admitted, the internal heat may have still acted efficaciously in increasing the temperature through the already thick crust of the rind of the earth, and whether thermal springs could rise, as they subsequently did, through beds much less folded and fractured, in rocks for the most part not stratified, and in the absence of any considerable elevations. Lastly, the initial temperature must have undergone climatic combinations very different from those of the succeeding epoch, since the elimination of most of the types of this first vegetation was rapid after a certain point of time, and many of them disappeared for ever.

The temperature of the secondary periods (still consulting only the indications furnished by plants) cannot have exceeded, and perhaps did not even equal, that of our present intertropical regions. The types of this period which still exist (*Equisetum*, *Araucaria*, *Encephalartos*) tend to prove this. In any case the climate was differently constituted, and the ground more broken up than before, since the Cycadeæ, which now predominated, are not plants of the marsh and riverside, but prefer to inhabit slopes and ridges.

The first appearance and development of the Angiospermia, and especially of the Dicotyledons, must have been the result of an organic evolution; it is impossible for us to conjecture whether the state of the temperature contributed to it at all. Great organic changes took place during the second half of the Cretaceous period; and the result of these changes, perhaps combined with the emergence of land, which then took place on a large scale, may have been to favour the origination of new types at the expense of the old ones. This movement is still more strongly marked at the commencement of Tertiary time, when most of the existing groups, or at least those which include the ligneous plants, appear endowed with the same characters which still distinguish them, and which have not since varied in anything essential. If the temperature seems to have remained stationary, the climate, or the external conditions of this temperature, appears to have changed repeatedly. Hence arise very sensible variations, by the predominance or exclusion of certain groups and the characteristic physiognomy of certain floras. Nevertheless these exclusions could not be absolute, but relative to certain regions or to the localities capable of furnishing us with impressions. The group of the Proteaceæ, developed in the first place during the Upper Cretaceous period, and effaced during the deposition of the Suessonian, reappears afresh after this epoch, and presents itself as far as the Miocene.

This intermittence is one of the principal phases of the alternations which we remark in the ancient vegetation, without being able yet to define them exactly. Nothing, I again repeat, indicates that the temperature was then sensibly lowered; but it is remarkable that the European genera seem to have been favoured in their origin by the very circumstances which were unfavourable to the Australian types, and especially to the Proteaceæ*. The latter, indeed, like the Cycadeæ themselves, as is proved by the presence in the Miocene of *Zamites epibius*, Sap. (Bonnicux), *Lomatites aquensis*, Sap. (Bonnicux, Manosque), and *Grevillea anisoloba*, Brong. (Koumi), did not disappear entirely until the European genera had become developed so as to occupy an important place in the vegetation.

About this period (that is to say, after the Tongrian) the new revolution seems to have been completely achieved; the various groups of the vegetable kingdom occur in Europe combined pretty nearly as they are in the most favoured subtropical regions of the existing world.

The richness of this vegetation, of which the flora of Armissan and subsequently that of Æningen furnish us two magnificent specimens, is very great. We must not, however, conclude from it that the vegetable forms of the whole world were then united in Europe—though the Europe of that period would have no occasion to envy the most luxuriant of existing countries. Latitude as yet exerted its influence only in a feeble manner. The palms, which were very numerous in southern Europe along the shores of that sea of the Mollasse which cut through its centre, became less numerous to the north of that sea; the Laurineæ, which were there very abundant, penetrated to the neighbourhood in which the Baltic now exists, where a leaf of *Cinnamomum* has been found in a piece of amber; Cupressineæ, probably of the genus *Thujopsis*, of which this substance was the resin, formed beyond, in conjunction with pines, vast forests; further still

* We must insist upon this double fact, which is so conclusively proved by the organic evolution of the vegetable types which seem at present reciprocally to exclude each other: the pines and cedars, Coniferæ now proper to the boreal zone, appear in Europe from Secondary times in the midst of *Aravcaria*, Proteaceæ, and forms of Cycadeæ which are no longer observed except in the southern hemisphere; on the other hand, these latter types do not finally quit our soil until the Tertiary epoch is already far advanced. Thus the existing boreal types made their appearance in the midst of vegetation to a great extent Australian, and the Australian types disappeared from our zone only when the European vegetation had already acquired the physiognomy which distinguishes it. It is therefore only in the course of long periods that the various vegetable communities have been constituted and differentiated by the progressive development of their characteristic elements, and the slow elimination of those which have become foreign to them.

towards the north, Iceland and Greenland possessed not only pines and birches, poplars, willows, oaks, and alders, but also *Sequoia* and *Salisburia*, elms, hornbeans, figs, *Magnolia*, *Liriodendra* and vines, the analogues of which cannot now be found nearer than at least 12° more towards the south: these organisms required, in order to fructify and propagate, a mean temperature which M. Heer estimates at not less than 9°·5 C. (=49° F.). Even beyond the Polar circle, at Spitzbergen, about 79° N. lat., the Tertiary vegetation, according to the same author, still included hazels, hornbeans, and planes; and this vegetation was probably continued to the Pole itself.

Such was Europe in the Miocene age; only at the end of this period, in consequence of phenomena of which we are ignorant, or perhaps by the action of several combined causes, the temperature tended to diminish: this decrease, when once well marked, continued until the glacial times, when the cold, exceeding that of the present period, drove from our soil the greater part of the plants which previously ornamented it, and which, but for this circumstance, would have remained upon it, at least in part, and would have still subsisted there—our climate, in consequence of a fresh change, having subsequently been tempered.

L.—*On the Occurrence of Ichthyosaurus and Plesiosaurus in Australia.* By FREDERICK M'COY, Professor of Natural Science in the University of Melbourne, and Director of the National Museum of Victoria.

To the Editors of the Annals of Natural History.

GENTLEMEN,

Referring to my paper in your Journal for November 1865, on the discovery of Cretaceous fossils in Central Australia, I have now the great pleasure of announcing the important fact that additional specimens have been received from Messrs. Carson and Sutherland, from the same locality, on the head of the Flinders River, enabling me to demonstrate the existence of Enaliosaurian reptiles in continental Australia during the period of Mesozoic deposits, which most geologists suppose not to occur in Australia. The remains are of the two well-marked genera *Ichthyosaurus* and *Plesiosaurus*. Of the former there are numerous vertebræ, deeply biconcave with conical articular surfaces, the centrum 4 inches wide, 3 inches deep, and 1½ inch long. The species I name *Ichthyosaurus australis* (M' Coy).

One of the species of *Plesiosaurus* has a slight resemblance to the New Zealand species noticed by Professor Owen, but is

obviously a distinct species, from the difference of its proportions. The length of the centrum of the trunk is $2\frac{1}{4}$ inches, width $3\frac{3}{4}$ inches, depth $2\frac{1}{2}$ inches. I name it *Plesiosaurus Sutherlandi* (M'Coy), in honour of the finder.

The second but not so abundant species is known by cervical vertebræ only, and appears specifically distinct from the former by the extraordinary rugosity of the edges of the articular ends of the centrum, each of which presents a remarkably elongate form, from which, if the species prove distinct, I would name it *Plesiosaurus macrospondylus* (M'Coy). Each centrum is 3 inches long, 3 inches wide, and $2\frac{1}{2}$ inches deep.

With these are remains of two Cephalopods (tending to prove the correctness of my previous reference of the deposit containing these fossils to the Lower Cretaceous period), namely:—A gigantic species of *Ancyloceras*, exceeding the *Ancyloceras gigas* of the Isle of Wight in size, and differing by having the transverse ribs larger, forking on the sides, and a row of large compressed tubercles on each side of the back; it most resembles the *A. Zabarelli* of the French Lower Greensand. I name it *Ancyloceras Flindersi* (M'Coy).

The second important mollusk is a Belemnite with the two dorsal sulci and general size and broadly hastate shape of the *Belemnitella plena* of the English, French, and German Lower Chalk so closely reproduced as almost to warrant the reference of it to a variety of the same species. Like most specimens of *B. plena*, it is broken off at the bottom of the phragmacone. As it is rather larger, the dorsal furrows a little further apart, and I see no trace of the ventral furrow, I name it separately *B. diptycha* (M'Coy).

I remain, Gentlemen,

Yours, &c.,

Melbourne, Feb. 26, 1867.

FREDERICK M'COY.

II.—On the Peculiarities of some *Stylospores* of *Sphæriæ*.

By H. KARSTEN*.

[Plate X. figs. 5–13.]

IN the opened anthers of *Fuchsia splendens* I found, besides the more or less irregularly developed pollen which was interwoven with a delicate colourless mycelium, some small, globular, grey *Sphæriæ*, finely villous externally and furnished at the vertex with a circular orifice, which was not drawn out, and was sur-

* From Karsten's 'Botanische Untersuchungen,' 1866, pp. 336–340; with an additional paragraph by the author. Translated by W. S. Dallas, F.L.S. &c.

rounded by fine hairs*. These were either perfectly separate (Pl. X. fig. 11) or two or three of them were united to each other without any pedunculiform supporters (fig. 13). When moistened with water, a white tortuous thread issued from the vertical orifice of these *Sphæriæ*, and quickly broke up in the water into innumerable simple oval vesicles (fig. 12), which, when moistened with dilute solution of iodine, acquired, like starch, a beautiful violet colour, and when preserved in glycerine, disappeared in a little time.

This is probably the first known example of a starch-reaction in the spores of Fungi, as which (and, indeed, as stylospores) I think these corpuscles must be regarded; and although a similar reaction of the spores was observed by Currey in the Lichens, and, indeed, in the plant named *Amylospora tremelloides* by that botanist, it is nevertheless worthy of notice as certainly a very rare occurrence among the Fungi in general.

For, to my knowledge, this starch-reaction has been observed in Fungi only in the filamentous excrescences of some species of *Erysibe* by Tulasne, in the tissues of the fruit of *Septoria Ulmi* by Mohl, and in the mycelium of *Polystigma rubrum* and *fulvum* by Bary. The behaviour of this tissue, in the iodized condition, towards glycerine is not mentioned by these observers: it certainly behaves differently from the starch-grains of the Lichens which react in the same way with iodine; for these (at least in *Cetraria islandica*) retain their form and reaction for years when preserved in glycerine. Consequently these spores of *Sphæria* must possess a peculiar chemical constitution, of which hitherto nothing has been known.

I found a very singular form of stylospore in a *Sphæriacean* which was growing, in June, in the tissues of the leaf-sheaths, chaff, and straw of *Festuca ovina* †.

The *Sphæria*, completely concealed beneath the epidermis of the stem, which is blackened at these spots, stand close together in groups without any amalgamation; they are nearly spherical in form, and have a very small vertical orifice, which is just

* Although I observed no perithecia furnished with spore-sacs, but only the so-called pycnides, this plant, from its similarity of habit to the *Sphæria* of the section "villosæ" of Fries, may be placed, until we know more about it, in the vicinity of *S. canescens*, Pers., and denominated *S. amylospora*.

† In the leaves of the same *Festuca* there was a Nematoid worm resembling *Anguillula Dipsaci*. This worm, which has still to be carefully studied, was discovered near Stralsund by M. Heinrich, who was kind enough to communicate it to me. The worm lays its eggs in groups in the parenchyma of the leaf, and then dies beside them; they are at once developed into young worms, and probably, like *A. Tritici*, pass the winter in an asexual condition in the place of their birth.

produced into a very short neck. These orifices are situated in the nearly unaltered epidermic layer, and resemble large stomata with white margins. In this way the *Sphæriæ* lie in rows in the parenchyma between the ribs of the above-mentioned organs, without raising the epidermis. The cellular tissue of the grass in the region occupied by the *Sphæriæ* is more or less completely displaced by mycelium, which forms a dense mass between the vascular bundles, and usually also immediately surrounds the *Sphæriæ*. The dark-grey *Sphæriæ* consist of a thin cortical tissue drawn out a little in the form of a mouth at the vertex; the outer cells of this, as is shown in fig. 5, are larger, darker-coloured, and rather thicker in the walls than the smaller, inner, very delicate, and pale coloured cells. The very large cavity of the fungus is filled with a white substance, which consists of delicate cylindrical spores, truncated and beset with a circlet of hairs at each end (fig. 6). Apparently these spores are produced singly upon very delicate footstalks, which spring from the inner wall of the perithecium; at least, in very fine sections, spores are seen standing all round the wall, as if they were supported upon the delicate filiform processes of the latter; but I was unable to detect this with perfect certainty.

From the uninjured *Sphæriæ*, when placed in water, these spores issue for a long time in a continuous stream, separating readily from each other at any movement of the water. The five or six very delicate hairs attached in a circle to each end of the spores are not simple, but usually forked once at about half their length; they are about half as long as the entire spore, and stand stiffly off all round, like a funnel- or wheel-shaped pappus.

The spindle-shaped body of the spore is partly opaque and apparently albuminous; but it also allows from two to four corpuscles of gelatinous appearance to be detected in it; in place of these, when the spore has lain for some time in water, small thin-walled vesicles occur, which, no doubt, were there before, but enveloped in the albuminous matter, which also fills their cavity. In many spores, two of these vesicles (those which are situated near the two ends of the spore) become enlarged in the direction of the middle of the spore, until finally they entirely fill it, and form a delicate transverse wall in the middle by their approximation. In the neighbourhood of this septum they swell more and more, so that each of them becomes pyriform, and the cylindrical spore more or less biscuit-shaped (fig. 7).

The tension exerted upon the mother cell (which probably no longer grows), in consequence of the continued centripetal growth of the two daughter cells, is no doubt the reason that the spore subsequently breaks across at the point where these two in-

creasing cells are contiguous* (fig. 8), in which case, however, the two halves generally adhere to each other for a long time on one side, whilst one of the two daughter cells thus still connected begins to elongate in the same direction, and grows up into a germ-tube filled with granular fluid (figs. 9, 10).

The capilliform appendages of the spores are retained until the germ-tube has attained a considerable size; afterwards they become indistinct, and at last are no longer to be detected. In this way the criterion is lost as to the nature of the mycelium which afterwards occurs at the spot where these germ-tubes were developed; so that a confusion may easily arise. To me, however, the mycelia, from their great delicacy, appeared so like the germ-tubes that I thought they might be taken for products of the latter, especially as they occurred on those parts of the object-slide where the greatest quantity of spores had germinated. They grew very slowly upon the slide kept in moist air; and it was not until after the lapse of six weeks that some branches rose, like hyphæ, at the apex of which single, very small, oval, opaque, and rather dark sporidia were developed. By the side of the few developed mycelia the greater part of the spores remained unaltered, without germinating. Experiments made upon living plants of *Festuca* produced no results.

Besides the *Sphæriæ*, there was in the tissues of the *Festuca* a second mycelium, recognizable by the rather greater diameter of its tubes; of this a few branches had grown out through the stomata, and bore *Sporidesmium*-spores. I could not ascertain that there was any connexion between this fungus and the *Sphæria*. As no tubular spores of this fungus were observed, but only the one developmental form, its relationships also remain doubtful for the present. The rather dense, soft, *Sclero-*

* Exactly similar phenomena are observed in the increase of the joint-cells of the *Edogonia*, *Spirogyræ*, and similar *Confervaceæ* (*Gesammelte Beiträge*, pp. 375 & 427, taf. 23 & 25; *Ann. & Mag. Nat. Hist.* ser. 3. vol. xiii. pp. 12 & 71, pls. 5 & 7). Although the *Fungi* in general are excellent objects for the study of the origin and development of cells, these spores, partly from their small size, partly on account of the albuminoid, opaque contents in which the nuclear cells are imbedded, are not applicable to the former purpose; but the growth and enlargement of the two daughter cells may be observed here upon the object-slide as distinctly as in many other cells of *Fungi* and *Algæ*. It is only by such actual observation of cell-development, and not by hypothetical combinations of different developmental states of cambium-cells, that our knowledge of cell-life can now be advanced: of this the workers in this department of our science must first of all convince themselves, in order that we may at last arrive at a conclusion with regard to this important fundamental point in physiology. The production and development of the cambium-cells can only be correctly understood by means of the analogy of these actually observed developmental phenomena.

tium-like mycelium which surrounds the perithecium in the interior of the plant on which it lives reminds one of *S. Graminis*, Pers., of which the preceding may perhaps be the pycnidic form.

Previous observers of this fungus also have always found only this one form of spore, and regarded it, like myself, as a stylospore, and not as an ascus, which likewise might be justified*.

Desmazières first described such spores, in a Fungus which occurred upon *Alopecurus*, *Agrostis*, and *Holcus*, under the name of *Dilophospora Graminis* (Ann. Sci. Nat. sér. 2. tome xiv. p. 5, pl. 1. fig. 2 a, b, c). Fuckel found a species of the same genus upon *Holcus lanatus*, and published it as *Dilophospora Holci* (Bot. Zeit. 1861, p. 250). Berkeley afterwards detected a very similar fungus as the cause of disease in a wheat-field (Horticultural Journal, 1862, No. 5). The spores, however, are described by this mycologist as furnished with only three, perfectly simple, much broader, linear, pointed, and not filiform appendages at each end; whilst Desmazières describes and figures the spores observed by him as furnished with three, or even only two, filiform appendages, which were sometimes simple, but usually forked once or twice. Fuckel describes his *Dilophospora Holci* as breaking out from yellow spots on the grass-leaf—a peculiarity not presented by the *Holcus*-leaves examined by me.

Further observations must decide whether these differences express the peculiarities of different species of plants, or only variations of one species.

LII.—Note on the Reproduction of the Aphides.

By Professor E. CLAPARÈDE †.

THE reproduction of the *Aphides*, after having attracted the attention of so many distinguished men, has recently given rise to fresh investigations on the part of two observers, M. Meczni-
kow and M. Balbiani. The results at which these two naturalists have arrived show plainly that the subject was far from being exhausted. Each of them has worked independently. The first of M. Meczni-
kow's publications ‡ is anterior by some months to the first communication of M. Balbiani to the Academy of Sciences in Paris (4th, 11th, and 25th June, 1866). Nevertheless the latter author seems to have had no knowledge

* Schlechtendal, Bot. Zeit. 1863.

† Translated by W. S. Dallas, F.L.S. &c., from the 'Annales des Sciences Naturelles,' 5^e série, tome vii. pp. 21-29.

‡ "Untersuchungen über die Embryologie der Hemipteren," Zeitschr für wiss. Zool. xvi. p. 128.

of it, since he does not mention it in a subsequent, more detailed paper*. The differences between these two observers have become still more striking since the publication of a very elaborate memoir by M. Mecznirow†, accompanied by more than fifty figures relating to the embryogeny of the *Aphides*, and which is only the development of the note already cited.

On examining the publications to which I have just referred, it is easy to see that both M. Mecznirow and M. Balbiani have very conscientiously studied the objects that they had before them, and that in most cases they have seen exactly the same things. And yet what a distance there is between the final results at which they have arrived! A single word will suffice to make this intelligible: with M. Mecznirow the *Aphides* are agamogenetic; with M. Balbiani they are hermaphrodites.

How are we to choose between these opposite results, announced by observers apparently equally conscientious? The only way is evidently to take up the subject again *ab ovo*, and to submit all the divergencies to the touchstone of new and impartial observations.

This is what I determined to do by an investigation of *Aphis Rosæ*, of which the embryos are comparatively favourable for researches of this nature. The theory of the hermaphroditism of the *Aphides* is untenable. Its author, founding his opinion upon certain facts carefully observed, has evidently allowed himself to be carried far beyond the conclusions to which they could legitimately give rise. His meeting by chance with certain morbid phenomena has also perhaps assisted to keep him in the track into which he had strayed. I do not hesitate to assert that any one who will have the patience to resume carefully this minute investigation will be compelled, while rendering justice to the labours of M. Balbiani, to reject completely the consequences which that author has drawn from them.

The problem of the reproduction of the *Aphides* is very simply solved, according to M. Balbiani, in the following manner:—From the first moments of embryonic life the blastoderm gives origin to two juxtaposed cellular masses, one colourless, the other permeated by granulations which give it a green or greenish-yellow tinge. Of these two masses the first becomes an ovary, and the second a testis, in which are developed zoospermia in the form of *Amæbæ*. These zoospermia fecundate the ovary, the testis itself disappears, and the fecundated ova

* Journal de l'Anat. et de la Physiol. 3^e Année, No. 5, September and October 1866.

† "Embryologische Studien an Insekten. Die Entwicklung der viviparen Aphiden," Zeitschr. für wiss. Zool. xvi. p. 437.

commence their evolution even in the interior of the embryo still contained in the body of its mother; consequently there is neither alternate generation nor parthenogenesis.

The two cellular masses to which M. Balbiani ascribes so important a part in the reproduction of the *Aphides* really exist, as we may easily ascertain. M. Mecznikow has studied them with extreme care. The colourless one he regards as a blastogene or *pseudovarium*, so that he attributes to it the same physiological part as M. Balbiani. But the other, the green mass, the testicle according to M. Balbiani, is regarded in a very different light by M. Mecznikow; he gives it the name of *secondary vitellus*, because he considers it a magazine of material fitted to be assimilated in the course of the organogenetic process. We shall see that this latter interpretation is by far the most probable; but for this purpose it is necessary to go back to the origin of the matter.

The extremity of each compartment of the *pseudovarium* is occupied by numerous nuclei disseminated in a protoplasm. These nuclei are the germinal vesicles of the future ovules; in fact the lowest one becomes isolated from the others, and surrounds itself with a mass of protoplasm, in which refringent granules soon make their appearance: this is the ovule. M. Balbiani, adopting throughout his memoir M. Robin's theory of the production of cells by gemmation upon the periphery of a blastoderm, represents the ovules as originating by gemmation upon the surface of a central cell. M. Mecznikow nowhere mentions or figures this central cell of the pseudovarium, nor have I succeeded in discovering it. But, however this may be, as soon as a *pseudovum* attains maturity in the lower part of the compartment of the pseudovarium its evolution commences. We soon see, in the midst of the vitelline granules, several clear nuclei, very similar to what the germinal vesicle was originally. M. Mecznikow regards these nuclei as having been produced by the division of this germinal vesicle. Is he quite right upon this point? I cannot venture to decide*. What is certain is, that these nuclei multiply and advance to the periphery, where they are found lodged in a layer of protoplasm, constituting thenceforward a true blastoderm. This membrane, in fact, becomes cellular by a differentiation of the protoplasm, which groups itself in little masses round each of the nuclei.

M. Balbiani, indeed, represents matters in a very different light; but it is impossible for me to agree with him. He first

* In certain *Acari* I have convinced myself that the nuclei of the blastoderm result from the division of the germinal vesicle; but I reserve these observations for future publication.

of all makes the germinal vesicle disappear in a homogeneous vitellus. As to the mere fact of the persistence of the germinal vesicle, it is, I admit, very difficult to arrive at perfect conviction, because it is possible that the first nucleus, from which all the nuclei of the blastodermic cells are produced by division, might be itself produced spontaneously in the midst of the vitellus some time after the disappearance of the germinal vesicle. Therefore I do not venture to pronounce too absolute an opinion upon this point; but in any case it is not true that the vitellus is homogeneous at this period. On the contrary, it contains numerous granules collaterally with the germinal vesicle, as M. Mecznikow has very well shown; and as regards the formation of the blastodermic cells by gemination at the surface of the vitellus (Robin's theory), as represented by M. Balbiani, I do not know how we are to reconcile it with the incontestable multiplication of the nuclei in the interior of the vitelline mass—a phenomenon to which I have just alluded.

The blastoderm formed surrounds the ovum, now become pyriform, over its whole surface, except at the inferior pole, as M. Mecznikow and M. Balbiani describe. The portion of the blastoderm in the neighbourhood of the inferior pole develops into a sort of cylindrical process, which is soon detached by a complete constriction, and separates from the embryo properly so called. This body, seen by both M. Mecznikow and M. Balbiani, has been very differently regarded by them. We shall not take any notice of it, as it plays no active part in the organogenic evolution.

From this moment the embryo presents an oval form, and is composed only of an external blastodermic layer and of a central vitelline mass. M. Balbiani calls this mass a *cell*. I regret to have to introduce here a discussion of words, but I cannot subscribe to this denomination. No doubt the investigations of MM. Brücke, Beale, Max Schultze, Häckel, and others have compelled us to accept a singular transformation of the nature of the word *cell*; but there is a long way from this to the confusion introduced into scientific language by M. Balbiani, a confusion to which I shall again have occasion to refer. With him, it would appear, the word *cell* is to be applied in histology to whatever has form; whilst with all histologists who still employ this term, the name *cell* can only be applied to a protoplasmic mass, which, at least during part of its existence, is furnished with a nucleus, with its well-known physical and chemical characters. Now the vitelline mass in question certainly has an ovoid form, since it is bounded by the blastoderm; but it possesses no nucleus, and consequently can on no account merit the name of *cell*. But we may pass over this technical point,

and the rather because, I repeat, the description of the blastoderm, as given by M. Balbiani, is correct in its chief points.

In consequence of a multiplication of the cells at the inferior pole of the blastoderm, this gives origin to a protuberance, which projects into the central vitelline mass. This protuberance gradually increases in size, and subsequently plays an important part in the organogenesis; but we may remark at once that, in proportion as the protuberance is developed, the vitelline mass diminishes by absorption, and finally even disappears completely.

One cell of the protuberance in question soon distinguishes itself from the rest by its green colour, due to the appearance in its protoplasm of a multitude of little coloured granules. This cell multiplies itself rapidly, giving origin in consequence to a mass of green cells, to which I shall apply the name of the *green mass*, so as not to prejudge its physiological value. It will be seen already that this is the *testis* of M. Balbiani*, the *secondary vitellus* of M. Mecznirow. At this same period of embryonic life a group of cells is seen to detach itself from the blastodermic protuberance and attach itself to the side of the green mass; and this will afterwards constitute the blastogene or *pseudovarium*, as both M. Mecznirow and M. Balbiani have proved.

I pass rapidly over these remarkable phases of organogenesis, because, with the exception of a few details, they have been represented in a very similar manner by the two physiologists who have led me to take up the pen; but at this point it is desirable to dwell upon some histological details, as upon these M. Balbiani has raised his theory, seductive but, I think, radically false, of the hemaphroditism of the *Aphides*.

According to M. Balbiani the cells of the organ in question, when once penetrated by the fine granulations which give them their green colour, generate in their interior a multitude of small, pale daughter cells, furnished with a membrane and with a nucleus, which he regards as cells of development of the spermatogenic elements. They are in fact soon replaced by innumerable small dark corpuscles of 0.001–0.002 millimetre in diameter, which, under a high power, appear “like very small *Amœba* ;” but, adds the author, “their form does not seem to change under the microscope.” “The mother cells,” continues M. Balbiani, “have then lost their transparency and their green colour; they have become opaque and brownish, and readily

* M. Balbiani, properly speaking, represents this green mass as originating, not from the blastodermic protuberance, but from the cylindrical process, which, I have said, plays no active part in the development of the ovum. I do not see that I can agree with him on this point.

break up, resolving themselves into a sort of dust after the destruction of their enveloping membrane. In many *Aphides* these amœboid corpuscles undergo a further degree of evolution by their conversion into little unequal bacilli, which are straight or variously bent, immobile and colourless, and from 0.005 to 0.020 millimetre in length. One would easily be led to take them for a parasitic vegetable production, but for having witnessed all the successive phases of the transformation of these elements." (Balbiani, *loc. cit.* pp. 548, 549.)

These observations, and the interpretation which accompanies them, are of prime importance. They form the cornerstone of M. Balbiani's theory. If we look through the memoir of M. Mecznirow, otherwise so conscientious and full of details, we do not find a single word upon these phenomena. It would be an essential phase of development which has entirely escaped him.

Let us now see what can be learnt on this point from the *Aphis* of the Rose. The cells of the green mass, the boundaries of which are always very distinct, present a clear circular nucleus, 0.01 millim. in diameter, and furnished with a nucleolus. They generate in their interior a number of homogeneous spherical globules, among which may be distinguished a multitude of exceedingly fine granules. These spherical globules are the *daughter cells* of M. Balbiani. Indeed it would appear that, in his eyes, every granule is worthy of this name. Examined in every way, with the best objectives of Smith and Beck, and with the aid of Hartnack's immersion lenses, these globules did not show me anything which presented even a distant resemblance to a nucleus in the histological sense of that word.

Even supposing that, entering into the views of M. Balbiani, we assign the name and value of daughter cells to the globules in question, we shall still be far from the theory of hermaphroditism; for the metamorphoses which this physiologist represents them as undergoing cannot be regarded as normal phenomena. The green mass, in fact, by no means disappears, but persists *with all its characters long after the development of a new generation of embryos has commenced in the interior of the embryo*; moreover, as M. Mecznirow has also shown, it persists *during the whole life side by side with the fatty body*.

This first point, namely the persistence of the green mass, being established in opposition to the description of M. Balbiani, I find myself compelled to dispute the correctness of all that relates to the formation of spermatic elements. M. Balbiani's statement, moreover, is obscure and in contradiction with itself. Thus this observer tells us that the daughter cells are soon replaced by innumerable corpuscles, which appear like little *Amœbæ*; "but their form," he adds, "does not seem to change

under the microscope." Now is there anything characteristic in the *Amœba* except their mobility? The mode of movement alone distinguishes an amœboid body from a drop of albuminous substance. Has not M. Balbiani, preoccupied by the notion of finding zoospermia in the *Aphides*, recollected that in some animals (certain Nematode worms, for example) the spermatogenic elements have a form which has been designated as amœboid? If this be the case, he has forgotten that the mode of movement alone led to the application of such an epithet to these zoospermia.

Moreover I repeat that the asserted disappearance of the green mass, upon which M. Balbiani lays so much stress in order to give probability to its testicular function, does not occur. The green cells persist, each retaining its nucleus and preserving in its interior the spherical globules, the latter not being transformed into either amœboid or bacilliform elements. This we may ascertain simultaneously from different generations contained one within the other. This essential point may easily be verified by any one; and whoever will take the trouble will find all doubt dispelled from his mind on this point.

But how are we to explain M. Balbiani's statement? for in this case we have to do not only with a question of interpretation, but also with a question of fact. I think that M. Balbiani himself furnishes us with the means when he says that at the first glance he thought he had to do with parasitic vegetable organisms. This first impression was no doubt an *inspiration* in the theological sense of the word. A morbid state of the individuals investigated by M. Balbiani can alone account for the essential differences which distinguish this part of his observations from normal phenomena. In connexion with this it is not uninteresting to find that at Naples the *Aphis* of the Rose, and especially its *pseudovaria*, are infested by parasitic Mucedinæ.

The function of a secondary vitellus ascribed by M. Mecznirow to the green mass is at all events more probable than that of a testis. This organ may very well serve as a magazine of assimilable substance when the primary vitellus is absorbed. The analogies of the green mass to a vitellus, both in appearance and position, are at any rate so great that Mr. Huxley regarded it as a true vitellus. An objection to this view may be derived from the fact that the organ in question exists not only during the embryonic period, but also throughout life. However, it must be remarked that its relative importance diminishes gradually with age, and that consequently the objection loses much of its weight.

To sum up, the theory of the hermaphroditism of the

Aphides does not seem to me to rest upon any solid basis; and the general opinion which regards the most habitual mode of reproduction of the *Aphides* as a case of agamogenesis is alone true. I have, however, no pretension to claim, by the publication of this note, any scientific rights in connexion with the embryogeny of the *Aphides*. Those who have resumed the investigation of these singular phenomena at the point where Mr. Huxley had left it, and who have caused it to advance remarkably, are at present MM. Mecznirow and Balbiani alone. If I have taken up the pen, it is because there existed between these two observers such considerable differences upon one point, and that a fundamental one, that it was necessary to test their observations. But I feel perfectly that if, by these few lines, I assist in banishing an error from science, I nevertheless introduce no new fact. Definitively I leave matters where M. Mecznirow has placed them.

LIII.—*Remarks on M. Claparède's Note on the Reproduction of the Aphides.* By M. BALBIANI*.

ALTHOUGH M. Milne-Edwards has had the kindness to communicate to me M. Claparède's note before its insertion in the 'Annales,' I do not think it necessary to reply at the moment to the objections which the author endeavours to raise against my interpretation of the mode of reproduction of the viviparous *Aphides*, or to some perfectly gratuitous allegations which his paper contains. I think this reply will be better placed in the memoir, accompanied by plates, which I propose shortly to publish upon the generation of the *Aphides*. There is only one point in M. Claparède's note which I think it essential to notice here, namely that relating to the priority which he seems to claim in favour of M. Mecznirow for all the facts upon which our observations present a more or less complete agreement.

It is certain that M. Mecznirow, three months before my communications to the Academy of Sciences, published some researches upon the embryogeny of the Hemiptera, which appeared, as a preliminary notice, in Siebold and Kölliker's 'Zeitschrift.' But in this paper, which occupies in all four pages of the journal in question, the author devotes only a little more than one page to the development of the *Aphides*; and here he omits most of the more characteristic facts in the embryogeny of those

* Annales des Sciences Naturelles, 5^e série, tome vii. pp. 30-31.

insects. It is true that in a subsequent memoir, published ten months after his first notice (December 1866) and six months after my various communications to the Academy of Sciences upon the same subject, M. Mecznikow gives a more detailed description of them, and corrects some of his previous observations; but it is difficult to admit that in the interval he was unacquainted with my investigations, published in June 1866 in the 'Comptes Rendus de l'Académie;' and yet no mention is made of them in M. Mecznikow's last memoir. M. Claparède, who must excuse me for not having mentioned M. Mecznikow's first publication, would have done an act of justice if he had indicated that the latter observer had much less reason for not citing a work which appeared six months before his own.

As regards the reproach made to me by M. Claparède of having introduced confusion into the language of histology, I believe I have not in any way contributed to increase that which already reigns in it, especially as to the definition, formerly so clear and distinct, of the word *cell*. Notwithstanding the very arbitrary acceptance that any one may now-a-days give to this term, I have not had the boldness to extend it so as to designate by it "*whatever has a certain form,*" as I am accused of doing by M. Claparède in his note. When I thought it proper to give the name of cells to the histological elements which I had before me, it was because I had ascertained the presence in them of at least the two constituent parts now recognized as strictly necessary to characterize a cell, in accordance with the recent works of MM. Max Schultze, Brücke, Häckel, and others, namely a nucleus and a protoplasmic mass. M. Claparède, who can see nothing in them but globules, nowhere mentions whether he has endeavoured to enlighten himself by the employment of reagents; and I have no doubt that a drop of acetic acid would have done him more service than the objectives of Smith and Beck, or the immersion lenses of Hartnack.

I can only regret that my investigations have not received the confirmation of an observer so distinguished as M. Claparède, who has taken the trouble to test them. Perhaps the fault may be that I have presented them with insufficient details, and especially that I have omitted to mention the means that I employed for the determination of facts which, for the most part, require minute and delicate observation. These are defects which I shall endeavour to supply in a more circumstantial work on the same subject.

LIV.—Description of a new Species of the Genus *Malurus*.

By JOHN GOULD, Esq., F.R.S. &c.

Malurus hypoleucus, Gould.

Crown of the head and all the upper surface dull indigo-blue, somewhat brightest on the head; ear-coverts azure blue; lores and a narrow ring around each eye white; wings nearly uniform brown, with a slight tinge of dull blue at the base of the primaries; under surface white from the chin to the vent, with a wash of fawn-colour on the flanks; tail similar in form and colouring to that of *M. cyaneus*, all the feathers being blue, except the outer web of the external feather and the tips of all of them, the extent of the white on the tips diminishing as the feathers approach the central ones; bill black; legs light brown.

Total length $4\frac{5}{8}$ inches; bill $\frac{7}{16}$, wing $1\frac{7}{8}$, tail $2\frac{1}{4}$, tarsi $\frac{5}{8}$.

Habitat. Supposed to be the Cape York district of Queensland, Australia.

Remark. This bird, which is a true *Malurus*, is easily distinguished from every other known species of the genus by the uniform dull blue colouring of the entire upper, and the equally uniform light hue of the under surface, which has suggested the specific name.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

March 21, 1867.—Lieut.-General Sabine, President, in the Chair.

“On a remarkable Alteration of Appearance and Structure of the Human Hair.” By ERASMUS WILSON, F.R.S.

I have the honour of submitting to the Royal Society a specimen of human hair of very remarkable appearance. Every hair is brown and white in alternate bands, looking as if encircled with rings; and this change of aspect extends throughout the whole length of the hair, and gives to the general mass a curiously speckled character. The brown segment of the hair, which represents its normal colour, measures about $\frac{1}{30}$ of an inch in length, or something less than a quarter of a line; the white, or abnormal segment about half that length, namely $\frac{1}{60}$ of an inch; and the two together about $\frac{1}{15}$ of an inch, or one-third of a line.

The hair was taken from a lad aged seven years and a half, a gentleman's son; he is reported as being “an active, healthy boy, quick and intelligent.” He was delicate up to the age of four, having suffered in quick succession the diseases of childhood, a severe attack of croup, and several attacks of convulsions. The change in the appearance of the hair was first noticed when he was between two and three years old, and has increased perceptibly

during the last two years. There is no similar alteration of structure of the eyebrows and eyelashes. His complexion is dark, while that of a younger brother is fair; and the latter is free from any alteration of the hair.

Examination of the hair with a lens shows that the cylinder of the hair is perfectly uniform, that the white portion is contained within the cuticle and occupies the whole breadth of the cylinder; whilst it frequently presents a rounded cone at the central extremity, and breaks up into fibres at the opposite or distal end; and in some instances this fibrous structure is apparent at both ends of the white segment. Moreover, by transmitted light, the white segment is found to be opaque, and consequently presents a dark shade, while the intermediate or brown portion has the transparency of normal hair.

When the transparency of the hair is increased by immersion in Canada balsam slightly diluted with spirits of turpentine, the white and opaque segment is reduced in dimensions, and is rendered more or less transparent by imbibition of the volatile fluid; moreover it is clearly demonstrated by this process that the opacity of the segment, its whiteness when seen by reflected light, and its darkness by transmitted light are all due to the presence, in the fibrous portion of the hair, of spaces filled with air-globules. The air-spaces are necessarily very numerous and assembled closely together; while at the ends of the white segment they have more or less of a linear arrangement, and give a fibrous appearance to the opaque mass. Moreover the partial transparency of the hair caused by the balsam demonstrates that, besides the air-spaces, large and small, contained in the opaque portion, minute air-spaces, sometimes arranged in linear order, and sometimes communicating and forming short irregular canals, are also met with in the transparent part of the hair. And, in addition to the minute air-spaces of the plates of the fibrous portion of the hair, an accumulation of air-globules is also very apparent in the cells of the medulla.

It is evident, from this examination of the hairs, that they are imperfect in structure and development, and that their imperfection indicates a weak producing organ, and probably a weakly constitution of the individual—that the cells of which the fibrous portion of the hair is composed, instead of being filled with a horny plasma, are turgid with aqueous fluid, and the desiccation of this fluid leaves behind it vacuities which in the subsequent growth of the shaft become filled with air. The most remarkable phenomenon in connexion with the case, however, is the alternation of imperfect and perfect cells, the period of continuance of the two processes (supposing them to be equally active in point of time) being twice as long for the perfect as for the imperfect structure.

Since the publication of the observations of Berthold in Müller's 'Archiv' for 1850, it is generally believed that the hair grows faster during the day than during the night; hence the first suggestion that occurred to me in connexion with the present case, seeing that the white or opaque segment was shorter by one-half than the brown, was that the former represented the slower growth by night, and the latter the quicker growth by day—the white and the brown

together representing an entire day of twenty-four hours. But other observations by myself have given, as the average growth of the hair of the head in persons who had been shaved, $\frac{1}{8}$ of an inch for the week, and consequently $\frac{1}{56}$ of an inch for the twenty-four hours. Now the length of hair comprehended by the white and the brown in the present case is $\frac{1}{36}$ of an inch, and consequently a much more active growth than is normally met with—corresponding, in fact, in a similar ratio, with thirty-seven hours instead of twenty-four.

I therefore refrain from speculating upon the cause of alternation of the healthy and morbid structure presented by this case, and restrict myself to the narration of the fact that during a certain space of time, amounting to a day or more, the hair is produced of normal structure, while during another space of time of undetermined extent the hair is produced unhealthily,—that the periods of healthy formation correspond pretty accurately in extent, as do those of unhealthy formation, while the latter, in measurement, are only half as extensive as the former,—moreover, that the differences of the pathological operation are, the production of a horny plasma in the normal process, and of serous and watery cell-contents in the abnormal process.

I may further observe that it is by no means improbable that the “dead” and faded hair which is met with after some illnesses and in instances of debilitated health may be due to a similar pathological process, although wanting in the periodicity and alternation which render the present case so remarkable.

MISCELLANEOUS.

Theory of the Skull and the Skeleton.

To the Editors of the Annals of Natural History.

GENTLEMEN,—In your December Number Mr. Herbert Spencer wrote claiming to have first enunciated the theory of growth discussed in my epitome-paper on the theory of the skeleton. At this the earliest opportunity possible, I wish to say a word in explanation.

I. I have never read any of Mr. Herbert Spencer's writings, nor do I know any one who has read them. I was therefore quite unaware that my views would find a single supporter beyond the circle of friends with whom they had been discussed.

II. The theory of growth given in the ‘Annals’ for Nov. 1866 was first expounded, so far as I am concerned, in a paper entitled “Researches on the Homologies of the Bivalve Mollusca,” read before the Cambridge Philosophical Society, March 17, 1862. The same doctrine was again urged in a paper on the meaning and value of some structures and modifications of Tetrabrancheate Shells, read Nov. 10, 1862, a portion of which was printed in the ‘Quarterly Journal of Science’ for Oct. 1864. The same view is implied, though not directly stated, in my paper on *Sauropsondylus*, printed in the ‘Annals’ for Sept. 1865; and it is known to certain of my friends that the paper “A theory of the Skeleton” was written

nearly in the form in which it is printed before any part of the 'Principles of Biology' could have been issued. Under these circumstances I did not feel called upon to award to Mr. Herbert Spencer the enunciation of views which I had been urging for years in private, and which I had only not published in full because, being absolutely opposite to the received doctrine that structures produce and determine functions, I did not wish to incur that "faint praise" which I had already found to be the reward of young men who propound new views.

The actual priority is a matter of no scientific importance; and for all that I care, any one who pleases to claim it is welcome to any credit that there may be in it. I do not doubt but the award of that credit will be made by others.

I am Gentlemen,

Very faithfully yours,

HARRY SEELEY.

A new Rodent.

M. Alphonse Milne-Edwards described lately before the Philomathic Society of Paris a very beautiful new rodent lately living in the Jardin d'Acclimatation. It is covered with long soft fur on the body and tail, and black, with white stripes, like a skunk. The teeth are like those of the Hamsters. The skull is most peculiar: the sides of the crown are extended, covering the muscles of the jaw like a hood; and all parts of the skull are studded with regular minute bony processes, only to be compared with the rugosities on the sternum of the *Trionyces*, but differing from them in all the processes being separate and nearly of equal size. M. Alphonse Milne-Edwards has given the name of *Lophiomys Imhausii* to the animal, which was sent from Aden.—*L'Institut*, Feb. 6, 1867.

On Euphysetes simus. By Sir WALTER ELLIOT.

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

GENTLEMEN,—On taking up the April Number of the 'Annals' this forenoon in the library of the Linnean Society, I observed a note by Dr. Gray, on Prof. Owen's description of Indian Cetacea from materials furnished by me, in which a statement occurs at page 263, made, no doubt, under an entire misapprehension of the facts, but which may lead to further error unless at once explained.

It is quite true that two representations of the same specimen of *Physeter simus* have been given, the one as a male, the other as a female; but the mistake arose from my having failed to observe, when communicating my notes and drawings to Prof. Owen, that I had inadvertently allowed a cancelled drawing of the *wongu* to remain in the packet. This incorrect sketch has been in my portfolio from the day it was made, fourteen years ago. During that interval it has been lent, with other drawings, at various times, to persons interested in natural history, and has been out of my possession for days, and sometimes for weeks. It is only now, on carefully examining it, that I have discovered a pencil note, made by some per-

son, thus, "*wonga* ♂," which is wholly unauthorized, but which at once explains how Prof. Owen has been misled.

I had already, on my arrival in London, discovered the mistake, and took immediate steps to rectify it. But some time elapsed before I recovered the drawings from the Zoological Society and obtained my papers from Scotland. As soon as I had cleared up the difficulty, I sent a full explanation of the circumstances to Prof. Owen, and called on him to express my regret for having led him into error. He said he would communicate with the Secretary of the Zoological Society on the subject, and at the same time returned to me some other drawings he had found among those I sent him, which showed that I had even been more careless than I supposed; for they related to matters wholly irrelevant, several of them being figures of other Cetaceans which I had copied from published works for reference, and which I should assuredly have eliminated had I examined the contents of my packet, as I ought to have done.

As to the missing lower jaw, it was unfortunately lost or mislaid in transmitting the specimens from India; but it had been in my possession for eight or nine years, and I can vouch for the accuracy of the drawings, which were carefully compared with the original.

I shall feel obliged by your inserting this in your next Number.

WALTER ELLIOT.

Linnean Society, Burlington House.

April 26, 1867.

Addition to the Note on Euphysetes simus.

The remarks I made at page 263 on the drawings and the sex of *Euphysetes simus* were founded on some observations of Sir Walter Elliot, who discovered the species and had the drawings made; and he seemed much annoyed at the mistake. I am this day (the 16th of April) informed (and Sir Walter Elliot was evidently not aware of the circumstance, and I have never seen the drawings) that some foolish mischievous person has made additions and notes on the drawings, which fully justified Professor Owen in believing they were intended to represent the two sexes of the species.—
J. E. GRAY.

Foraminiferal Soundings.

A series of twenty-nine soundings, made in November 1866 (under the superintendence of Captain Oesterreicher, of the Imperial Navy of Austria), along the southernmost part of the west coast of the Istrian peninsula, yielded the following results:—Some contained only small Shells and detritus of shells, with Polyzoa and Corals and very few Foraminifera; others, especially of sandy and loamy ooze, were poor in small Polyzoa and Shells, but richer in both small and relatively large Foraminifera. Soundings from a depth of 13–130 feet (Austrian) abounded in *Polystomella crista*, Lam., and *Rotalia Beccarii*, Linn., associated with rarer specimens of *Miliola* (*Triloculina*) *trigonula*, Lam., *M.* (*Quinqueloculina*) *seminulum*, Linn., *M.* (*Q.*) *bicornis*, Walk., and its var. *angulata*, and *M.* (*Spiroloculina*)

depressa, D'Orb. ; and *Peneroplis planatus*, F. & M., occurred very rarely in a few shallow places. The last-mentioned forms are frequent at several localities along the coast of Dalmatia, and, being confined to a shallow horizon, may serve to characterize a subdivision of the Littoral Zone in the diffusion of the Foraminiferal fauna.—*Proceed. Imp. Geol. Instit. Vienna*, February 19, 1867.

Observations on the Situation of the Alkaloids in the Bark of the Cinchonæ. By CARL MÜLLER.

Some years ago M. Wigand thought he had demonstrated that the alkaloids of the Cinchonas reside in the liber. He had, in fact, observed that when thin transverse sections of the bark of these plants are soaked in a solution of cochineal, the liber-region of these sections is most strongly coloured. Thinking that the alkaloids in question might perhaps act as mordants and possess the property of fixing colouring-matters, M. Wigand had the idea of treating simultaneously, with the same tincture of cochineal, flax-bark previously soaked in an infusion of bark, and cinchona-bark deprived of all traces of alkaloid. He then observed that the flax-bark became vividly coloured, whilst that of the Cinchona had lost the property of fixing the pigment; and from this he concluded that as in the first experiment the liber absorbed the cochineal most freely, this must be due to the fact that this part of the bark was richest in alkaloid.

M. Carl Müller, having repeated these experiments without arriving at the same results, attempted to solve the question by the method of direct determination. For this purpose it was necessary to effect the complete separation of the liber from the parenchyma; and this was by no means easy, as the liber of the Cinchonas does not form thick layers, but is composed of small and scarcely visible groups of cells. M. Müller nevertheless thinks he has succeeded in surmounting all the difficulties by the following process:—

He commences by reducing the bark, by means of a plane, into thin shavings, which he then breaks up by shaking them in a bottle, at first with fragments of iron wire, and then with fine sand. By examining under the microscope the fragments of bark thus obtained, he finds that the parenchyma is entirely detached from the liber; and he effects the separation of these two elements by an ingenious process. He pours the contents of the bottle into the body of a retort communicating on the one hand with a pair of bellows, and on the other with another retort, which is in communication with a receiver full of water. It is clear that by setting the bellows in action the powder contained in the first retort will be strongly agitated. The particles of parenchyma, being lighter than the rest, are then driven through the whole apparatus into the receiver, whilst the liber remains in the first retort or does not pass beyond the second one. The nature of the deposits found in the various parts of the apparatus may then be easily ascertained by microscopic examination. When this operation is completed, M. Müller treats

the contents of the receiver and those of the retort with dilute sulphuric acid, so as to extract all the alkaloid in the form of the hydrate $C^{10}H^{24}N^2O^4, 6HO$, of which he then determines the quantity after desiccation at 212° .

This analysis proves that the parenchyma contains 9.876 per cent. of quinine, whilst the liber only contains 2.462 per cent., or about one-fourth of the quantity that exists in the parenchyma. This result is therefore precisely the reverse of that which would have been expected from M. Wigand's experiments. It is clear also that the quinine, although much more abundant in the parenchyma, does exist in the liber. It even appears that it is the more abundant in proportion as the bark is more developed, which would lead one to suppose that the production of quinine is in relation with the formation of the liber. This consideration has naturally led M. Müller to inquire at what period and in what region of the bark the first appearance of the quinine takes place; and he proposes to take up this question as soon as he can procure a sufficient number of living *Cinchona*-plants.—*Pringsheim's Jahrbücher*, 1866; *Bibl. Univ. Bull. Sci.* February 25, 1867, pp. 182-184.

On the Cephalic Disk of the Remora (Echeneis).

By E. BAUDELOT.

The disk on the head of the Remora has from the earliest period attracted the attention of observers. Among modern naturalists, some, such as Vogt and Stannius, have expressed the opinion that this disk might be regarded as the equivalent of a dorsal fin; but this view has not been supported by a rigorous determination, certain internal pieces of the disk having remained undetermined. Moreover the mechanism by means of which the fixation is effected has never been analyzed and explained satisfactorily.

The investigations which I have the honour to submit to the Academy had for their object the solution of these still obscure questions.

The disk of the Remora, as is well known, occupies the upper surface of its head. Its form is a very elongated oval, of which the slightly raised margins are formed by a fold of skin arranged so as to form all round the organ a sort of moveable frame. The upper surface of the disk is flat; on each side of the median line it presents a series of little transverse plates, which are nearly parallel and a little inclined backwards, so as partially to cover each other, like the laths of a Venetian blind. Between these laminae there are the same number of corresponding empty spaces.

Except at its margins, the disk is sustained by an internal framework, formed by a considerable number of small bones distributed in a series of similar segments regularly arranged (*échelonnés*) from behind forwards. Each segment consists of the following pieces, four in number—an interspinous bone, two rays, and an articular ossicle.

a. The interspinous bone is a small unpaired median piece, placed at the lower surface of the disk, of the form of a slender spine, with

its point directed downwards, and completely resembling in its aspect the interspinous bones which sustain the rays of the fins. It is of the same nature as these.

b. The rays are represented by two small osseous rods, laid transversely in a horizontal plane, and articulated by their base, at the level of the median line, with the corresponding interspinous bone. Each of these rods, taken by itself, represents one-half of a fin-ray; this half, instead of remaining united with its opposite half in a vertical plane, has departed from it to fall down on the side.

c. The articular ossicle is an unpaired symmetrical bone, extended across the disk, of which it occupies the whole width. It consists of a very narrow median portion and of two lateral portions, which are widened into laminae or quadrilateral palettes. From the upper surface of the latter springs a small lamellar apophysis directed backwards (articular apophysis), beneath which the extremity of the ray belonging to the same segment is attached.

This ossicle, the nature of which has hitherto been misunderstood, must, in my opinion, be regarded as the equivalent of the little osseous nodule which occurs in the fin in the space left between the bases of the two halves of a ray.

As regards the mechanism by means of which the fixation of the disk is effected, this is easy to understand when we have ascertained the arrangement of the pieces of this little apparatus.

Each ray, in fact, serves as a support to a lamina of the disk. It is capable of moving upon its anterior border as upon a hinge, and consequently of inclining the lamina with which it corresponds either forwards or backwards. This double movement is effected by means of small muscles inserted, on the one hand, upon an apophysis of the base of the rays projecting at the lower surface of the disk, and, on the other, upon the interspinous bones of the neighbouring segments. These bundles correspond with the elevator and depressor muscles of the rays of fins.

It is easy to demonstrate, by means of a very simple geometrical construction, that when the lamellæ of the disk are raised, the space which they intercept is enlarged; the air consequently tends to become rarefied in this space, and, as all communication with the exterior is interrupted by the cutaneous fold which borders the disk, an effect of suction is thus produced, exactly comparable to that of the cupping-glass.—*Comptes Rendus*, March 18, 1867, pp. 625-627.

Apus and Branchipus.

Mr. Grunow has lately discovered at Pottenstein, near Vienna, a locality of *Apus cancriformis* and of *Branchipus stagnalis*, the two Phyllopora remarkable for their affinity with the extinct *Hymenocaris*, *Ceratiocaris*, *Dithyrocaris*, and Limuloid Crustaceans. The *Apus* and *Branchipus* under notice live in a pool about 20 feet broad and 30 feet long, which is completely dried up in summers that are hot throughout. In September 1866 myriads were observed in the slimy water of the pool.—*Imp. Geol. Instit. Vienna*, Feb. 19, 1867.

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LV.—*On the Dentition of the Common Mole* (*Talpa europæa*).
By C. SPENCE BATE, F.R.S. &c.*

[Plate XI.]

AMONG the families of the Mammalia none is found in which there is a greater variation in the dental arrangement than in that of the Talpidæ.

The number of the teeth is also larger than in any of the Mammalia except the Marsupials; they are only deficient by one on each side of each jaw of the full number of the Mammalian type.

The development of the teeth in the European species has been so little understood that the greatest diversity of opinions as to their homological distinction exists amongst zoologists. Thus we find, in Prof. Owen's 'Odontography,' four different formulas are given, being the result of as many different anatomists' observations, which may be expressed as follows:—

That of *Fréd. Cuvier* as

$$\text{In. } \frac{3}{4}, \text{ C. } \frac{1}{0}, \text{ P.M. } \frac{4}{4}, \text{ M. } \frac{3}{3} \times 2 = 44;$$

Bell as

$$\text{In. } \frac{3}{4}, \text{ C. } \frac{1}{1}, \text{ M. } \frac{7}{6} \times 2 = 44;$$

De Blainville as

$$\text{In. } \frac{4}{4}, \text{ C. } \frac{1}{1}, \text{ P.M. } \frac{3}{3}, \text{ M. } \frac{3}{3} \times 2 = 44;$$

Owen as

$$\text{In. } \frac{3}{3}, \text{ C. } \frac{1}{1}, \text{ P.M. } \frac{4}{4}, \text{ M. } \frac{3}{3} \times 2 = 44;$$

whilst *Prof. Blasius* gives, in his 'Fauna der Wirbelthiere Deutschl.,' that which may be expressed by

$$\text{In. } \frac{3}{4}, \text{ C. } \frac{1}{1}, \text{ P.M. } \frac{3}{2}, \text{ M. } \frac{4}{4} \times 2 = 44.$$

* Abstract of a paper read at the Odontological Society of Great Britain, April 1, 1867. Communicated by the Author.

Thus we have five formulas, expressive of as many separate opinions. It was therefore with satisfaction that the author obtained several specimens of young moles, as by their dissection he has been enabled to clear up the several points of difficulty, and establish the homological relations of each individual tooth beyond dispute.

Having made out and determined the forms and positions of the several teeth, and the relation that they bear, in the adult animal, to each other, the author proceeded to unravel the problem of their homological relation to the teeth in the Mammalian order.

In the placental mammals the largest number of teeth is forty-eight, consisting of three molars, four premolars, one canine, and four incisors, on each side of each jaw. In the European mole we find all present excepting one on each side of each jaw. The great point, therefore, to be determined is, which of the teeth of the permanent series is absent. M. Fréd. Cuvier has pronounced it to be an incisor from the upper jaw and the canine from the lower. Prof. Bell leaves out an incisor from the upper jaw and a molar from the lower; or, since he classifies the premolars and molars under that of molars, we may say that he omits a premolar from the lower jaw. Prof. De Blainville leaves out a premolar from the series in each jaw. Prof. Owen omits an incisor from each jaw; and Prof. Blasius, the most recent comparative anatomist who has written on the subject, leaves out an incisor from the upper, and a premolar from the lower jaw; but this last zoologist differs from all the previous writers in classifying the last premolar in each jaw as belonging to the series of molars. In this arrangement Prof. Blasius has evidently been governed by the form and size of the tooth rather than by its relative connexion with the deciduous teeth or their position in the jaws. Classification based upon such observation is liable to great variation, dependent upon the existing wants of animals, and therefore must possess a shifting character—a condition that must exclude it from scientific consideration. The only true classification of the teeth must be based upon their position in the jaws, and the homological relation that they hold to each other and to the teeth of other animals.

Thus there are only three molar teeth in the placental mammals, because there are but three teeth in the range of each jaw that are developed without having been preceded in their position by deciduous or milk-teeth. Therefore, since the tooth that Prof. Blasius classifies as the most anterior of the molar series is anticipated by a deciduous tooth, it must belong to the premolar, and not the molar series.

The author believes that if this test were applied to the Cape mole (*Chrysochloris aurea*), the teeth that Prof. Owen has pronounced to be molars would be found to belong (some of them) to the premolar series, and the huge biting-teeth in the anterior part of the jaw to the incisor or premaxillary teeth.

At the period when the young mole is about four inches long the deciduous teeth are so far developed that most of them are cutting their way through the gums, and all of them in a forward state. The two premaxillary bones are separated by a distinct suture from the maxillary, and by an extensive fissure from the palatal plates, which they approach only in the median line, by long projecting bony processes, and at the alveolar walls. In these bones are planted the eight anterior (four in each bone) of the deciduous teeth; these consist of slightly curved cylindrical tubes differing somewhat in the form of their crowns, that of the posterior being pointed and larger than the others. This tooth is implanted within the limits of the premaxillary bone, the suture separating it from the maxillary passing through the posterior portion of its alveolus, in which, in progress of development, is the large pointed crown of the first permanent double-fanged tooth, which we can now positively assert to be the homologue of the true canine, the peculiar implantation of which must therefore be described as a variation from the normal type to meet the requirements of a large and powerful tooth implanted in a jaw insufficiently deep to receive a corresponding fang.

The next series of deciduous teeth are situated in the maxillary bones; these represent the deciduous premolars (commonly called deciduous molars, and are succeeded by the permanent premolars.

In the lower jaw the canine tooth of the deciduous set may be determined by its position and form viewed in relation to that of the upper jaw; but all the deciduous teeth of the lower jaw are small and single-fanged, though the last or fourth deciduous premolar has a tendency to develop itself into two fangs at the extremity.

The entire series of the deciduous set may therefore be expressed by the following formula—as

$$\text{Decid. Premax. or Incisor } \frac{3}{3}, d. C. \frac{1}{1}, d. P.M. \frac{4}{4} \times 2 = 32;$$

and that of the permanent set as

$$\text{Premax. or Inc. } \frac{3}{3}, C. \frac{1}{1}, P.M. \frac{4}{4}, M. \frac{3}{3} \times 2 = 44.$$

Thus by actual observation the author has been enabled to

support the correctness of Prof. Owen's inductive analysis of the teeth of the mole, and demonstrate the homological relation of the several teeth.

At the period of examination no fur was developed upon the young mole's skin. The deciduous teeth had not yet pierced the gum, whilst the small extent of fang yet to be produced at the extremity shows how nearly the period had arrived for their protrusion through the gums; yet we cannot but be struck with the feeble connexion existing between the teeth and the alveolar walls, which rather appear to be undergoing absorption and waste for the purpose of the reception of the permanent set, than to be strengthening to support the milk-teeth in any efficient action. These circumstances, together with the forward stage of the development of the permanent set, suggest the idea that the deciduous teeth are developed according to a law of growth, but are not required to fulfil any want in the economy of the young animal's life; for they can scarcely be developed in their places before the period of the eruption of the permanent teeth; and this is probably coeval with the time when the fur is placed upon the young creature's back, and it is able to excavate the soil for itself.

Large spaces separate the deciduous teeth from each other, which, together with the feeble attachment that they have to the jaw, shows them to be useless as organs of mastication: this is most distinctly exhibited in the character of the deciduous premolars when compared with that of their permanent successors.

It is the most usual condition in the Mammalia above the Cetaceans and Bruta for the deciduous teeth that anticipate the premolars to be developed upon a more complex type, assuming more nearly the shape of the true molars than do those of the permanent set; but the author believes that this is but a rule subservient to a universal law—that whenever teeth are developed according to a law of growth, and not required for any functional purpose, they have a tendency to return to the primitive form of the Mammalian type; and such he takes to be the character of the deciduous teeth of the genus *Talpa*.

The author also described the microscopic structure of the teeth, and exhibited numerous drawings of the minute anatomy both of the teeth and jaws of the animal.

EXPLANATION OF PLATE XI.

- | | |
|---|----------------------------------|
| <i>Fig. 1.</i> Upper jaw; adult. | <i>Fig. 3.</i> Lower jaw; adult. |
| <i>Fig. 2.</i> Ditto; immature. | <i>Fig. 4.</i> Ditto; immature. |
| 1, 2, 3 Inc., incisor or premaxillary teeth. | |
| 1, 2, 3 d. Inc., deciduous incisor or premaxillary teeth. | |

C., canines.

d. C., deciduous canines.

1, 2, 3 P.M., premolars.

1, 2, 3 d. P.M., deciduous premolars (commonly called deciduous molars).

1, 2, 3 M., molars.

LVI.—*Descriptions of some Indian and Burmese Species of Assimineæ.* By WILLIAM T. BLANFORD, A.R.S.M., F.G.S.

IN Dr. E. von Martens's "Conchological Gleanings," published in the March Number of the 'Annals' for 1866 (ser. 3. vol. xvii. p. 202), the first portion of the paper consists of observations "on some species of *Assimineæ*." Two new species from China and Singapore are described, and a list is added of the forms belonging to this genus known to the author. Amongst these the only species mentioned as occurring in India or Burma is the well-known *A. Francisci*, Gray*, from the estuary of the Ganges. The object of the present notice is to call attention to some species of the genus inhabiting Bombay and described some years since by Dr. Leith, and to describe two other species—one from Bombay, collected by the Rev. Mr. Fairbank, and another obtained by myself, in 1862, from the estuary of the Irawaddy in Burma.

Three species from Bombay were described by Dr. Leith as a new generic form, under the name *Optediceros*, in the 'Journal of the Bombay Branch of the Royal Asiatic Society' †, vol. v. p. 145. The paper, I learn from Dr. Leith, was presented to the Society in 1853, and published in July of that year, although the completed volume of the Society's Journal bears the date 1857. It is entitled "Note on an apparently New Genus of Gasteropod, by A. H. Leith, Esq., M.D." The genus is described as "a minute mollusk inhabiting the shores of Bombay Island, by the edges of salt-water pools, moving on the moist earth or rocks, and taking shelter under stones," and is distinguished by the following characters:—

* Called *A. Francesia*, Benson, by H. & A. Adams in the 'Gen. Rec. Moll.,' *A. francesia*, Gray, by Benson in the 'Journal of the Asiatic Society of Bengal,' and *A. francesi*, Gray, by Troschel (Geb. d. Schneck.). I cannot procure the work containing the original description in Calcutta.

† That Dr. von Martens was unacquainted with this paper is evident (indeed it appears to have entirely escaped the observation of conchologists), the description of the animal and operculum being excellent and amply sufficient to prove its identity with *Assimineæ*. It is greatly to be regretted that this paper is, so far as I am aware, the only published contribution to malacological science by one of the most careful observers in India. That the paper should have been overlooked is not surprising, as the Bombay Journal, though rich in archæological and geological papers, contains but few zoological contributions.

"The animal has a broad short foot, a head expanded into a broad and slightly emarginated lip, used as a fore foot, only two tentacles, which are short, nearly cylindrical, contractile, and bearing the eyes on their summits. The respiratory opening is a round perforation in the mantle, behind the right tentacle.

"Operculum is horny, with subspiral lines running from a nucleus near the columella.

"Shell subumbilicated, with an elevated spire; aperture rounded below and at the summit angular; peristome edged, at base effuse; lips united by callus, which encroaches on or even covers the umbilicus."

The above description is amply sufficient to prove the identity of the genus with *Assimineæ*. I have had the advantage of examining the animal of one species, which corresponds precisely with Dr. Leith's account and also with the animals of other forms of *Assimineæ* which I have examined elsewhere.

The specific descriptions of the three forms named by Dr. Leith, although ample for the purpose of discriminating them, are scarcely sufficient, in some respects, to distinguish them from other forms of *Assimineæ*; and I therefore give more detailed descriptions below.

Subsequently the Rev. S. Fairbank found a fourth species, which he distributed under the MS. name of *O. rotundum*. Of this no description has ever been published.

This note would have been sent sooner, but that I was in hopes of receiving authentic specimens of the various Bombay species. In this I have succeeded: both Dr. Leith and Mr. Fairbank have, most obligingly, not only compared my specimens of the shells with their types, but have also most liberally supplied me with typical specimens as well as with notes on the habitat of the several mollusks.

Assimineæ cornea, Leith, sp. (Fig. 1.)

A. testa subobtecte perforata (interdum imperforata), conoideo-ovata, cornea, glabra, oleoso-nitente, vix striatula. Spira conoidea, lateribus convexis, apice acuto, sutura impressa, non marginata. Anfr. 6, convexi, sensim accrescentes; ultimus subtus rotundatus, haud carinatus. Apertura spiram vix æquans, subovalis, obliqua, supra aperte angulata; peristoma rectum, margine externo tenui, columellari incrassato expansulo, umbilicum partim v. omnino tegente.

Operculum corneum, paucispirale, nucleo subbasali, interno. Long. 4, diam. 3, apert. long. vix 2 millin.

Hab. Bombay Island, on the mud-flats of the harbour shore, near high-water mark. "On tufts of grass at high-water mark" (Fairbank, MS.).

"Animal grey; lip subcrenate" (Leith, *l. c.*).

Although doubtless locally abundant, this little mollusk does not occur so generally on the shores of Bombay Island as the next two species; and Mr. Fairbank informs me that, in a recent search, he failed to find it. It may be distinguished from most others of the genus by its rounded, gradually increasing whorls, and, in general, by its distinct perforation, which is only completely covered by the columellar margin of the aperture in two specimens out of fourteen which I have before me.

It is manifest that the name of this species was published before Dr. Pfeiffer's *Hydrocena cornea*, from Borneo, described in 'Proc. Zool. Soc.' for 1854, and shown by Dr. E. von Martens to be an *Assimineæ*. The Number XVIII. of the 'Journal of the Bombay Branch, Royal Asiatic Society,' in which Dr. Leith's description appeared, was, as I have already mentioned, circulated to the members of the Society in July 1853. The Borneo species will therefore require to be named afresh—a task which, as I am unacquainted with it, I would prefer leaving to Dr. Pfeiffer.

Assimineæ subconica, Leith, sp. (Fig. 2.)

A. testa imperforata, subrimata, ovato-conica, solidula, pallide aurantiaca, glabra, nitidula. *Spira* conica, lateribus vix convexis, apice acuto, sutura parum impressa, non marginata. Anfr. 7, subplani, sensim accrescentes, ultimus subtus rotundatus. *Apertura* spira multo brevior, parum obliqua, superne angulata; *peristoma* rectum, margine externo tenui, columellari vix incrassato expansulo.

Operculum præcedentis.

Long. 4, diam. $2\frac{1}{4}$, apert. long. $1\frac{1}{2}$ millim.

Hab. Same as that of *A. cornea*.

This small species has more the form of *A. Francisci* and its allies. The animal was found by Dr. Leith to be similar in colour and form to that of *A. cornea*. Mr. Fairbank informs me that he has found *A. subconica* at a rather lower level than *A. cornea*, on the mud, near high-water mark.

The colour of the shells in this and other species of *Assimineæ* tends to fade after a time; and some of my specimens are rather yellowish horny than orange.

Assimineæ marginata, Leith, sp. (Fig. 3.)

A. testa imperforata, subrimata, ovato-conoidea, solidula, olivacea, oleoso-micante, striatula, lineis minutissimis spiralibus sub lente signata. *Spira* conica, lateribus convexis, apice acuto, sutura parum profunda, linea impressa aliquando obsoleta late marginata. Anfr. 6, supra lente, infra celerius accrescentes, parum convexi; ultimus magnus, subtus globosus. *Apertura* spiram paulo superans, parum obliqua, supra acute angulata; *peristoma* rectum, margine externo tenui, columellari incrassato expanso.

Operculum simile ei *A. corneæ*.

Long. $4\frac{1}{2}$, diam. 3, apert. long. $2\frac{1}{2}$, lat. $1\frac{1}{2}$ millim.

Var. *major*. (Fig. 4.) Sutura non marginata; anfractibus 6-7. Long. 6, diam. 4, apert. long. $3\frac{1}{4}$ millim.

Hab. The same as that of the two preceding species. "Most abundant on the oozy mud at half-tide mark" (Fairbank, MS.).

"Animal scarlet; lip rectangular" (Leith, *l. c.*). The animal of this species I examined some years ago. The tentacles are very short and blunt, with the eyes on their summits.

This form must approach very closely to *A. pinguis*, Von Martens. It is the most nearly allied of all the Bombay forms to *A. rubella*, from Burma, described below. From its congener *A. cornea* it differs in the absence of perforation, flatter whorls, and greater size of the last whorl as compared with the others.

The name is unfortunate, as, although the margination was well marked on the small variety (two-tenths of an inch in length) to which the name was first applied, it is always indistinct and often absolutely wanting in larger specimens. To this Dr. Leith himself called my attention. Should the present name be objected to on this ground, that of *A. Leithi* might be substituted.

Assiminea rotunda, Fairbank, MS. (Fig. 5.)

A. testa imperforata, rimata, conoideo-globosa, solidula, striatula, oleoso-micante, coccinea, anfractibus superioribus sæpe albescentibus. Spira conoidea, lateribus convexis, apice acuto, sutura impressa, non marginata. Anfr. 6-6 $\frac{1}{2}$, convexi; ultimus multo major, ventricosus, subtus rotundatus. Apertura spiram superans, fere verticalis, supra acute angulata; peristoma rectum, margine externo tenui, columellari subincrassato expanso.

Operculum simile ei *A. corneæ*.

Long. 4, diam. 3, apert. long. $2\frac{1}{4}$, lat. $1\frac{1}{2}$ millim.

Hab. Lives partly buried in the mud between tide-marks, rather lower down than *A. marginata* and *A. subconica*, in the same localities (Fairbank).

The animal is grey. Specimens of this species have been distributed in the United States and in England under the above name; but no description has hitherto been published.

Assiminea rotunda is a rounder and more ventricose form than any other of the Bombay species. It may also be recognized by the large size of the last whorl, and by its bright scarlet colour.

Assiminea rubella, n. sp. (Fig. 6.)

A. testa imperforata, subrimata, ovato-globosa, solida, glabra, oleoso-micante, striatula, rubra vel rubello-fusca, lineis binis impressis infra suturam sculpta, superiore persistente, inferiore juxta aperturam evanescente. Spira breviter conoidea, apice acuto, sæpe erosula, sutura vix impressa. Anfr. 5, parum convexi; ultimus multo major, ventricosus, non carinatus. Apertura spiram supe-

rans, subverticalis, supra acute angulata; peristoma rectum, margine externo tenui, columellari incrassato expanso. Operculum corneum, tenue, radiatim striatum, distincte paucispirale. Long. $5\frac{1}{2}$, diam. 4, apert. long. $3\frac{1}{4}$, lat. $2\frac{1}{2}$ millim.

Hab. Mud between tide-marks near Dalhousie, in the Irawaddy Delta.

Animal scarlet; proboscis bilobed, with a black spot above in the centre of each lobe. The ends of the proboscis are applied in walking. Tentacles and eyes as usual in *Assiminea*. The animal closely resembled that of *A. marginata*, Leith, in which, however, the black spots on the proboscis are wanting. The shell is perhaps, on the whole, more nearly allied to *A. rotunda*, Fairbank; but that species has no spiral lines below the suture, and the animal is differently coloured. *A. rubella* differs from *A. pinguis*, Von Martens, in being more globose, in having a double instead of a single impressed line below the suture, and in the colour of the animal.

I found *Assiminea rubella* very abundant crawling upon the mud between tide-marks, just above the port of Dalhousie in the Bassein river, one of the many mouths of the Irawaddy, but which, like several of the mouths of the Ganges, is for many months of the year an arm of the sea rather than a river, as it receives scarcely any fresh water except in the rainy season. The whole molluscan fauna of this portion of the Irawaddy delta is peculiar and very interesting, comprising a new genus of Rissoidæ, species of *Tectura*, *Martesia*, *Teredo*, and other marine forms, with fluvial and estuarine types such as *Neritina*, *Cyrena*, and *Scaphula*. With the *Assiminea* a species of *Amphibola* occurred in abundance. A small form, apparently of the same species, occurs with the *Assiminea* of Bombay. I have described the molluscan fauna of the Irawaddy delta in a paper which will be published in the 'Journal of the Asiatic Society of Bengal.'

Within the last few days I have received from Mr. Damon specimens of an *Assiminea* from Borneo, which appear to belong to the present species. In one specimen there is only a single impressed line below the sutures; but in another there are two, which are even more strongly marked than in Burmese specimens.

The only other known species of *Assiminea* inhabiting India or Burma, as already observed, is *A. Francisci*, Gray. This abounds on the mud of the Hoogly and of various tidal creeks and canals around Calcutta; and a variety, differing in nothing except its rather darker and occasionally reddish colour, is found at Molmain in Burma. Specimens were found there, I think, by Mr. Theobald; and some were brought to me, amongst other shells, by a collector whom I sent to Molmain.

As regards the habits of *Assiminea*, I can, to a very great extent, confirm the remarks of Dr. von Martens. It is essentially

a brackish-water genus, living between tide-marks on the mud of estuaries. But species are to be found both in perfectly salt and in perfectly fresh water. The water of Bombay harbour is almost purely sea-water; and I have met with some of the Bombay species on the sea-shore at Bombay, far from the mouth of the harbour: on the other hand, the water of the Hoogly, where *A. Francisci* is found, is quite fresh. The latter species occurs also in brackish water, I believe; for, although I have not noticed it alive, dead shells are common in the brackish-water creeks east of Calcutta. The individuals that have been habituated to salt water, however, will not live in fresh, nor *vice versâ*. In Dr. Leith's description of *Optediceros*, he says of the animals generally:—"If put into salt water, they all quickly make their escape from it by creeping up the sides of the vessel; but if placed in fresh water, they close their opercula, and remain shut up until they die." I tried a similar experiment with *A. Francisci*, from the fresh water of the Hoogly. On placing the specimens in perfectly fresh water from a tank, all crawled out of the water; but on putting them in brackish water (not salt water), a few began to crawl about, but by degrees nearly all closed their opercula and remained at the bottom; and after half an hour only six out of about two hundred specimens had crawled out of the water. On throwing away the brackish water, and substituting fresh, all began moving about and creeping out of the water as usual.

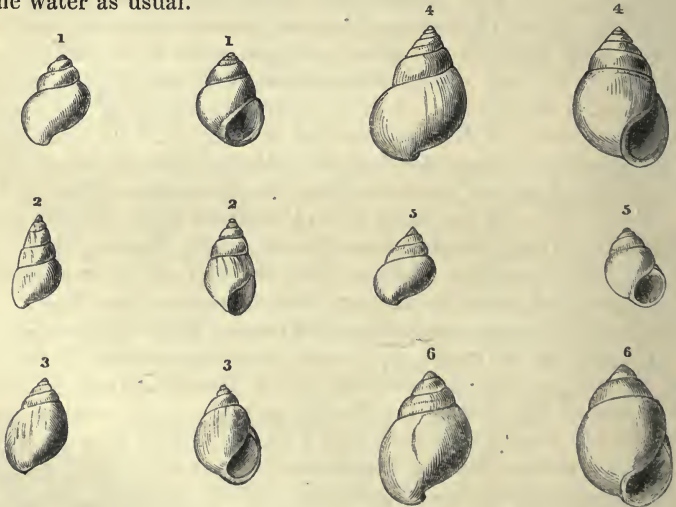


Fig. 1. *Assimineæ cornea*, Leith.

Fig. 2. *A. subconica*, Leith.

Fig. 3. *A. marginata*, Leith (type).

Fig. 4. *A. marginata*, var. *major*.

Fig. 5. *A. rotunda*, Fairbank.

Fig. 6. *A. rubella*, W. Blanford.

LVII.—*Descriptions of several Species of East-Indian Spiders apparently new or little known to arachnologists.* By JOHN BLACKWALL, F.L.S.

A COLLECTION of spiders made at Meerut, Agra, and Delhi, by Captain Francis Lyon, of the Royal Artillery, and obligingly presented to me by his sister, Mrs. Greenall, of Stretton Parsonage, at the suggestion of my kind friend Miss Ellen Clayton, comprised the following species:—

Tribe Octonoculina.

Family LYCOSIDÆ.

Genus LYCOSA, Latr.

Lycosa Greenallia, n. sp.

Length of an immature female $\frac{5}{16}$ of an inch; length of the cephalothorax $\frac{3}{10}$, breadth $\frac{1}{8}$; breadth of the abdomen $\frac{1}{10}$; length of a posterior leg $\frac{9}{10}$; length of a leg of the third pair $\frac{5}{12}$.

The eyes, which are unequal in size, are disposed in front and on the sides of the anterior part of the cephalothorax; four, much smaller than the rest, form a transverse row immediately above the frontal margin, the two intermediate ones being decidedly larger than the lateral ones of the same row; the other four describe a trapezoid, the two anterior eyes, which are the largest of the eight, forming its shortest side. The cephalothorax is long, convex, sparingly clothed with hairs, compressed before, rounded in front and on the sides, which are marked with furrows converging towards a narrow indentation in the medial line of the posterior region; it is of a brownish-yellow colour, with narrow, black lateral margins; the region of the eyes has a brownish-black hue, and there are oblique rays on the sides formed by rows of dark-coloured hairs. The falces are long, powerful, conical, vertical, armed with teeth on the inner surface, and have a red-brown hue. The maxillæ are straight, and increase in breadth from the base to the extremity, which is rounded; the lip is quadrate, and somewhat hollowed at its apex; and the sternum is oval. These parts are of a dull-yellow colour, the base of the lip is tinged with brown, and the sternum has a black band extending along the middle, which is somewhat constricted at a moderate distance from its pointed extremity. The legs are provided with hairs and sessile spines, and have a dull-yellow hue, with imperfect, faint, soot-coloured annuli on the femora and tibiæ; the fourth pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the short inferior one is inflected near its

base; the palpi, which are long, resemble the legs in colour, but are without any soot-coloured marks; the digital joint is provided with hairs, and has a minute, curved, pectinated claw at its extremity. The abdomen is oviform, sparingly clothed with hairs, convex above, and projects over the base of the cephalothorax; it is of a dull-yellow colour, the under part being the palest, with a broad, dentated, dark-brown band extending along the middle of the upper part, which tapers from its anterior extremity to the spinners; the anterior part of this band comprises a fusiform dull-yellow band that extends about one-third of its length, and is followed by several transverse bars of the same colour; the sides are marked with spots and longitudinal streaks of a dark-brown colour, and a series of minute spots of the same hue passes along each side of the under part; the spinners are of a red-brown colour.

Two immature females of this new *Lycosa* were comprised in the collection; and I gladly avail myself of the circumstance to dedicate the species to Mrs. Greenall, to whose liberality I am indebted for this opportunity of extending our knowledge of the spiders of India.

Family SALTICIDÆ.

Genus SALTICUS, Latr.

Salticus biguttatus, n. sp.

Length of an immature female $\frac{5}{24}$ of an inch; length of the cephalothorax $\frac{1}{12}$, breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{12}$; length of a posterior leg $\frac{1}{4}$; length of an anterior leg $\frac{5}{24}$.

The minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The cephalothorax is large, glossy, somewhat quadrilateral, sloping abruptly at the base, and projecting a little beyond the falces in front; it is of a brown colour, the region of the eyes having a brownish-black and the narrow lateral margins a dark-brown hue. The falces are small, conical, vertical, and of a pale red-brown colour. The maxillæ are short, straight, and enlarged and rounded at the extremity; and the lip is oval. These organs have a brownish-yellow hue, the base of the lip being much the darkest. The sternum is oval, glossy, and of a brownish-black colour. The legs are moderately robust, glossy, provided with a few fine spines, and have a brownish-yellow hue; their relative length could not be ascertained, as all but the posterior pair and one anterior leg were missing; each tarsus is terminated by two slender, curved, pectinated claws, and below them there is a small scopula. The palpi are short, and the digital joint is supplied with pale hairs; they are of a yellowish-

white colour, with the exception of the axillary joint and the greater part of the humeral joint, which have a brown hue. The abdomen is oviform, convex above, and projects over the base of the cephalothorax; it is of a dark-brown colour, and has a large, dull, yellowish-white spot on each side of the medial line of the upper part, near its middle; some scale-like hairs, that reflect prismatic colours, are distributed on the under part; and the spinners have a brownish-yellow hue.

An immature female of this *Salticus* was the only specimen of the species included in the collection.

Salticus candidus, n. sp.

Length of an immature male $\frac{1}{10}$ of an inch; length of the cephalothorax $\frac{1}{10}$, breadth $\frac{1}{4}$; breadth of the abdomen $\frac{1}{6}$; length of a posterior leg $\frac{1}{8}$; length of a leg of the second pair $\frac{1}{12}$.

The cephalothorax is large, glossy, somewhat quadrilateral, abruptly sloped at the base, and advanced a little beyond the falces in front; it is of a pale-yellow colour; the entire region of the eyes and a large spot on each side of its base have a black hue, and the sides are sparingly supplied with scale-like hairs that reflect brilliant prismatic colours. The very minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The falces are small, subconical, vertical, and of a pale-yellow hue, with an oblong, soot-coloured spot at their base, in front. The maxillæ are short, straight, and enlarged and rounded at the extremity; and the lip and sternum are oval. These parts have a pale-yellowish hue, the sternum being the palest; and the lip having a tinge of brown at its base. The legs are provided with hairs and a few fine spines, and are of a yellowish-white colour, with a small black spot at the extremity of the femur of each posterior leg, on the inner side; the fourth pair is the longest, then the third, and the second pair is the shortest; each tarsus is terminated by two curved, pectinated claws, and below them a small scopula is situated. The palpi resemble the legs in colour, and the development of the digital joint is such as merely to suffice for the determination of the sex. The abdomen is oviform, glossy, convex above, and projects over the base of the cephalothorax; it is of a yellowish-white hue, with a soot-coloured mark on each side of its anterior extremity, from which a short longitudinal streak of the same hue passes to the sides; the upper part is crossed by two somewhat irregular, curved, black bands, the anterior one is the broader, and their convexity is directed forwards; a circular black spot, situated immediately above the spinners, comprises two very minute white specks placed transversely; and the sides, like those of the cephalothorax, are

sparingly supplied with scale-like hairs that reflect brilliant prismatic colours.

The collection contained a single immature male of this pretty *Salticus*.

Family THOMISIDÆ.

Genus SPARASSUS, Walck.

Sparassus striatus, n. sp.

Length of an immature female $\frac{1}{2}$ an inch; length of the cephalothorax $\frac{5}{8}$, breadth $\frac{5}{8}$; breadth of the abdomen $\frac{1}{4}$; length of a leg of the second pair 1; length of a leg of the third pair $\frac{2}{3}$.

The abdomen is oviform, somewhat depressed, and projects a little over the base of the cephalothorax; it is clothed with pale-yellow hairs, and is of a yellowish colour faintly tinged with brown, the under part being much the palest; two brown lines extend from the anterior extremity to the middle of the upper part, where they meet, and are followed by a series of angular lines of the same hue, which diminish in size as they approach the spinners, and have their vertices directed forwards; the sides are marked with numerous longitudinal brown streaks, and the under part is spotless. The eyes are disposed on the anterior part of the cephalothorax in two transverse, nearly parallel rows; the four constituting the anterior row, which is the shorter, are rather the largest, and are situated immediately above the frontal margin. The cephalothorax is large, slightly compressed before, truncated in front, rounded on the sides, convex, glossy, thinly clothed with pale hairs, and has a narrow indentation in the medial line of the posterior region; it is of a dull-yellow colour, with a faint brown line extending from the intermediate eyes of the posterior row to the medial indentation, and the frontal margin has a dark-brown hue. The falces are powerful, conical, vertical, armed with teeth on the inner surface, and are of a brownish-black colour faintly tinged with red at the base. The maxillæ are short, straight, powerful, and rounded at the extremity; the lip is broader than long, and somewhat quadrate; and the sternum is heart-shaped, and supplied with long, pale hairs: these parts are of a pale-yellowish hue, the lip being the darkest. The legs are robust, glossy, provided with sessile spines, and have brown hair-like papillæ on the inferior surface of the tarsi and also on the extremity of the metatarsi of the first and second pairs; the second pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by two curved, pectinated claws; the palpi have several long spines on their radial and digital joints, and the latter, which has numerous hairs at its extremity, on the under side, is

terminated by a slightly curved, pectinated claw. These limbs are of a yellow colour, the joints of the legs having a tinge of red-brown at their extremity.

The collection contained two immature females of this species.

Family DRASSIDÆ.

Genus DRASSUS, Walck.

Drassus delicatus, n. sp.

Length of the male (not including the spinners) $\frac{1}{3}$ of an inch; length of the cephalothorax $\frac{1}{10}$, breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{10}$; length of a posterior leg $\frac{3}{8}$; length of a leg of the third pair $\frac{1}{4}$.

The eyes are seated on black spots, and are disposed on the anterior part of the cephalothorax in two slightly curved transverse rows; the anterior row, which is the shorter and less curved, is situated immediately above the frontal margin, the two intermediate eyes being the largest and darkest-coloured of the eight; and the two intermediate ones of the posterior row are oval, almost contiguous, divergent, and diaphanous. The cephalothorax is nearly oval, rounded in front and on the sides, convex, glossy, with a slight, narrow, dark-brown indentation in the medial line of the posterior region; it is of a very pale yellow colour, with a faint tinge of red in the region of the eyes. The falcæ are long, conical, prominent, and armed with a few small teeth on the inner surface; the maxillæ are convex near the base, depressed obliquely near their rounded extremity, and are somewhat inclined towards the lip, which is longer than broad, and rounded at the apex. These organs are of a red-brown colour, the maxillæ being the palest. The sternum is oval, glossy, with minute eminences on the sides, opposite to the legs; it is of a yellowish-white colour, with a few short, longitudinal, red-brown streaks on the lateral margins. The legs are long, glossy, provided with black sessile spines, and have brown hair-like papillæ on the inferior surface of the tarsi; they are of a yellowish-white colour, the metatarsi and tarsi of the first and second pairs being tinged with pale reddish-brown; 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. The palpi resemble the legs in colour, with the exception of the digital joint, which has a red-brown hue; the radial is longer than the cubital joint, and has no apophysis at its extremity; the digital joint is of an oblong-oval form, convex and hairy externally, compact and somewhat pointed at its extremity, and has a shallow concavity at its base, on the underside, comprising the palpal organs, which are small,

little complicated in structure, with a fine, curved, black spine towards the extremity, on the inner side, and are of a pale red-brown colour. The abdomen is of an oblong-oviform figure, slightly convex above, and projects a little over the base of the cephalothorax; it is sparingly clothed with pale silky hairs, and of a yellowish-white colour, with an obscure soot-coloured fusiform band extending from the anterior extremity of the upper part rather more than one-third of its length, and a dark-brown spot situated immediately above the spinners, which are cylindrical and prominent, the inferior pair being the longest.

The only specimen of this species included in the collection was the adult male described above.

Family THERIDIIDÆ.

Genus PHOLCUS, Walck.

Pholcus Lyoni, n. sp.

Length of the female $\frac{5}{10}$ of an inch; length of the cephalothorax $\frac{1}{10}$, breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{6}$; length of an anterior leg $2\frac{6}{10}$; length of a leg of the third pair $1\frac{2}{10}$.

The legs are very long, slender, provided with short, fine hairs, and are of a pale brownish-yellow colour, minutely streaked and spotted with black; a brown annulus occurs near the whitish extremity of the femora and tibiæ, and the genual joint has a brown hue; the first pair is the longest, then the second, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. The eyes are seated on black spots, and are disposed on the anterior part of the cephalothorax, which is rather prominent; three are closely grouped on each side in the form of a triangle, and two, which are much the smallest of the eight, are placed transversely, a little in advance of the two lateral groups. The cephalothorax is nearly circular, glossy, somewhat convex, with a small conical process on each side of its base, and a large indentation in the middle; the lateral margins are depressed, and the space between the small anterior pair of eyes and the frontal margin is broad and nearly vertical; it has a very pale-yellow or yellowish-white hue, the anterior slope of the indentation is tinged with brown, and two obscure brown lines, on the space above the frontal margin, meet in an angle near the anterior pair of eyes. The falces are small, conical, vertical, united at the base, armed with a short, slightly curved fang, and have a single pointed tooth near their extremity, on the inner side; the maxillæ are long, and taper to the extremity; they are greatly enlarged at the base, where the palpi are inserted, and inclined towards the

lip. These organs have a brownish-yellow hue, the latter being much the darker-coloured. The lip is short, broad, slightly dilated in the middle, and somewhat pointed at the apex; and the sternum is heart-shaped, with a slight inward curve at the extremity, which has a small protuberance at its centre; and there are minute prominences on the sides, opposite to the legs. These parts are of a dark-brown colour, the apex of the former and the lateral margins of the latter having a yellowish-white hue. The palpi are short, and of a yellowish-white colour, the digital joint, which tapers to a point, and is well supplied with hairs, having a brown hue. The abdomen is short, somewhat convex above, sparingly clothed with pale hairs, projects slightly over the base of the cephalothorax, and has at its extremity a conical protuberance situated high above the spinners; it is of a yellowish-grey colour, with a red-brown spot on each side of its anterior extremity, a few oblique black streaks on each side of the medial line of the upper part, and a curved line and spot of the same hue on the conical protuberance; in the space between the protuberance and the spinners there is a vertical black line, on each side of which an obscure, curved, whitish line occurs; a broad, longitudinal brownish-black band, mingled with yellowish-grey, occupies the middle of the under part; the anterior part of the band is the broadest, and comprises two contiguous, oval, divergent, dull-yellow spots: the sexual organs are highly developed, rather prominent, and present a narrow, transverse orifice; they are of a red-brown hue, and the anterior margin, which is the darker-coloured, particularly at its extremities, has a small prominence in the middle.

The sexes are similar in colour; but the male is the smaller, and the femur of each anterior leg is provided with a longitudinal row of erect black spines on its inferior surface, which extends from its extremity nearly to its base. The falces are somewhat hollowed on the inner surface, and have a conical, pointed process on the outer side, towards their extremity, near the base of which, on the inner side, a tooth-like process originates, that is directed obliquely inwards and downwards. The palpi are short, very robust, and of a pale-yellow colour, with the exception of the digital joint, which has a dark reddish-brown hue on its sides and extremity; the humeral joint is slender at its base, but its extremity is enlarged and convex underneath; the radial joint is greatly dilated, very convex above, and much larger than the cubital joint; the digital joint is supplied with some long hairs, and tapers from the base to the extremity, which is terminated by a fine, curved, pointed process; the palpal organs are connected with the base of the digital joint, towards the inner side; they are subglobose, of a

yellowish-white colour, and are terminated by a strong, curved, dark red-brown process.

I have connected the name of Captain Francis Lyon with this highly interesting *Pholcus*; and I entertain a hope that his excellent example of collecting and transmitting specimens of natural objects to this country may be extensively followed by gentlemen who, by professional engagements or the love of enterprise, may be led to sojourn in our Indian possessions.

Numerous specimens of this curious species, in almost every stage of growth, were comprised in the collection; it chiefly inhabits the interior of buildings, and must be very abundant in those parts of India in which it was obtained. A careful inspection of these specimens led to the discovery of one in the adult state in which the two sexes were united, the left side (as indicated by the very remarkable structure of the palpus, palpal organs, and falx) being that of a male, and the right side (as shown by the structure of the palpus, falx, and the small and irregularly developed vulva) being that of a female: unfortunately the two anterior legs were missing; consequently it was not possible to determine whether they manifested the usual conformation characteristic of sex or not; but that such would have been the case, had they been present, scarcely a doubt can be entertained. Among the many thousands of spiders that I have examined, this is the only instance of the union of the sexes in the same individual that has come under my notice; and, as I have not met with any record of a similar case, in the course of my reading, it must be one of exceedingly rare occurrence.

Genus ARTEMA, Walck.

Artema convexa.

Artema convexa, Blackw., Annals & Mag. Nat. Hist. ser. 3. vol. ii. p. 332, and vol. xviii. p. 459.

Specimens of both sexes of *Artema convexa*, in the adult state and in various stages of development, were contained in the collection. The large brown-black spots on the upper part of the abdomen in every instance formed two distinct longitudinal rows, proving that their occasional junction merely constitutes a variety of the species.

I have received specimens of this *Artema* from Pernambuco and from Equatorial Africa; and the curious fact of its very extensive geographical distribution is rendered the more surprising by the circumstance of its being a spider that commonly inhabits the interior of buildings.

LVIII.—On some British Neuroptera.

By A. E. EATON, of Trin. Coll. Cambridge.

IN the collection of Neuroptera in the Zoological Museum of the Cambridge University there are some British insects which deserve mention on account either of individual peculiarities or of their being unrecorded hitherto as natives of this country.

Tribe PLANIPENNES.

Family Hemerobiidæ.

Genus CHRYSOPA, Leach.

C. vittata, Wesmael.

A specimen of this insect has the third cubital cell of the fore wing normal on the right side; but on the left the partition vein receives two transverse nervures, the additional one being near the apex of the cell.

C. phyllochroma, Wesm.

Another example of the above arrangement of nervures is met with in both fore wings of an insect of this species.

Family Panorpidæ.

Genus PANORPA, L.

The structure of the last three segments of the body, especially of the last one, presents peculiarities which serve to distinguish the males of the several species of this genus.

At first sight the terminal segment seems to be merely an oval or pyriform forcipate mass with two appendices beneath; but upon a close examination it is found to be far more complicated. The segment proper is comparatively small, and is mitriform, the horns of the mitre being respectively dorsal and ventral. The dorsal horn carries near its end two minute appendices superiores (app. sup.); the ventral horn, in a like manner, supports two long appendices inferiores (app. inf.). The sides and base of the mitral cleft bear the enormous two-jointed appendices intermediæ (app. interm.), which, together with the seventh and eighth segments, constitute the well-known forceps. Their basal joints are convex without and concave within, and enclose a considerable hollow space, in which lie the penis and its sheaths.

In the absence of other structures, the number of the denticulations on the lower edge of the tarsal claws is of use in determining the species of female specimens.

P. communis, L.

Lower edge of the tarsal claws with four long teeth before the tip. Wings usually with an apical and a median transverse blotch, and with numerous spots of a brownish-black colour.

♂. Abdomen:—

The lateral profile of the seventh segment (fig. 1) somewhat resembles that of an inverted gun-stock, its upper edge being oblique, and almost angulated near the base; its lower edge curved slightly, and the segment itself being expanded towards the apex; its posterior edge is convex. The eighth segment is very like the seventh. The dorsal extension of the ninth segment seems oblong, and has raised edges. At its abrupt apex are the triangular app. sup. (fig. 2). The app. interm. has a

Fig. 1.



Fig. 3.

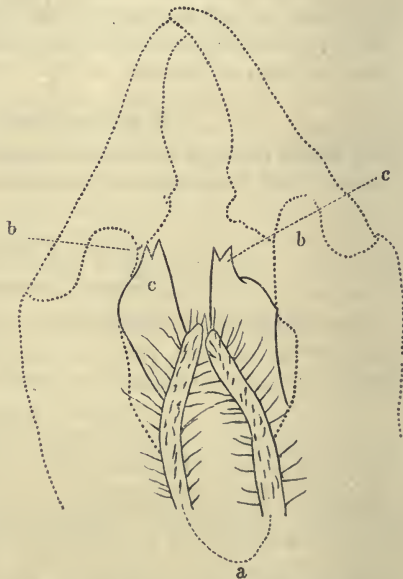


Fig. 2.



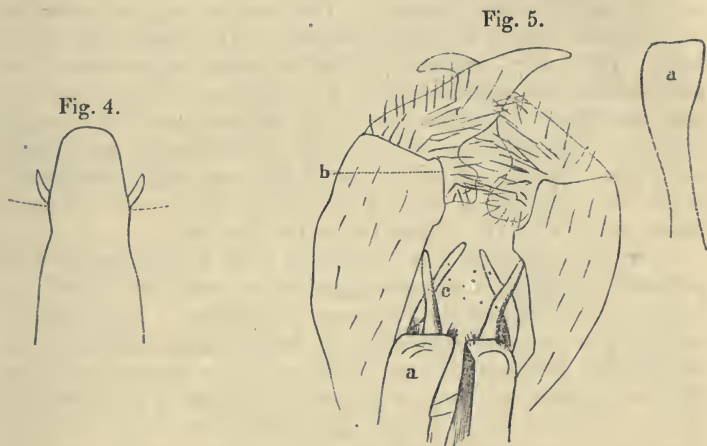
minute oblong projection (fig. 3 *b*) at the apex of the first joint, which is applied to the underside of the second joint. The second joint is flattened from above downwards, curved inwards at the tip, and bidentate within. The ventral extension of the segment seems somewhat triangular and truncate. The filiform app. inf. fall short of the tip of the first joint of the app. interm. (fig. 3 *a*). Projecting above them are the broad and flattened penis-sheaths, which are somewhat expanded just before their oblique apices, and which end in two short triangular points (fig. 3 *c*).

P. germanica, L.

Claws of the tarsi tridentate within. The wings are usually well spotted with black or grey brown.

♂. Abdomen:—

The seventh and eighth segments are very like those of *P. communis*. The dorsal extension of the ninth segment seems oblong; it is prolonged in advance of the app. sup. (fig. 4), which



appear almost cylindrical from one point of view, and clavate from another. The basal joint of the app. interm. has a minute, almost semicircular projection within, from the apical margin beneath (fig. 5 *b*). The second joint has one large tooth on the inner edge. The ventral extension of the segment seems sub-quadrangle with rounded corners. The app. inf. (fig. 5 *a*) are flattened at either extremity, narrowed in the middle, and have a rounded impression near their tips. Above them are seen the acute linear divisions of the bifid penis-sheaths, which are twisted together in opposite directions (fig. 5 *c*). The penis is forked; its short and widely divergent divisions are each of them armed with two unequal hooks, the inner and shorter of which is curved upwards; the outer hook is at first directed upwards, and then suddenly curved backwards and inwards.

P. cognata, Rambur.

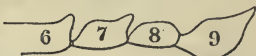
The wings have a median brownish blotch, and a few dots of the same colour on the veins. Expanse of wings 11 lines. Length of the body 6 lines.

♂. Abdomen:—

The last three segments, the tip of the sixth, and a hump at

the upper margin of the fifth segment testaceous. The seventh segment is something like an old-fashioned bonnet. The eighth segment is oblong. Figure 6 will give some idea of their outline as it appears from the side. The dorsal extension of the ninth segment seems oblong. The app. sup. are obtuse and apparently cylindrical. The apical margin of the first joint of the app. interm. has only an obscure projection beneath. The second joint appeared to be toothless; but it is not well shown in the Cambridge specimen. The ventral extension of the segment seems triangular, and bears the obtuse filiform app. inf., which extend as far as the projection from the apical margin of the first joint of the app. interm. The divisions of the bifid penis-sheaths are linear, long, and subequal; they diverge at the base, and converge towards their tips in a vertical direction. The lower divisions reach just beyond the extremities of the app. inf.

Fig. 6.



A single specimen was associated with *P. germanica* in a collection of British insects presented some years ago to the University by the Cambridge Philosophical Society. Although no locality was assigned to it, I do not doubt that it is British; for the foreign Neuroptera were contained in a separate cabinet. Rambur appears not to have known the habitat of this species.

Tribe TRICHOPTERA.

Section *INÆQUIPALPIDÆ*.

Family Limnephilidæ.

Genus *ANABOLIA*, Leach.

A. nervosa, Curtis.

I captured a ♀ specimen near Cambridge in October 1864, in whose left fore wing the first two apical sectors become united at about the last quarter of their length, *i. e.* just before they reach the anastomosis. In both its hind wings the first apical sector bifurcates near its distal extremity. This specimen is not in the museum.

Family Sericostomidæ.

Genus *SILLO*, Curtis.

S. fumipennis, M'Lachlan.

In Mr. Jenyn's collection of Cambridgeshire insects this species stood for *Polycentropus picicornis*, Steph. It is common on small streams near Cambridge.

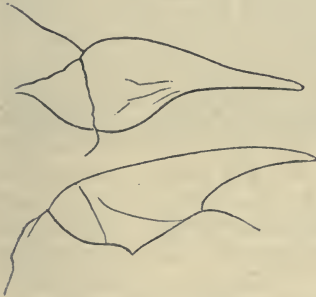
Genus BRACHYCENTRUS, Curtis.

B. subnubilus, Curtis.

Description of the empty pupa-skin.—Mandibles 2-jointed, edentulous (fig. 7); under a high power, however, their inner edge seems very finely denticulated. The subulate anal

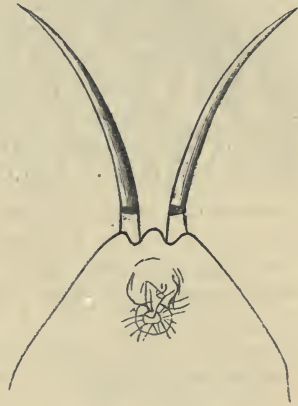
Fig. 7.

♀ (side).



♀ (beneath).

Fig. 8.



crotchets (fig. 8) are testaceous, with a broad whitish ring at the base, and are nearly as long as the last segment. A raised hairy tubercle in the middle of the back of the last segment precedes a deep excavation. The testaceous chitinous processes on the back of the abdomen, which are subservient to movements within the case, are disposed in two oval patches at the base of each of the segments between the third and the seventh inclusively (the points of these being directed backwards), also on the edges of two semicircular projections from the apical edge of the second segment, and, lastly, in a line near the tip of the fifth segment, with the points forwards.

Section *ÆQUIPALPIDÆ*.

Family Rhyacophilidæ.

In April 1865 I found a small *Trichopteron* on the river above Cambridge, which did not conform to any described genus. It was pronounced by Dr. Hagen to be the *Silo minutus* of Kolenati. Unfortunately it was too late to insert a description of it in Mr. M'Lachlan's 'Monograph of the British Trichoptera' (*q. v.* page 166).

As it resembles a *Berea*, and is closely related to that genus, the name *Bereodes* may be not inappropriately assigned to it.

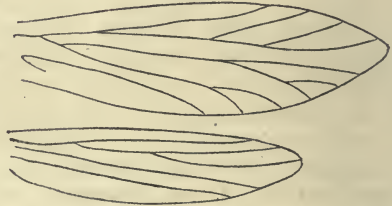
BEREODES, nov. gen.

The second joint of the labial palpi is equal to the third in length; the first joint is minute. The second joint of the maxillary palpi is shorter than the fifth, equal to the fourth, and longer than the third; the first joint is minute. Ocelli absent. The first two joints of the antennæ are very much stouter and longer than the others. Spurs 2.2.4. There is no sexual difference in the neuration of the wings, excepting that the short nervure at the base of the fore wings behind the cubitus is greatly thickened in the male, and that the costule (?) in the hind wing is furcate in the ♀ (fig. 9), and simple in the ♂ (fig. 10). The fore wings are very hairy, and have long fringes. The neuration is indistinct. The transverse veins are alike in both sexes. Fig. 10 represents the neuration of the ♂,

Fig. 9 (♀).



Fig. 10 (♂).



according to Mr. McLachlan. Any discrepancies that can be detected between the two figures, other than those I have already mentioned as dependent on the sex, are due to a difference of opinion respecting the neuration. The lower edge of the last abdominal segment in the ♀ is produced upwards and turned in. The appendices of the ♂ are well developed, but are not easily seen, on account of the last segment being clothed with long hair on the sides. In both sexes there is a tubercle on the last ventral plate, clothed with erect hairs.

B. minutus, Kolenati.

Length 2-2½ lines. Antennæ and maxillary palpi sooty; the first two joints of the one and the first four joints of the other are clothed with spreading hairs. Labial palpi testaceous. Wings fuscous, the anterior with suberect black hairs on the veins near the inner margin. Legs testaceous, with fuscous joinings. Hairs on the tubercle of the last ventral plate fulvo-griseous. The app. inf. of the ♀ are obtusely triangular; in the ♂ the app. inf. are short, very like spear-points, and are testaceous. The app. sup. are difficult to describe: they are filiform, except at the base, which is greatly expanded in the form of a

triangle; they seem to consist of one joint only, and are testaceous. The filiform part is curled in a peculiar manner, its general direction being first upwards and then backwards and inwards towards the tip of the penis. Its middle portion being hidden more or less by the long hair of the segment, the extremities are at first liable to be mistaken for two independent organs; and the shape of the upper would be likened to an italic *S*. The above-mentioned appendices are glabrous; but the app.interm. are clothed with short hairs. The whitish app.interm. are obovato-lanceolate and curved inwards at the tips; they are furnished with a slender divergent process near the base, and are applied to the edge of the segment during life. Seen from the side in this position, they appear to be obliquely truncate. Penis bifid, strongly deflected in dried specimens; the triangular points of its upper sheaths project from beneath its oblong upper cover. Its long and subulate lower sheaths are about equal in length to the penis, and are curved downwards at the tips. The dorsal extension of the last segment has a raised dot on each side, and two raised longitudinal lines in the middle*.

This insect is common above Cambridge, from the end of April to the end of May. I have found it also on the Kennet and Avon Canal, near Reading.

Tribe SUBULICORNES.

Family Ephemeridæ.

Genus CLOEOPSIS, mihi.

C. diptera, L.

In the museum, together with the ordinary form of this insect, are some specimens whose costal area is traversed towards the apex by numerous irregular veins, which here and there are united so as to form double cells. An examination of living specimens is required before their identity can be disproved; but as, even in the dry examples, there appear to be some other slight deviations from the type, this is possibly a distinct species.

* Dr. Hagen considers these to be the app. sup., and the app. sup. of this paper to be the penis-sheaths. In figs. 9 and 10 the wings are represented with the costal fold not flattened out; and the pouch-like fold near the short nervure at the base of the fore wing (σ) is not given in fig. 10. This should be borne in mind if at any time they happen to be compared with the figure in a monograph of *Berea* and its allies which, I am told, Dr. Hagen is going to bring out. The usual tubercles on the head are largely developed.

LIX.—*Notulæ Lichenologicae*. No. XV.*Notes on the Lichens of Cader Idris, North Wales.*

By the Rev. W. A. LEIGHTON, B.A., F.L.S.

CADER IDRIS is a long mountainous range extending seven or eight miles in wavy length from Dolgelley, E.N.E., to the sea, W.S.W., on the southern side of the estuary of the Mawddach. Its northern face is one continuous precipitous escarpment rising abruptly from an extensive slope, formed by spurs or lower elevations, covered with boulders and fallen stones, and converted by numerous rivulets into a wet bog or morass. At its north-eastern end is a small but beautiful "Cwm," formed, as all the others are, by glacial action, enclosing with its perpendicular precipices a small tranquil lake named Llyn Aran. The stream from this lake constitutes the river Aran, which flows over the moraine into the river Wnion at Dolgelley. Westward of this, and about midway of the northern escarpment, is a large sublime Cwm, immediately below the highest point Cader (alt. 2929 feet), in which is a fine lake called Llyn-y-Gader; and below the steep moraine which retains this is another smaller lake, Llyn Gafr. Immediately opposite, on the southern side of the mountain, is another deeper and more terrific Cwm, with perpendicular precipitous sides surrounding the lake Llyn-y-Cae, whose stream flows down the steep sides of the range, joins the river in the bottom of the pass, until eventually both are lost in the great lake Tal-y-llyn. Beyond this, westward, the range is grassy, with gradual slopes almost destitute of bare rocks. The geological formation is felspathic trap and greenstone. The height of the east end is 2855 feet, and of the western 2403 feet. The summit is a narrow grassy ridge, with extensive patches of scattered stones at intervals.

I arrived by rail at Dolgelley on a Monday in July 1866, and quartered at the Ship Hotel, with good and clean accommodation, great civility and attention, and reasonable charges. The evening only afforded a brief time for reconnoitring. Tuesday morning proving showery and unpromising for ascending Cader Idris, I deferred fulfilling my intention until the next day, in hope of more propitious weather, and so determined to devote the day to a kind of home circuit in examining the shores and rocks of Llyn Gwernan, a small lake two miles south-west from Dolgelley, close to the turnpike road skirting the northern base of Cader Idris. By the way I found on the stone walls *Lecidea lithophila*, Ach. (new to Wales), *Parmelia perlata* (L.), and small quantities of *Stereocaulon Cereobus*, Borr., in fructification. On the stones around Llyn Gwernan nothing notable occurred

but a few specimens of *Endocarpon fluviatile*, DC. The sun now broke through the clouds, and tempted me to ascend to the Llyn Gafur and Gader, collecting on the way *Lecidea lithophila*, Ach., *L. fusco-atra*, Ach., *L. contigua*, Fr., in various states and stages, one with curious subgyrose apothecia arising from the inserted growth of an Alga, and another in which the apothecia were broken up into several clustered smaller apothecia; *L. lapicida*, Fr., and its var. *declinans*, Nyl. (new to Great Britain), *L. umbrina*, Ach., and its form *vermifera*, Nyl., *L. petræa*, Flot., in various states, *L. lutosa*, Mont., thallo denudato, *L. atro-alba*, Flot., *Endococcus erraticus* (Mass.) and *gemmifer* (Tayl.), the latter in an unusual state, sine thallo substrato; *Lecanora cinerea* (L.) and *calcareæ*, Ach., *L. badia*, Ach., and its var. *cinerascens*, Nyl. (new to Great Britain), *L. atra*, Ach., and *L. leucophæa*, Flk. (new to Great Britain), *Stereocaulon Cereolus*, Borr., and *S. denudatum*, Flk., and the following entirely new species:—

Lecidea subnigrata, Nyl.

Thus characterized by Dr. Nylander in the 'Flora,' 1866, p. 370:

"Thallus obscure cinerascens, granulosis, diffractus; apothecia fusco-nigra vel spadiceo-nigricantia vel rufo-nigra, convexa, immarginata, sæpius conglomerata, intus concoloria; sporæ 8, incolores, ellipsoideæ, 1-septatæ, long. 0·009–0·011 millim., crass. 0·004–0·005 millim.; epithecium sordide lutescens; paraphyses non discretæ; hypothecium incolor. - Gelatina hymenea iodo cærulescens. Vix separanda a *L. denigrata*."

Lecidea biformigera, Leight.

Thallus sordide albus, tartareus, crassus, verrucoso-areolatus, rimoso-diffractus; apothecia conglomerata, nigra, parva, plana, tenuiter marginata; hypothecium pallidum; sporæ 8, incolores, anguste oblongæ, 1-septatæ, loculis binucleolatis.

Spores very similar in shape and size to those of *Verrucaria biformis*, Borr.

Also, in very small quantity (and new to Britain), *Lecidea Dufourei*, Ach. herb., which Dr. Nylander considers to be a good species, but which he has forgotten to insert in his 'Lich. Gall.' although the lichen has been known to him for fifteen years past.

Arrived at the lakes, the promising sunshine and the apparently short distance to the summit tempted me to persevere and endeavour to reach it, purposing to return eastwards over the ridge to Dolgelly. Noticing a well-marked road at a con-

siderable distance, which could be readily traced to the summit, I resolved to gain it by skirting the base of the precipitous escarpment. After a laborious skipping from stone to stone over a distance of about a mile, I succeeded. Looking northwards, I observed that this road could be traced winding up the spurs and slopes of the mountain, and that it was even then traversed by guides with ladies and ponies. So, though suffering much from fatigue, and having no refreshment with me except some whiskey, not having set out with the intention of making so extended an excursion, I concluded that I was in the right track, and should eventually gain the summit, where I expected to find a hut at which, as on Snowdon, refreshments might be procured. As I ascended, I examined the rocks close to this path, and instantly lost all my weariness on discovering *Platygrapha tesserata* (DC.) (Leight. Brit. Graph. p. 8, t. 5. f. 1) in fine state and in plenty, and also *Lecidea Bruyeriana*, Schaer. (new to Great Britain), of which I bagged some goodly specimens. The latter lichen, I believe, is new to our flora; and its chemical reaction shows that it is distinct from *L. coarctata*, Ach., f. *ornata* (Somrf.), with which some lichenologists have allied it.

My attention being thus diverted, I soon lost all trace of the ascending ladies and guides, whom I saw no more; and time (5 P.M.) warned me that it would be prudent to proceed and gain the summit. No sooner had I set my feet on it, than a dense mist enveloped the whole mountain, through which I could see scarcely two or three yards in advance. However, judging I should scarcely go wrong, I followed the beaten path, which, however, I soon discovered was leading me over the mountain down to the southern or Tal-y-llyn side. Taking out my pocket compass, I steered eastwardly and struck another beaten path, which, after pursuing for nearly half a mile, suddenly terminated in a patch of scattered stones. The dense mist still continuing, I grew somewhat alarmed, dreading the possibility of having to pass the night on these heights, as the descent down the precipitous sides in a mist would be a dangerous risk. Still wandering about, I alighted on another path, which conducted me into rather fearful proximity to the yawning abyss of Llyn-y-Cae. This roused me to watchfulness, and, knowing that I could not be far now from the highest point, I kept more to the left along a track on the edge of the northern escarpment, and gained the Gader and the hut adjoining. But, oh! painful disappointment! no provisions, no inhabitant; nothing but a squalid den of blocks of stones, dripping with wet and begrimed with filth. My alarm now increased; and after proceeding a short distance forward, I returned to the hut, resolving under the circumstances to remain there

during the night, where at all events I should have shelter and safety, if nothing else. Second thoughts urged me to go forward, knowing that, whilst maintaining the ridge, I was safe, and, at the same time travelling eastwards, was in the right direction to eventually reach Dolgelley. The mist now rose a little; and, seating myself for rest, I watched with admiration and awe the mighty mists whirled upwards from the cwms and hollows of the sides, like steam from some huge boiling cauldrons, in very grand and sublime masses. The mist at intervals also opened and closed, alternately revealing and again enveloping glimpses of the beautiful mountainous and wooded scenery lit up by bright sunshine, on the Barmouth side of the estuary, and resembling immense magnificent dissolving views. Turning my eyes eastwards, to my astonishment I caught a glance of what appeared, through the mist, as a man six or seven feet high, with two huge dogs. I halloed; and he fortunately heard, and awaited my coming up to him, when, lo! he proved to be a boy about fourteen, with two shepherd dogs: such was the illusion caused by the mist. With anxious earnestness I entreated him to guide me down, stating that I was a stranger and had lost my way. Luckily he understood English, but stoutly refused to be my guide, saying his home lay on the southern side of the mountain, and merely indicating the position of Dolgelley. Knowing the powerful attraction of money, I pulled out some coins and offered them if he would be my guide. Still without effect. As a last resource, I in despair asked him how I must get down, when he merely pointed with his finger down the precipices, saying "Down there, down there." So, bidding him good-bye, I commended myself to Providence, and descended the precipices slowly and cautiously. To my great astonishment and delight, the mist now entirely and suddenly cleared off, and the sun once more broke out in splendour. I now recognized that I was descending the far-famed Llwybyr Cadnaw, or "the Foxes' Path," a steep and fatiguing slope of loose débris and broken stones, and was striking the lake Llyn Gader, the very point from which I had ascended in the earlier part of the day. Most thankful did I feel, and, draining my last drop of whiskey, addressed myself to steering as straight a course as possible across the morasses and spurs to Dolgelley, throwing myself down, ever and anon, in sheer fatigue and exhaustion, for a few moments' rest. Eventually I gained my inn, refreshed exhausted nature, and turned in for a glorious and welcome night's sleep.

I may here remark that there is in reality no real danger in ascending any of the Welsh mountains alone and without a guide. The great use of guides is that, in a strange moun-

tainous country, they can point the easier and readier way of ascent and access. Moreover it is always well to have a companion in the event of mists coming on, or for procuring immediate assistance in case of a sprained or broken limb on the rocks, since a person prevented from walking by such an accident might remain for days even without anybody coming near him or hearing his cries for aid.

Next morning I took the coach and travelled through the beautiful scenery of the estuary ten miles to Barmouth, encountering a fierce storm of hail and rain *in transitu*. This day's collecting on the rocks immediately above and around Barmouth yielded the following:—*Spilonema paradoxum*, Born., in fruct.; *Ephebe pubescens*, Fr.; *Physcia erosa* (Borr.); *Lecanora cervina*, Ach., var. *smaragdula*, *sinopica*, and *simplex*; *Lecidea stellulata*, Tayl.; *Lecidea lævigata*, Nyl.; *Pertusaria ceuthocarpa*, T. & B.; *Lecidea enterochlora*, Tayl.; *Lecidea fuliginosa*, Tayl.; *Opegrapha Chevallieri*, Leight.; *Lecanora epanora*, Ach.

Returning to Dolgelley by rail, I picked up on the trees near Pen-maen-pool *Lecidea bacillifera*, Nyl. (new to Wales).

The following morning proving rainy, I wandered before breakfast along the Bala road, and there, about one mile from Dolgelley, gathered *Sticta limbata*, Sm., and *fuliginosa*, Dicks., and on a Scotch fir by the roadside discovered a new species of *Opegrapha*, which Dr. Nylander has thus named and characterized in the 'Flora,' 1866, p. 374:—

“*Opegrapha amphotera*, Nyl.

“*Similis O. varia* f. *diaphora*, apotheciis sat confertis; sed sporæ tenuiores (long. 0·030–0·035 millim., crassit. 0·0035–0·0045 millim.), septis 5–9 (vel sæpius indistinctis). Hybrida quasi inter *O. variam* et *vulgatam*.”

After breakfast, the weather clearing up a little, I took an unfrequented road across the base of the eastern spur of Cader Idris to the Cross Foxes on the Tal-y-llyn road, and on the stone walls there gathered *Lecidea lucida*, Ach., in magnificent and abundant fructification, *Lecidea sabuletorum*, var. *milliaria*, with fine and plentiful spermogonia on the mosses, *Pannaria muscorum* (Ach.) in fruit, *Leptogium muscicolum*, Fr., *Stereocaulon denudatum*, Flk., with magnificent cephalodia. Proceeding onwards to a little tarn on the roadside, Llyn Trigraienyn, the fine view of the whole pass, with the lake Tal-y-llyn, bursts on the sight—so beautiful as not soon to be forgotten. Close to the tarn are the “Giant's Pebbles,” on which I found *Cetraria aculeata*, Ehrh., *Alectoria bicolor*, Ehrh., *Platysma sæpinolum*, Hoffm., and a new species of *Lecidea*, in very small quantity,

which Dr. Nylander has named *Lecidea rusticula*, and thus describes in the 'Flora,' 1866, p. 371 :—

“*Lecidea rusticula*, Nyl.

“Thallus albidus, granulis constans depressis subcrenatis; apothecia nigra, minuta (latit. 0·2 millim. vel parum amplius), planiuscula (juniora obtuse marginata); sporæ 8, incolores, ellipsoideæ, long. 0·010–0·015 millim., crass. 0·005–0·008 millim.; epithecium vage fuscescens; paraphyses haud discretæ; hypothecium fuscum. Gelatina hymenea iodo intense cærulescens, dein sordide lutescens. Sporis majoribus, thallo, &c., differt a comparanda *L. dispansa*, Nyl. in 'Flora,' 1866, p. 87.”

Lunched at the little roadside inn at Minffordd, and retraced my steps to Dolgelley for the night.

I was now joined by my friend Dr. John Fraser, of Wolverhampton; and we essayed the ascent of Cader Idris by the lakes, purposing to examine carefully the northern escarpment. We had, however, scarcely surmounted the moraines before a beating hailstorm and pelting rain chilled, benumbed, and wetted us to the skin, compelling us to halt and seek shelter amid the boulders. But, no abatement in the storm occurring, we were obliged to descend and return home through the morass, which (and even the turnpike road itself) was swimming with water several inches deep. Our gatherings were necessarily trifling—*Parmelia conspersa*, Ach., with spermogonia, *Lecanora cervina*, Ach., var. *rufovirescens*, Tayl., and a few other species before enumerated. The evening was spent in a walk to the famous “Torrent Walk,” which proved to my friend a very paradise of mosses, but afforded nothing of any interest in lichens.

Nothing daunted, we next day tried Cader Idris from the north-west, purposing to traverse the summit eastward to Dolgelley, but were again beaten back by dense mists and drenching rain, collecting nothing save *Lecidea milliaria*, Fr., f. sporis subsimplicibus, *Lecidea flavovirescens*, Mass., *L. bacillifera*, Nyl., f. *muscorum*, *L. coarctata*, Ach., f. *elachista*, Ach., *Lecanora ventosa*, Ach., thallo pallidiore, and *Lecidea rivulosa*, Ach.

A fine day now tempted me (in the absence of my friend, who went to Barmouth in search of mosses) to a stroll along the Festiniog road, on the banks of the river flowing through this most beautiful and picturesque valley. Here, on the stone walls, roadsides, and trees, I met with *Opegrapha saxatilis*, DC., *Verrucaria gemmata*, Ach., *V. margacea*, Whlbn., var. *æthiobola*, Whlbn., *V. rupestris*, Schrad., *V. chlorotica*, Ach., *V. nitida*, Schrad., *Arthonia Schwartziana*, Ach., and *A. epipasta*, Ach.,

Lecidea stellulata, Tayl., *L. chalybeia*, Borr., *L. Cæderi*, Ach., *L. vernalis*, Fr., *L. sabuletorum*, Flk., states of *Lecanora cinerea* (L.), *L. calva* (Dicks.), *L. pyracea*, Ach., and *L. aurantiaca* (Lightf.), and *L. galactina*, Ach., *Lecanora sophodes*, Ach., forma *virescens*, *Bæomyces icmadophilus* (Ach.), and a new *Sphæria* growing parasitically on the thallus of *Lecanora tartarea* or its variety *pallescens*, and which Dr. Nylander, to whom I submitted it, proposes to name *Sphæria tartaricola*, Nyl.

Our last day was devoted to the east end of the range, about Llyn Aran, and was a glorious one. This portion seems but little frequented; for we here observed *Saxifraga nivalis* (L.), *Oxyria reniformis* (Hook.), *Sedum Rhodiola* (DC.), *Thalictrum minus* (L.), *Asplenium viride* (Huds.), *Cyrtia dentata*, Sm., &c.

Mylichen-gatherings were:—*Stereocaulon cereolus*, Borr., abundant and in fine fructification, and with pycnides; *Stereocaulon denudatum*, Flk., scarce; *Lecidea panæola*, Ach. (new to England), *L. excentrica*, Ach. (new to Great Britain), *L. phæops*, Nyl. (new to Great Britain); *Abrothallus Welwitschii*, Tul.; *Lecanora leucophæa*, Flk., abundant; *L. irrubata*, Ach.; *L. murorum*, Hffm., var. *obliteratum*, Pers.; *Normandina pulchella* (Borr.); *Endococcus gemmifer*, Tayl.; *Verrucaria Sprucei*, Leight.; *V. mesotropa*, Nyl., n. sp.; and *Lecidea advertens*, Nyl., n. sp. The two latter are thus described by Dr. Nylander in the 'Flora,' 1866, p. 419:—

“*Verrucaria mesotropa*, Nyl.

“Thallus pallidus, tenuis, inæqualis; apothecia nigra, turgidula; perithecio convexo, dimidiatim nigro (latit. 0·15–0·20 millim.), epithecio vix distincto; sporæ 8, incolores, ovoideæ vel ovoideo-oblongæ, 1-septatæ (vel septo spurio), long 0·012–0·017 millim., crass. 0·005–0·006 millim.; paraphyses nullæ. Gelatina hymenea iodo vinose rubens. Affinis videtur *V. superpositæ*. Gonidia viridia (latit. 0·004–0·006 millim.), sæpe oblonga.”

“*Lecidea advertens*, Nyl.

“Thallus olivaceo-nigricans, tenuis, subfurfurellus, indeterminatus; apothecia nigra, minuta (latit. 0·2–0·3 millim.), demum convexiuscula, immarginata, intus concoloria; sporæ 8, incolores, ellipsoideæ, longit. 0·011–0·014 millim., crassit. 0·007–0·009 millim.; epithecium sordide cærulescens; paraphyses non discretæ; hypothecium nigrum vel fusco-nigrum. Gelatina hymenea iodo cærulescens.

“Facie *Spilonematis revertentis*, sed thallo tenuiore texturaque omnino alia, scilicet gonidia. Thallus gonidiis constans chroolepoidee concatenatis, filamenta sistentibus articulata (crassit. 0·014–0·018 millim.), chlorophyllo viridi in cavitatibus rotun-

datis, parietibus crassulis; si thallus non est alienus, hæc species proprium genus sistit, quod *Heterostroma* dicere liceat. Conferendus est thallus in *Thelopsi melathelia* (quam etiam ad Onegam detexit præstantissimus Simming) etiam texturam *Chroolepi* habens, ut facile crederes hic agi de lichenibus parasitis.”

We scrambled to the summit, traversing the ridge, finding nothing but *Lecidea rivulosa*, Ach., and *L. contigua*, Fr., on the very highest points, and descended by the Foxes' Path, where *Allosorus crispus* (Bernh.) grows abundantly, and where I also gathered *Placopsis gelida* (L.).

Thus this excursion has added to our British Flora a score of new lichens, of which six are entirely new to lichenology, and a new species of *Sphæria*,—proving that our Welsh mountains, if thoroughly searched, would yield an abundant harvest of good, rare, and novel lichens, and probably many novelties in other natural orders.

Dr. Fraser kindly permits me to add a list of the mosses which he found near Dolgelley, chiefly on Cader Idris:—

<i>Andreaea alpina</i> .	<i>Orthotrichum Lyellii</i> .
— <i>rupestris</i> .	— <i>crispum</i> .
— <i>Rothii</i> .	<i>Diphyseium foliosum</i> .
<i>Sphagnum acutifolium</i> (in fruit).	<i>Pogonatum urnigerum</i> .
<i>Gymnostomum rupestre</i> .	— <i>alpinum</i> .
<i>Dicranum squarrosum</i> .	<i>Bryum polymorphum</i> .
— <i>heteromallum</i> .	— <i>crudum</i> .
— <i>falcatum</i> .	— <i>pseudo-triquetrum</i> .
— <i>majus</i> .	— <i>alpinum</i> .
<i>Leucobryum glaucum</i> .	— <i>cirrhatum</i> (intermedium).
<i>Campylopus longipilus</i> .	— <i>nutans</i> (a variety).
<i>Distichium capillaceum</i> .	— <i>Zierii</i> .
<i>Didymodon rubellus</i> .	<i>Entosthodon Templetoni</i> .
— <i>cylindricus</i> .	<i>Physcomitrium ericetorum</i> .
<i>Trichostomum homomallum</i> .	<i>Bartramia fontana</i> .
<i>Encalypta vulgaris</i> .	— <i>pomiformis</i> .
<i>Hedwigia ciliata</i> .	— <i>ithyphylla</i> .
<i>Schistidium maritimum</i> . (Bar-	— <i>arcuata</i> .
mouth.)	<i>Tetraplodon mnioides</i> .
<i>Grimmia Doniana</i> .	<i>Cedipodium Griffithianum</i> .
— <i>patens</i> .	<i>Anæctangium compactum</i> .
<i>Racomitrium aciculare</i> .	<i>Antitrichia curtispindula</i> .
— <i>fasciculare</i> .	<i>Hypnum rutabulum</i> (a variety).
— <i>heterostichum</i> .	— <i>loreum</i> .
— <i>lanuginosum</i> .	— <i>revolvens</i> .
<i>Ptycomitrium polyphyllum</i> .	— <i>pulchellum</i> .

LX.—*Diagnostic Characters of some new Genera and Species of Prionidæ.* By FRANCIS P. PASCOE, F.L.S., F.Z.S., &c.

SARMYDUS.

Antennæ compressæ, articulo tertio quam scapus longiore et latiore. Prothorax transversus, lateraliter spinosus. Femora et tibiæ compressæ. Prosternum productum.

Dorycera affinis, sed antennæ valde diversæ.

Sarmydus antennatus.

S. fuscescens; elytris costatis, postice subreticulatis; antennis articulis quatuor basalibus fuscis, cæteris flavis. Long. 11 lin.

Hab. Sarawak.

XAURUS.

(♀) Caput infra antennas paulo productum. Antennæ breves, articulo tertio quam scapus brevior. Prothorax irregularis, lateraliter spinosus. Parapleura metathoracis oblongo-quadrata.

Tragosomæ affinis, sed antennæ et parapleura diversa.

Xaurus depsarius.

X. fulvo-brunneus; elytra ampliata, intricate punctata. Long. 20 lin.

Hab. Morty.

NEPIODES.

Mandibulæ elongatæ. Scapus antennarum perbrevis. Oculi magni, supra approximati. Prothorax transversim subquadratus, inermis.

Ægosomæ affinis.

Nepiodes cognatus.

N. rufo-fuscus; elytris tricostatis. Long. 8 lin.

Hab. Sarawak.

ZARAX.

Palpi brevissimi. Antennæ incrassatæ, breves, muticæ, scapo brevissimo. Tarsi brevissimi, infra canaliculati.

Cum *Macrotomate* prosterno congruit, aliter diversus.

Zarax eurypodioides.

Z. piceus, supra crebre et subtiliter punctatus; elytris obsolete octocostatis. Long. 11 lin.

Hab. Sarawak.

OMOTAGUS.

Tarsi lineares, articulis tribus basalibus infra ad apices biscopuliferis. Mandibulæ dentibus duobus magnis conjunctis instructæ.

Hystato affinis, sed mandibulis aliis.

Omotagus Lacordairii.

O. capite prothoraceque nigris, opacis; hoc subtilissime granuloso-

punctato, lateribus dentato-serratis; elytris crebre punctulatis, piceis, nitidis, leviter quadricostulatis. Long. 34 lin.

Hab. Dorey.

The above diagnoses are made from specimens forming a part of the rich collection made by Mr. Wallace in the Malayan archipelago, and will be treated in detail in my 'Longicornia Malayana.' In the interval they will be redescribed by Prof. Lacordaire in the forthcoming volume of the 'Genera,' and they are now in his hands for that purpose. I am already in possession of his views regarding the affinities of these genera; and although they are not in all cases in accordance with what is here given, I have thought it better to let what I had previously written stand without any alteration.

I have taken this opportunity to describe some new species of the family from other localities. One is an entirely new genus, from the extreme north of Australia; and another is a second and very distinct species of *Hoplideres*, from Madagascar*.

Prionus Gerrardi.

P. capite prothoraceque nigrescentibus, hoc dentibus duobus latis utrinque instructo; antennis 11-articulatis, articulis a quinto ad decimum apice unilateraliter productis.

Hab. Madagascar.

Head and prothorax brownish black, roughly punctured; eyes large and nearly approximate above; each side of the prothorax with two broad teeth, the posterior angle not produced, the disk with three large flat tubercles, punctures coarse and crowded; scutellum coarsely punctured; elytra elongate, parallel, light brown, thickly punctured, the intervals very slightly wrinkled, each elytron with four raised lines, which by their union present a small reticulate area near the apex, the latter completely rounded; body beneath glossy reddish brown; legs rather feeble, clothed with short stiffish hairs; antennæ 11-jointed, the fifth to the tenth joints, inclusive, prolonged on one side at their apices, the last elongate-ovate. Length 18 lines.

A somewhat long and depressed species, with feeble legs (σ), not suggestive of any near ally. I have named it after the late Mr. W. S. Gerrard, who fell a victim to the climate while collecting in Madagascar.

* The names of two of the genera of Prionidæ are preoccupied, viz. *Chiasmus* and *Hephiattes*, J. Thoms., the former previously used in the Hemiptera by M. Mulsant, and the latter (more correctly *Ephialtes*) by Keyserling and Blasius for a genus of birds. *Chiasmus* I propose to change to *Chiasmetes*; *Ephialtes* is unknown to me. *Cacosceles*, Newm., will, I fear, be regarded as too near to *Cacoscelis*, Chev., which has the priority.

Prionus tetanicus.

P. fuscus, prothorace scutelloque nitidis, interrupte et subtiliter punctatis; elytris rugosis, fere obsolete quadricostatis.

Hab. Chosan (Japanese Sea).

Dark brown; head not very closely punctured: prothorax shining, two rather strong teeth on each side, the posterior angle well-marked, but not spiniform; punctures very fine, interrupted in the middle; scutellum smooth and shining, marked by a few small punctures: elytra somewhat narrow, finely rugose, very closely covered with very numerous small punctiform impressions separated from each other by minute zigzag lines, very clear and distinct under a good lens, each elytron marked by two scarcely elevated but sufficiently obvious lines: body beneath and femora glossy brown: legs rather long, robust; tibiæ spinosely rugose, especially the two posterior pair, fluted; tarsi reddish chestnut: antennæ 12-jointed, the joints large, mostly depressed and dilated on both sides from the third to the ninth or tenth, but gradually less on one side as they approach the twelfth, which is oblong-ovate. Length 14 lines.

Allied to *P. Besicanus*, but, among many other points of difference, distinguished by the numerous small spines covering the intermediate and posterior tibiæ. I owe my specimen to Arthur Adams, Esq., R.N.

Hoplideres levicollis.

(♀) *H. brunneus*, subnitidus; prothorace bicalloso, obsolete punctato; elytris antennisque muticis.

Hab. Madagascar.

Reddish brown, subnitid; face with crowded but very shallow punctures: prothorax with five spines on each side, the two posterior united at the base; the disk with two large flat callosities, from each of which projects a short lateral tooth, the interval obsoletely punctured; scutellum nearly semicircular, minutely punctured: elytra very glossy and thickly punctured at the base, suddenly becoming very finely and then almost obsoletely punctured, and at the same time losing much of the glossiness, not spined at the shoulders, and the sides beneath not serrated: body beneath with a short, greyish pile; antennæ without spines. Length 14 lines.

Much shorter and more glossy than *H. spinipennis*; the head and prothorax not coarsely and roughly punctured; the shoulders and sides of the elytra beneath without armature, the punctures at their bases equally disposed from side to side, and no spines on the antennal joints. On account of the last character, it comes rather badly into *Hoplideres*, in a technical point of view.

Ægosoma lacertosum.

Æ. brunneo-rufum; elytris fuscis, opacis, costis valde elevatis, rufifulvis, subnitidis, sutura apice breviter mucronata.

Hab. Sylhet.

Deep red or brownish red; head and prothorax covered with numerous minute granules, the latter with the sides gradually broader from the apex to the base, the posterior angle subacuminate, slightly recurved; scutellum scutiform; elytra dark brown, opaque, very minutely granulate, the ribs strongly raised, reddish yellow, glabrous, and subnitid, the sutural angle shortly mucronate; body beneath with a thin, rough, greyish pile; legs reddish brown, the knees black and glabrous. Length 14 lines.

A very distinct species, on account of its colour and the strongly raised glabrous lines of its elytra.

ELAPTUS.

Antennæ corpore longiores, subcompressæ, articulis tertio et quarto æqualibus, sequentibus gradatim longioribus, ultimo acuminato. Oculi magni. Prothorax transversus, carina laterali pone medium paulo angulata. Elytra depressa, breviuscula, apice rotundata. Femora brevia; tibiæ haud dentatæ; tarsi subangustati, æquales, articulis tribus basalibus quam ultimus vix longioribus. Abdomen segmentis longitudine æqualibus.

Apparently allied to *Sarmyds*, which I have not at present an opportunity of examining. From *Notophysis** it differs in the antennæ and eyes.

Elaptus simulator.

E. fuscescens, nitidus; elytris fulvescentibus.

Hab. Cape York (Northern Australia).

Glossy, brownish, the elytra inclining to fulvous; head roughly punctured, the eyes occupying the greater part of it; prothorax a little broader than the head, finely and rather closely punctured, lateral ridge slender, depressed, slightly emarginate behind the angle; scutellum rounded behind; elytra finely and closely punctured, each puncture with a short greyish hair, three scarcely raised lines on each; body beneath and legs with a greyish pile. Length 10 lines.

P.S. Since this was written, M. Lacordaire informs me that this Prionid belongs to his "groupe Clostérides."

* A species of *Notophysis* in my collection has the following differences from Serville's description of his *N. lucanoides*:—mandibles not denticulate internally; head and prothorax not "very smooth," and elytra not spined at the sutural angle; the tarsi, also, do not agree. The male is nearly black, with the antennæ scarcely two-thirds the length of the body; the female is larger, light chestnut-brown, the antennæ not half the length of the body.

LXI.—Notes on *Pelonaia corrugata*.

By W. CARMICHAEL M'INTOSH, M.D., F.L.S.

[Plate XII.]

A BRIEF description (with drawings) of this animal was read in Section D of the British Association, in August last, under the idea that it was a new molluscid animal—a mistake which arose from the defective descriptions and figures of Messrs. Forbes and Goodsir in the 'Edinburgh Philosophical Journal' and the 'British Mollusca' of Messrs. Forbes and Hanley. Prof. Huxley, in remarking on the paper, observed that the dependence placed on the descriptions of the above-mentioned authors was too great, and he thought the animal was a *Pelonaia*. I am especially indebted, however, to the late Mr. Joshua Alder, who examined the specimen, its description, and the drawings, for much valuable information on the subject, as well as for the accurate determination of the species.

The specimen (Pl. XII. fig. 1) from which the original description was drawn up had been about four years in spirit before an examination showed its true nature; and then, unfortunately, the state of the preparation prevented so precise an examination as might have been desirable. The transmission of another small specimen, however, in a fresh condition has enabled me to correct some doubtful points in the previous description. Both examples were procured at St. Andrews, by relatives,—the larger being cast on shore after a severe storm, the smaller occurring amongst the débris from the deep-sea fishing off the Bay*. Both were injured at the anterior end. The following description is thus necessarily fragmentary.

The test in the larger example measures about $1\frac{3}{4}$ inch in length, possesses a club-shaped outline, and is of a brownish-sandy colour, resembling an elongated Florence flask with the bottom a little produced and the neck much elongated. In the other specimen the form is more strictly club-shaped, the bulbous end being smaller in proportion to the stalk. The case is rough to the touch, like sand-paper, and bears at the bulbous end a series of minute hairy processes, while the apertures are situated at the extremity of the elongated portion. In structure the external tunic is fibrous, dense, and elastic, and, with the exception of the terminal portion of the smaller end in the larger specimen, loaded with minute and closely adherent sand-particles imbedded in a hyaline matrix. Like the more regular and exquisitely fitted, though larger-grained and less elastic

* A third, much less coated with sand, has just been sent from the same locality.

tubes of *Pectinaria belgica*, the test is little affected by hydrochloric acid or caustic potash, the former only disengaging a few bubbles of gas from some calcareous fragments, the latter rendering the basis structure more translucent, but not destroying its cohesion. Such an investment, as usual, is calculated to restore the shape of the animal, by whatever means alteration is brought about. In the smaller specimen the transverse wrinkles were very distinctly marked, encroaching even on the bulbous end. So firm was the test in the latter, that very considerable pressure produced no alteration. The test, however, varies much in this respect in different examples.

The hairs are evidently essential parts of the test of the animal, like those of *Cynthia ampulla*. Microscopically, they present a rugged, semiopaque, fibro-granular aspect, having a hyaline basis structure containing many granules, with granular débris of mud and sand attached to it. The sand-particles were often largest at the base of each process; and the edges were rough from projecting threads of the basis structure with adhering débris. On the whole, the process was much finer than that of *Cynthia ampulla*, which, under the same power (350 diam.), showed a great increase of coarse sand-particles, Diatomacæ, sponge-spicula, and Foraminifera, together with Crustacean and Annelidan hairs, shells of *Cyprides*, and other débris.

Underneath the external matrix of the test generally is a layer of interlaced broad fibres, which cross each other at right angles, the longitudinal ones being somewhat fasciculate, the circular less so. The individual fibres (fig. 4) are of large size and faintly striated longitudinally, and some contain traces of nuclei. At some parts a cellulo-granular texture is incorporated with the layer, the fibres in that case following for the most part one direction, and leaving intervals between the fasciculi, in which the cellulo-granular structure is situated. This, however, may have been due to the ordinary epithelial lining of the layer superseding it. This muscular coat is very easily separated from the whitish internal surface of the test in spirit; and in the fresh specimen it is scarcely more difficult, with the exception of the narrow portion, where the fibres adhere to the test more firmly. It is also proportionally thicker in the latter region. The general appearance of the layer is shown in fig. 2, f.

On removing the soft pinkish textures from the test, the appearance is as represented in fig. 2, a great portion of the body of the animal being occupied by the branchial apparatus, which lies within the muscular coat. When minutely examined with the naked eye or a lens, this structure is found to be ribbed

longitudinally and crossed by regular transverse bands, on the whole somewhat resembling the same apparatus in *Boltenia**. Under a power of 90 diam. (fig. 5), the longitudinal fibrous bands (*a*) are crossed by circular belts (*b*) of nearly equal thickness, and the square or oblong spaces thus formed are again subdivided by more slender bands (*c*). All these bands project inwards from the ovoid branchial spaces; and thus, when viewed from the inner surface, the latter are in the background, as in the figure. A portion of the branchial membrane, somewhat compressed, and with the small circular band (*c*) removed, is represented from the spirit preparation in fig. 6, $\times 200$ diameters. The aperture is surrounded by a well-defined minutely granular rim of cells, which cells in life are covered with long and powerful cilia, whose remains are apparent even in the spirit preparation. The branchial fenestrated membrane is continued along the stalk of the animal to the oral aperture (*a*, fig. 2). This oral aperture, when removed from the test, is found to be situated in the largest and most muscular of the terminal cones; and when this is contracted, a little within the opening are a number of small red specks. Below these is a ring of minute filiform tentacles (fig. 3), composed of a transparent basement structure, with numerous granules.

The termination of the slender end in the larger example as seen under a lens is shown in fig. 7; and it had a less sandy investment than the rest of the animal: indeed towards the end the sand-particles obtained an individuality not seen elsewhere, from the predominance of the tough basis substance. In the smaller specimen this part was similar to the rest in this respect. The oral aperture is seen at *a*, and the anal at *b*. Each of these apertures had a concentric and finished arrangement of carunculae and papillae externally. The external investment of the narrowed portion is the densest on the animal, though, as above mentioned, the sand-particles are less closely set towards the tip. The glistening white fibrous lining of the test is also thickened; it becomes more yielding where it expands to meet the bulbous portion. The muscular layer of this part formed a powerful tube (*f*, fig. 2) of external circular and internal longitudinal fibres.

The endostyle lies along the side of the branchial chamber (*g*, fig. 2), and forms a somewhat zigzag pinkish band. A portion from the larger specimen is seen in fig. 9, viewed under a lens. This structure looks like a simple folded basement membrane, with a closely set series of granular cylindrical epithe-

* Savigny, 'Mémoires sur les Animaux sans Vert.' 2nd part, 1^{er} fascic. pl. 5. I am indebted to Dr. Lauder Lindsay for kindly placing a specimen of *Boltenia* from Otago, New Zealand, at my disposal.

lium-cells (fig. 10), tipped with a vigorous array of cilia, which are shorter than those in the fenestræ of the branchial membrane.

The mouth, opening freely at the bottom of the branchial sac, leads into a muscular œsophagus, which is readily distinguished from the intestine by its emptiness. It is marked externally by longitudinal striæ in its ordinary state, and is lined with a very closely set layer of cylindrical epithelium richly ciliated on the inner surface. Some of the separated cells are represented in fig. 11. When viewed under pressure, the membrane has often a minutely cellular appearance, the ends of the cells only being visible. The equally muscular stomach is of a dull orange hue, and is marked by longitudinal rugæ which have a somewhat regular arrangement. The colour is due to the presence of the liver-cells (figs. 12 & 13), which form dense yellowish masses arranged in a longitudinal manner. Numerous branching bile-ducts were also apparent, many of them having cæcal extremities. Portions of these are seen in fig. 14; and they appeared to be lined with epithelium. The inner surface of the stomach, again, is furnished with a curiously folded arrangement of glandular membrane (fig. 15), with its inner surface richly ciliated. These folds are composed of cylindrical ciliated, and rounded granular cells (fig. 16). The addition of a little sulphuric ether to a slide from the stomach brought out at some parts a beautiful series of fusiform nucleated cells or cell-fibres (fig. 17); but their exact anatomical relations could not be made out. The yellowish colour of the stomach is traced to the pylorus, after which the alimentary canal (*h*, fig. 2) becomes less muscular, and, in the present instance, is loaded with muddy débris. The inner surface of the intestine is covered with large rounded glands having fatty globules in their interior, which are shown under pressure in fig. 18. Numerous Diatomaceæ occurred amongst the muddy débris in the intestine. The gut terminated superiorly at the anal opening. The foregoing organs are retained *in situ* by delicate membranous bands.

Lying to the outer side of the branchial membrane in the larger specimen were two rows of bodies like ova (*d*, *d'*, fig. 8), which proceeded from the bulbous portion for some distance along the stalk. They had the usual structure, viz. granular contents, large nucleus, and nucleolus, as shown in fig. 19. The ova varied in size from $\frac{1}{150}$ to $\frac{1}{90}$ inch or more.

The inner surface of the bulbous portion had numerous projecting and somewhat pediculated bullæ, indicated at *o*, fig. 2, which, in the larger specimen, were marked externally (within the test) by one bulla, and in the smaller by two. These organs are evidently glandular; and a portion of one is shown, $\times 350$

diam., in fig. 20. Its entire surface is studded with granular glands. At *r* (fig. 2), entangled in the lining membrane, was, in each specimen, a small reddish grain, apparently of a fatty nature.

In the angle between the oral and anal openings is the opaque pinkish nerve-ganglion, composed of minute, granular nerve-cells. The branches have a granular appearance.

EXPLANATION OF PLATE XII.

- Fig. 1.* *Pelonaia corrugata*, of nearly the natural size.
- Fig. 2.* View of the animal removed from its test, and enlarged under a lens: *a*, oral aperture slit open; *b*, pink anal cone; *c*, oral tentacles; *d*, nerve-ganglion; *e*, red pigment-specks; *f*, muscular sheath; *g*, endostyle; *h*, intestine bulged with muddy débris; *i*, branchial chamber; *m*, œsophagus; *n*, pyloric extremity of stomach; *o*, prominent and somewhat pediculated glandular organs; *p*, stomach; *r*, reddish granule.
- Fig. 3.* Tip of one of the oral tentacles, $\times 350$ diameters.
- Fig. 4.* Fibres from the muscular coat, $\times 350$ diam.
- Fig. 5.* Arrangement of the branchial apparatus: *a*, longitudinal bands; *b*, large circular bands; *c*, slender circular bands; *e*, branchial spaces surrounded by rim; *f*, portion of the endostyle, $\times 90$ diam.
- Fig. 6.* A few of the branchial spaces, with cilia at *c*, $\times 200$ diam. The slender circular band has been removed.
- Fig. 7.* Smaller end of the larger example, as seen under a lens: *a*, oral aperture; *b*, anal aperture.
- Fig. 8.* The larger specimen with its test laid open, and the parts removed so as to show the rows of ova, &c.: the conical ending of the muscular coat is seen at *a*; *b*, bulla on the exterior of the latter, indicating the region of the pediculated glandular organ; *c*, detached mass containing stomach &c.; *d, d'*, rows of ova; *e*, test.
- Fig. 9.* Endostyle of spirit preparation, magnified under a lens.
- Fig. 10.* Cylindrical epithelium of the same, $\times 350$ diam.
- Fig. 11.* Cylindrical epithelium of œsophagus, $\times 350$ diam.
- Fig. 12.* A few loose hepatic cells, $\times 350$ diam.
- Fig. 13.* Portion of the yellowish longitudinal streaks (of liver-cells) from stomach, $\times 350$ diam.
- Fig. 14.* Portions of hepatic ducts, $\times 350$ diam.
- Fig. 15.* Outline appearance of the glandular plaits in stomach, with hepatic ducts, $\times 90$ diam.
- Fig. 16.* Fragment of the plaited structure under pressure, $\times 350$ diam.
- Fig. 17.* Fusiform cells from stomach, after the addition of sulphuric ether, $\times 350$ diam.
- Fig. 18.* Large glands of intestine, $\times 350$ diam.
- Fig. 19.* Ova, $\times 200$ diam.
- Fig. 20.* Apex of one of the pediculated glandular organs in swollen part of animal, $\times 350$ diam.

LXII.—On *Hyalonema lusitanicum*, and on the Animal or Vegetable Nature of Sponges. By Professor EHRENBERG*.

THAT the glass-plant (*Hyalonema Sieboldii*), which had been previously regarded as a polype with a siliceous axis, is only an artificial product of Japanese industry, the siliceous axis of which has been brought into an unnatural union with foreign substances, including polypes and sponges, by means of thread and wire, was stated by me in 1860 and 1861, as is published in the 'Monatsberichten' of those years. The true origin of siliceous axes resembling threads of glass as evidently concentric organic structures was then inexplicable.

In the year 1864 Professor Barboza du Bocage, of Lisbon, described, in the 'Proceedings of the Zoological Society of London,' a new species of the interesting glass-plants from the European seas off Portugal; but its habitat was not then quite certain. As the point whether these are polypes with a siliceous axis appears to me to be of essential significance for the physiological conception of systematic zoology, I regard this subject as not unworthy of being mentioned again to the Academy. The locality of the so-called *Hyalonema lusitanicum*, which was founded upon a single specimen, was still doubtful in 1864; but, according to a more recent notice by the same naturalist in the same journal (Proc. Zool. Soc. 1865, p. 662), it has been established with certainty by the discovery of new examples. Besides the first specimen, the Museum at Lisbon now possesses two others, likewise obtained from Setubal, and also numerous isolated siliceous filaments, which appear to belong to three or four different individuals. The two perfect specimens are 17 and 29 inches in length, and the largest is very beautifully preserved. The discoverer says that in the best-preserved, largest, and most perfect specimen a skin (corium) completely envelopes the axis. He now thinks that this form is established not only systematically, but also as belonging to the Portuguese seas, and that it is not even rare. The superstitious fishermen know it very well; they call it *Cravache de la Mer* (Sea-whip), and when it makes its appearance they fear bad success in their fishing. It is found in the apparatus used in the Dogfish fishery, and is immediately torn to pieces and thrown into the sea by the fishermen.

As regards the nature of this body, Professor Barboza du Bocage does not share the opinion of those naturalists who regard the Japanese form as the production of a sponge, but takes part with those who consider it a polype. On no specimen of

* Translated from the 'Monatsbericht der Berliner Akad. der Wissenschaften,' December 1866, pp. 823-837, by W. S. Dallas, F.L.S. &c.

the Portuguese form does there exist a sponge-mass like that of the Japanese. The *corium polypigerum* in the Portuguese specimens completely covers the whole of the thin end and three-fifths of the axis. The polype-structures occurring at the extremity of the axis are the smallest. The corium and the polypes are formed of several superposed layers of tissue, in which there is a very great quantity of siliceous spicules, which have different forms in the different layers. The shagreened and granular surface of the corium is not a sandy incrustation as in the polypes from Japan, but it is caused by regular clavate siliceous spicules, which are spinous all over (*Spongolithis clavus*, Ehrenb. Monatsb. Berl. Akad. 1861). These clavate spinous spicules form an essential part of the external skin or covering. Each tube, regarded as a polype, is supported by a border of fine siliceous spicules, which are deposited in a longitudinal direction and at equal distances in the inner wall of the body-cavity.

From these very meritorious communications of Professor Barboza, it appears most distinctly that the body more than 2 feet in length occurring near Setubal in the Portuguese sea certainly answers the question relating to *Hyalonema*, whether it be a polype or a sponge, in favour of the latter view.

The long filiform siliceous spicules which, forming a bundle, constitute the axis, are certainly the middle portion of a sponge. This sponge, the structure of which is described in detail by M. Barboza du Bocage as consisting of smaller siliceous spicules, and the numerous orifices of which he regards as the apertures of polypes, covers, as was to be expected, the thin end of the fasciculated siliceous filaments of the axis up to the apex, where, moreover, the above-mentioned efferent apertures (?) are smaller than on the middle and lower part of the body; so that in a *sound state* there exists neither a short nor a long tuft of freely projecting siliceous threads. The lower part, which, according to M. Barboza, amounts to two-fifths of the whole length, is therefore free, probably, however, only in consequence of injury in tearing the object away from a firm basal piece, which may perhaps be exactly like that of the upper part. It therefore appears indubitable that the thicker part of all known similar siliceous filaments is the lower part, and the thinner the upper. Consequently the comparison of certain natural orifices in the corium with polypes appears to be not sufficiently well founded. The observer has seen either parasitic polypes, or merely orifices such as occur so frequently in sponges. Moreover the structure of the so-called corium is completely different from that of the parasitic polype-corium of the Japanese stems, which certainly contains demonstrable antho-

zoarian polypes (as was shown even by Brandt), and which bear no sponge-spicules, but only sea-sand, in their skin, as I proved in 1860. The great difference between the Japanese *Hyalonemata* and the Portuguese ones is, that the Japanese axial bundles are artificially twisted, and compelled to remain in this form by means of thread and wire. Moreover the Japanese siliceous filaments, having been torn from their natural connexion, are sometimes put together again in a reversed position, and nearly always the entire direction of the axial bundle in relation to the sponge covering it at one end is reversed. The superior, natural sponge, which produces the axis, has been stripped off and thrown away, and a new foreign sponge has been allowed to grow, or been fastened upon the thicker end.

By these new Portuguese observations, therefore, the subject is, in my opinion, settled, and the forms of *Hyalonema* can certainly no longer be described as anthozoarian polypes; whilst the origin of their siliceous axial threads has also found a satisfactory explanation; but neither can they be regarded as sponges furnished with a projecting siliceous tuft. Moreover there can now be no doubt that the Phytolitharia, hitherto known almost exclusively as microscopic corpuscles, will certainly by these observations be enriched with Spongolithes of from 1 to $2\frac{1}{2}$ feet in length, which may be designated hereafter as *Spongolithis vaginata Hyalonematum* when they occur isolated, without their sponge, in the sea-bottom, or as fossils in rocks.

The notion which has lately been often expressed, that there are sponges with frequently long, protruding tufts of filaments of a siliceous axis at their apex, appears now to be due to mutilation, often brought about naturally, in the same way as in the cortical polypes with horny axes, which may not unfrequently be raised fresh from the sea with dead horny points from which the living polype-bark has been stripped off, and even with the basal portion of the stem destitute of bark. In the same way the spongy coat of the apices of *Hyalonemata* and of their bases may sometimes be lost, even in the sea, whilst the rest of the covering continues to vegetate; for it is organically inconceivable that naked siliceous threads without a cellular envelope should grow out freely from within.

As regards the question whether these sponges themselves are animals or plants, and whether, little as they are comparable with the true polypes of the Anthozoa, they might be named polypidoms in a much simpler series of forms, as, indeed, is indicated by my former representations from Bacillarian and even Monadic stocks, I see no inducement at present to give up the opinion, already repeatedly expressed by me, that the Sponges cannot be described as animals. It is true that the most recent

and very meritorious German systematic student of sponges has adopted the opinion of those who regard the marine sponges as animals; and the beautiful observations upon the motile young of the *Spongillæ*, as well as the demonstrated filling of many tubes in the horny sponges with fine sea-sand, in which there are *Polythalamia* and *Bacillariæ*, appear to many naturalists to be sufficient proofs that the reception of solid nutriment into the interior of the body of these organisms really takes place. The cilia and fine motile filaments observed here and there upon sponges strengthen these arguments. But neither the ciliary organs, which also occur on the swarm-spores of plants, nor the tubes, nor the anti-vital (*lebenswidrige*) filling of the tubes of many horny sponges with sand, evidently after their death, appear to me sufficient to prove the animal organization of these objects.

Hitherto we have no observation of the primary character of all true animals, the limitation of an individual, which is unmistakable in all true polypes, and is distinct even where the individual forms are intermixed and coalescent below, as in the *Ascidia composita*, *Sertularinæ*, *Halcyonellæ*, and many similar forms. Separate individuality, the reception of solid nutriment through a mouth into internal spaces, very different from tube-currents through cellular tissues, as also frequently quite distinct muscular substance for contractions, very different from contractile tissues, as demonstrated by me and others in *Vorticellinæ*, *Stentorinæ* (confirmed in 1857 by Lieberkühn), *Carchesium*, *Opercularia*, and most strikingly in the Rotatoria and many similar animals, are characters still undetected in sponges, and which separate animals from plants. Nay, in microscopic animals, as so distinctly in the Crustacean *Cyclopidæ* and many others, the eye-spots may not unfrequently directly indicate a nervous system, the colourless transparency of which may often cause it to appear to be wanting. Even in *Ophryoglena flavicans* a confirmatory greater complication was indicated by Dr. Wagner in 1856. Undoubtedly it must be pointed out that the most recent and best observers constantly discover new conditions of organization—*i. e.* greater compositeness, which is quite in opposition to the notion of unicellularity, but not suited to disprove animal organization.

In the elucidation of the question whether the Sponges may be regarded as polypoid animals of a low grade of organization, which have been named sometimes Protozoa, sometimes Zoidia, sometimes Amorphozoa, and so forth, we must not pass over the fact that of late there has seemed to be more to justify our regarding the bodies lying in the interior of these structures near the base as ova, especially as their development into perfect swarming young has been carefully traced, and even spermatozoid-

capsules have been detected. But, nevertheless, no one has yet succeeded in proving either a tube-relation or a body-relation of an individual animal towards these bodies as ova.

Matters are very different in the case of the true animal-stocks of the *Ascidia composita* and of *Halcyonella stagnorum*, which are often very like a *Spongia* or *Spongilla*. Here we have numerous separate individual animals, each in its separate tube, and united into a mass, and the very numerous ova occurring at the bottom of these may be recognized as belonging to individual animals, just as those Rotatoria which bear tubes deposit their ova in the bottom of the tubes.

As, therefore, a polypoid individuality could never be detected in sponges—as, also, the granules regarded as ova occur only in the interior of the base—and as, further, the tubes of all sponges (and I have examined them myself repeatedly in the fresh state in various seas) are always open empty canals which allow the currents of water produced by ciliary action to flow to and fro freely,—the greater part of these bodies appears rather to be a plant-like cellular structure, the basal fruit-production of which (and this is not known in all) has its still indistinct analogue in that of many different Algæ only now beginning to be elucidated, and perhaps even in the *Rhizocarpeæ*.

Even in the true *Rhizocarpeæ* the conditions of structure have only been very recently elucidated; and as to their developmental conditions a somewhat satisfactory result has only been quite recently arrived at, as in the case of many Algæ, of which, however, many forms still require further investigation. The swarming young of the *Spongiaceæ* do not differ from those of the *Vaucheria* and *Saprolegniæ*: these were observed by Unger in 1827 in green *Vaucheria*, but long before him, in 1745, by Gruithuisen and Needham in Algæ; and upon their very different character from Infusoria, leaving all ciliary movement out of the question, I have given a very detailed historical and physiological critique in my 'Infusionsthier' (1838, p. 37). In what way the segmentation (cell-formation?) of the supposed ova of the *Spongilla* is to be interpreted must be left to further investigation to determine.

Moreover, according as we suppose the Sponge to be an animal or a vegetable body, the question of its nutriment must be affected in opposite ways. If the Sponges be animals, their nourishment must be conveyed from in front and without, through apertures capable of being closed; if they be plants, the nourishment must be supposed to pass from the root-like base outwards and forwards by endosmose and exosmose (diffusion). Artificial siliceous nourishment presented to the base alone in elongated *Spongilla* may perhaps decide this point.

It has always struck me as very remarkable that in the many investigations of the largest and smallest forms of life which I have carried on under multifarious and favourable conditions, I have never met with an animal with a constantly open mouth and digestive cavity; whilst in the Sponges, both of the sea and of fresh water, I could find nothing but constantly open tubes, which never closed even periodically or under the influence of irritation. Nay, I have always found a physiological impossibility in the notion that a tube with no obstacle to the access and change of water, even when clothed with a ciliary coat, can furnish any assistance to zoochemical assimilation or digestion. Decomposable matters may certainly become putrid and soluble in water in them, and be thrown out again; but a constant change of water will not bring even this to assimilation. On the other hand, the periodically and voluntarily closable mouth of animals is usually aided by a second closure, which is to be characterized as the œsophagus, and is retained by nature in a very remarkable manner even down to the smallest forms of animals, by which means the quiet segregation of the materials conveyed into the interior of the body for assimilation is greatly favoured. The observations so carefully made since the year 1856 by Lieberkühn and Wagner upon the organization and reproduction of the *Spongillæ* certainly furnish many characters which seem to be in favour of their animal nature; and these have also quite recently been recognized by Van Beneden*, as also by Hæckel, as animal characters. But the great irregularity of this organism, which is also frequently formed by the fusion of several individuals, and the slight filling of its so-called nutritive cells with recognizable materials even during very rapid growth, appear to me to have not yet admitted a satisfactory solution of the mystery. It is true the large open tubes of the *Spongillæ* are the more shown not to be polype-bodies; but the essential character of all animals known to me is remarkably wanting—namely, the individual separation of a single organism, which constantly occurs in animals, and is as constantly wanting in plants. I have never been able to obtain accumulations of indigo or carmine in *Spongillæ* and sponges, either in tubes or in round cells, in the way so distinctly presented by even the smallest of true animals; and the deposits of indigo noticed by the above-mentioned observers are clearly not regular aggregations, and are only so represented even by them. I must here not allow the fact to pass unnoticed that I always expect to find œsophagoid contractile organs behind the mouth in all animals: these, in the Poly-

* Recherches sur la Faune littorale de Belgique, Polypes, 1866, (Mém. Acad. Belg. tome xxxvi.) p. 198.

gastres, by their multiple repetition form the segmented nutritive apparatus.

In connexion with the beautiful observations upon the development of the siliceous spicules, even in swarming spores, the inquiry as to the possibility of such inception of silica from the water becomes still more pressing, although in glass vessels it may readily be explained from the glass.

These siliceous spicules present another character, which this is the place to mention. They have no corresponding analogy in the elements of the animal body, but have a great analogy in those elementary parts of plants which, as fusiform, thick-walled liber-tubes, belong to the prosenchyma, and also, sometimes, like the siliceous threads of *Hyalonema*, become several feet in length. These thick-walled liber-tubes of plants consist of separate short cells, and, according to the most recent investigations*, sometimes contain milky juice in their median canal. They are variously formed—sometimes (distinctly in *Cannabis*) digitated at the extremities and variously united in the middle, always cylindrical, sometimes knotted with pore-canals. The spongolithes are also cylindrical, also frequently divided at the extremities, and variously furnished with verticillate branches or anchor-like †. Many are, like twin-crystals, crossed either obliquely or at a right angle, like staurolith; many are glandiform, globular, with or without conical points, comparable to the frequently stellate hairs of plants (stellate hairs in the interior of the stem of *Nymphææ* and on the surfaces of some leaves), but very rarely to animal cells; all are, therefore, morpholithes in the sense ascribed by me to that term in the last plate in my 'Mikrogeologie,' 1854. Frequently the surfaces of the fusiform spicules are perforated (pore-canals) and present canals passing perpendicularly to a constantly present median tube (*Spongolithis foraminosa* and *S. fistulosa* ‡, *S. porocyclia* § and *S. porosa* ||). In the Spongolithes also there is never air in these tubes during life, as may be learnt from the fact that under the microscope they do not appear as black streaks, but colourless and difficult to make out, whilst in dead Spongolithes in water this blackness is distinct. When alive they are consequently filled with a colourless juice. Nodose Spongolithes also are not uncommon (*S. mesogongyla* ¶, *S. nodosa*, *nodulosa*** and *monile* ††, *S. tracheogongyla* ‡‡ and *S. philippensis*).

* Schacht, Prüfung der Gewebe, 1853; Milchsaftegefäße, 1856. Hans-stein in his prize essay on the "Milchsaftegefäße," 1864.

† Schacht, 1853, Hanffaser, taf. vi. fig. 4 b.

‡ Mikrogeologie, taf. xvi. fig. 118 ss. *furcata*, and fig. 119.

§ Monatsbericht, 1861.

|| *Ibid.* 1845.

¶ Mikrogeol., taf. xvii.

** Monatsbericht, 1855, 1861.

†† Mikrogeol. taf. xxxiv.

‡‡ Monatsbericht, 1856.

The whole of these Spongolithes are, indeed, most like isolated, variously entangled tubular cells; but in *Hyalonema* they acquire the perfect character of long connected liber-tubes.

Quite different is the behaviour of the calcareous parts of the Radiata and Anthozoarian Polypes, which, although often fusiform, have no canal, and are frequently net-like and variable in form. All these, named Zoolitharia by me in 1841, remind us of the first isolated developments of the bones, shells, and hard cutaneous parts of animals, the aggregations of which are solid and (because like calcareous sinter) doubly refractive. Even the anchor-like organs of the skin of many Echinodermata (*Synapta*) are seated upon reticulated calcareous plates, and are articulated in the manner of the spines of the sea-urchins (*Cidaris*); they have consequently, except in form, no relation to the anchors of the *Spongillæ*. They are calcareous setæ with barbs.

Summary.

1. Thus the Portuguese *Hyalonema* is not a Polype, but a Sponge.

2. The Sponges themselves are without those decisive characters of independent animal bodies which have been detected down to the smallest monads.

3. The essential characters of the Sponges coincide without difficulty with those of vegetable structure, inasmuch as their supposed animal characters, automatic ciliary movement, swarming young and spermatozoids, and some contractility, as also a movement of the juices, have been recognized in both kingdoms.

4. The siliceous parts of the Sponges, or Spongolithes, appear to have a great analogy to usually innumerably isolated, smooth, juice-bearing vascular cells, like the thick-walled liber-cells of plants, with which they coincide also in the most various forms, but to have no similarity to any structures in the animal body,—in the *Hyalonema*-threads even resembling internal liber-tubes of two feet long.

5. The supposed normally protruding tufts of *Hyalonema* appear, when they occur on true sponge-structures, to be mutilations by the loss of the apices of these sponges, like the dead points of the horny corals, just as the deciduous trees in the north or on elevations often bear antler-like dead summits whilst the trunk is still well furnished with foliage.

6. The *Euplectellæ*, described by Owen in the years 1841 and 1857 as *E. aspergillum* and *E. cucumer*, the latter from the Seychelles, and the former from the Philippine Islands, exhibited to their very meritorious discoverer, who only saw them in a dry state, a gelatinous interstitial mass, but no trace of

animal character. Thin threads, several inches in length, united into a complex network, which, in *E. aspergillum* are expressly described as horny and not siliceous, do not form a protruding tuft, but are rather external bent hairs, free only at the base. How far these external filaments of the *Euplectella*, which are very like those of *Hyalonema*, likewise resemble tubular cells I cannot say from my own inspection, as these very rare bodies were never accessible to me for examination. But undoubtedly I can detect no character of animal organization in the description, inasmuch as gelatinous interstitial parts occur also in large Fungi and Algæ (*Myxomycetæ*, *Tremellæ*, *Ulvæ*, and *Fuci*, the latter often edible in consequence of the amount of mucus and jelly they contain). It is also to be observed that in England no near relation was noticed between *Euplectella* and *Hyalomena*, although the latter had been in the British Museum since 1835, and Valenciennes in 1850 had already referred *Hyalomena* to the sponges; it then, as at present, was everywhere placed as a polype in the zoological museums.

7. The penetrating ammoniacal odour of the sponges occurs also in living *Characæ* and dead *Fucoidea*.

8. Another portion of the Phytolitharia are fillings up of variously formed vegetable cells analogous to woody deposits, or siliceous membranes, all without double refraction.

9. The Zoolitharia are isolated and often tubercular calcareous parts of a discontinuous, complete or partial, framework in the Echinodermata and other Radiata, the Corals, and many other forms, without any vasculiform character and with double refraction.

10. The animaliform *Bacillaria* furnished with openings, intercepting indigo, and creeping, are essentially different in the formation of their siliceous shells from the siliceous cells of plants.

11. It is probable that the great deposits of silica in these plants are only effected by means of the flow through them of extremely large quantities of water containing but little silica.

LXIII.—*Remarks on the River-Fishes of Chili.* By Dr. R. PHILIPPI, Director of the Mus. of Nat. Hist. at Santiago in Chili*.

ALTHOUGH we may affirm in general terms that Chili is poor in freshwater fishes, the number of these which it actually possesses is much more considerable than has hitherto been supposed. In Gay's work the only Percoid given is *Perca trucha*,

* Translated from the 'Monatsbericht der Berliner Akademie' for November 1866, by Arthur W. E. O'Shaughnessy.

further described and figured by Girard, in the 'United States Naval Astronomical Expedition,' as *Percichthys chilensis**.

Girard himself adds in this family, *Percichthys melanops* and *Percilia Gillisii*. I have described two other species as *Perca pocha* and *P. Segethi*, and am now able to add to the list a second species of *Percilia*; so that, instead of one, six Percoids are at present known to me as inhabiting the rivers of Chili. I believe, however, that there are yet more species of *Percichthys*.

I am convinced that there are many more species of *Atherina* (or, rather, *Basilichthys*) than the two given by Gay; however, I have not had sufficient leisure to examine closely the specimens existing in the Museum, or to have collections formed from the various localities.

The Carp family is entirely unrepresented in Chili. Of Siluroids, Guichenot in Gay's work enumerates one *Arius*, one *Hypostomus*, and four *Trichomycterus*: of the fourth species of the latter genus Girard has, with sufficient reason, made a new genus, *Nematogenys*. He himself gives a new species of *Trichomycterus*, *T. Macraei*, which, however, is from the province of Mendoza on the eastern side of the Cordilleras. *Hypostomus erinaceus* and *Trichomycterus nigricans* have not as yet come under my notice, and I doubt whether or not I possess *Arius papillosus*; on the other hand, I know five more species of *Arius*, three new species of *Trichomycterus*, and two new species of *Nematogenys*.

We do not find a single Salmonoid mentioned by Gay as found in Chili; I know, however, at least four, all belonging to the genus *Farionella* and to the province of Valdivia, where, on account of their want of scales, they are called *Peladillos*.

Of the Pike family, Gay mentions not a single species as belonging to the inhabited parts of Chili, and only two species of *Galaxias* from Tierra del Fuego. These diminutive representatives of our Pike are very abundant, however, in the rivers of Valdivia; but, as yet, I have not had time to accurately study the species. It is singular that they seem to be quite absent from the interior provinces of Chili, as do also the salmonoid *Peladillos*, while I believe that no Siluroid fish has as yet been found in Valdivia. I have at present no sufficient data to enable me to pronounce where the southern and northern river-fish faunas of Chili meet.

Of the Characinidæ one species, *Cheirodon pisciculus*, Girard, is apparently plentiful in most of the rivers of Chili.

* Girard has seen no spotted *Trucha* from Chili, neither have I; whence I conclude, 1st, that the Chilean *Trucha* is different from the Patagonian, 2nd, that Gay has figured the Patagonian for the Chilean fish. It would, in fact, be wonderful should the same river-fishes occur on both sides of the Andes.

Eels seem not to occur in the fresh waters of Chili; but the sea possesses a true Conger, which the fishermen call *Anquilla negra*, and to which I have applied the name *Conger chilensis*. The *Congrio* of the Chilian fishermen is no Malacopterygian; I have described it under the appellation of *Genypterus nigricans*; and the *Anquilla blanca* is *Bdellostoma polytrema*, Girard.

According to Gay the order Cyclostomata is entirely unrepresented; it is now, however, some time since a species, *Bdellostoma Dombeyi*, was made known through Dombey as occurring in the Chilian seas; and Girard has added a second, *Bd. polytrema*; while Gray mentions a *Velasia chilensis* (probably my *Thysanochilus valdivianus*) from the fresh waters. I have described two species of *Petromyzon*, *P. Foncki* and *P. acutidens*, as also several early stages of *Ammocætes* and *Chilopterygum*; whence it would seem probable that more species of *Petromyzon* will yet be afforded.

I will now enter into a short description of some of the river-fishes which appear to me to be new.

1. *Percilia gracilis*, Ph.

Corpore angusto; dentibus obtusis, cylindricis, subtruncatis.

From the waters of Peine in Santiago.

The entire length of the fish is 60 millim., its greatest height only 11½ millim., its thickness 7 millim. The head from the snout to the point of the gill-cover is 14 millim. long. With regard to the general form of the fish, we may notice the regular and rather strong curve of the head from the shoulder to the snout; the back and belly present regular, equable and gradual curves. The nasal apertures are situated each in a rather long depression, bounded by a sharp ridge; and the space between the two ridges is also depressed. The eyes are 4 millim. in diameter. The forehead and shoulder are scaleless; the scales of the præoperculum and of the operculum are smaller than those of the body, which are large, rough, and ciliated.

The upper surface and dorsal fin, as also the caudal, are grey; the ventral surface and anal fins whitish; the chest and ventral fins bright citron-yellow. Lateral line bent suddenly beneath the middle of the second dorsal fin. The numbers of the fin-rays are as follows:—I. D. 7; II. D. 10; A. 3-7; P. 15; V. 6; C. about 18.

2. *Arius papillosus*.

Cuvier and Valenciennes have described and figured (vol. xv. p. 118, t. 431) under this name a fish said by Gay to be from Chili; and under the same name we find a fish described by Guichenot in Gay, and figured by him (vol. ii. p. 305, and t. 5 bis,

f. *i*), the figure not being referred to in the text. However, these two representations exhibit striking differences at the very first glance. First of all, both lobes of the caudal are represented by Cuvier and Valenciennes as very pointed, whereas Gay makes them rounded as in all other Chilean species of *Arius* known to me. But since in Cuv. and Val. it is evident, from the relative position of the rays, that the upper half of the fin is represented as the lower, I attribute these discrepancies to an error of the draughtsman. Thus the ventral fin is represented by Cuvier as considerably shorter than it is made to appear by Gay; the anal is also much shorter, and the breadth attained by the adipose fin is much greater in Cuvier's figure; it is, in fact, equal to the space between the first dorsal and the adipose, while this space is represented by Gay as once and a half as great as the length of the base of the adipose fin.

According to Cuvier and Valenciennes the coloration is greyish, with somewhat of green on the back, and, as the figure shows, without any spots; whereas Gay describes it as brownish, with green spots on the back, and his figure represents, in fact, the entire fish varied with brown spots, the back brown, sides green, belly grey, all these colours subsiding one into the other. It is characteristic of *A. papillosus* to have the palatine teeth obtuse and almost granular (*dents mousses et comme grenues*). I have seen this character of the teeth in no other *Arius*.

3. *Arius carcharias*, Leyb.

In the year 1859, Fr. Leybold described a second species in the 'Anales de la Universidad de Chile,' p. 1083, under the above name, and presented the specimen which had served him for the description to the Museum. The plate of the same referred to by him in the text has not yet been published. His description runs:—

A. corpore brevi, regionem pectoralem versus lato, depresso, postice compresso, elongato; capite omnino nudo, depresso; rostro prominente, triangulato-acuminato, obtusiusculo; maxilla superiore et inferiore, membrana branchiostega et isthmo papillosis; cirrhis tantum duobus, crassis; cute undique molli; oculis parvis, ovalibus, supremis; pectoralibus rhomboideis, undique inermibus; ventralibus rotundato-truncatis; dorsali et anali angustatis, truncatis; caudali furcata; linea laterali recta; dorso lateribusque griseis, abdomine albo.

I now quote from the Spanish description:—"The nasal apertures are large, placed very near to each other, and sur-rounded, and at the same time separated, by a lamellar fleshy membrane. The pectoral fins are entirely without teeth . . . ; the adipose fin is lanceolate. D. 1 . 8; P. 1 . 8; V. 6; C. 20."

The number of the anal rays is not given. Most of the characters given by Leybold are generic ones, and belong to all the species of *Arius*; that, however, of the spine of the pectoral fin being unserrated (for this is what is actually meant by the expression “pectoralibus undique inermibus—pectorales sine dente alguno”) would be a very peculiar one; but beyond a doubt this rests on an error. In the living or freshly killed specimens the teeth on the hinder edge of the pectoral spine are not apparent; but in the same specimens after a longer immersion in spirit they become even more conspicuous than in any other species. Nevertheless I look upon *A. carcharias* as a good and easily definable species; for, in the first place, it has only eight rays in the anal fin, while *A. papillosus* has twelve; and in the second, the lips, chin, gill-membranes, and isthmus are thickly covered or, so to speak, paved with large, broad, flat warts, and not with small papillæ “qui rendent la peau comme saigneuse.”

4. *Arius villosus*, Ph.

On examining the specimens of *Arius* in the Museum on the occasion of Herr Leybold's present of *A. carcharias* to the collection, I found another species (differing from both *A. papillosus* and *A. carcharias*), which I named *A. villosus*, but, being otherwise occupied, had not then the leisure to describe. It is characterized by having almost the entire body thickly covered with a minute down, almost densely pubescent. The under surface of the head has the large warts of *A. carcharias*; but they are not so close together, and project more. The adipose is very large, and reaches, when laid back, to the fleshy borders of the caudal. (These fleshy borders are, by the by, entirely forgotten in Cuvier and Valenciennes's figure of *A. papillosus*.) The entire fish measures 186 millim. in length, and the adipose fin is 31 millim. long and 8 millim. high. The membrane separating the nostrils appears to me larger than in other species, and forms a valvular covering to the upper nasal aperture, surrounding the lower mostly as a projecting lamellar border. The colour is a very pale reddish brown, passing into pure white on the belly. The number of the fin-rays is as follows:—D. 17; A. 11; C. 18; P. 18; V. 6.

The rays of the caudal are difficult to count, by reason of the thick membranous covering which hides them; I do not think, however, that there are twenty of them. The rays of the anal fin are as long as those of the first dorsal. The palatine teeth are as large and as pointed as those of the maxillary, and form two slightly diverging oval patches.

5. *Arius squalus*, Ph.

The fore part of the body is thickly covered with minute

papillæ; but the hinder part is quite smooth. The inferior surface of the head is scarcely papillose, without any warts, and consequently very different from the condition of this part in both the preceding species. The membrane between the nostrils is considerably smaller than in *A. villosus*. The adipose is comparatively small, and the ventral seems smaller than in the other species; the first measures 20 millim., while the total length of the fish is 164 millim. Coloration above blackish grey, gradually passing into the greyish white of the belly. The number of the fin-rays is:—D. 1. 7; A. 9; C. 20–22; P. 1. 9; V. 6. The palatine teeth are proportionally as large and long as those of the maxillary, and form two strongly diverging oval patches.

From *A. papillosus* this species is distinguished by the smaller number of the rays of the anal fin (which in that species are twelve), and by the condition of the palatine teeth, which are not smaller than the maxillary teeth, and not “mousses et comme un peu grenues.”

I received this species a few days since from the waters of Peine, in this province; the fishermen call it *Tollo*, Shark—a name which I suspect they apply to all the species of *Arius*.

6. *Arius micropterus*, Ph.

A specimen long preserved in spirits, and, after a superficial examination, referred by me to *A. papillosus*, is, however, very distinctly removed from it by the comparative smallness of the adipose and ventral fins, and by the palatine teeth being much larger than the maxillary teeth; they form two slightly diverging oval patches. The adipose fin has a length of only 28 millim. and a height of 6 millim., for a total length of 214 millim.; the ventrals are only 19 millim. long (These fins are of the same length in *A. squalus*, which measures only 164 millim., and has the adipose only 20 millim. long and 8 millim. high.) The number of fin-rays is, I find, as follows:—D. 1. 8; A. 9; C. 18–20; P. 1. 9; V. 6. The fore part of the body is strongly papillose; the hinder part smooth. Coloration blackish above; beneath whitish: the pectoral and ventral fins are whitish at the commencement, blackish towards the tip.

7. *Arius synodon*, Ph.

This species is rendered very distinct by the fact that the palatine teeth do not form two separate oval patches, but a single transverse trapezoid rounded off at the angles; in other points they nearly resemble the maxillary teeth. The form of the body also is slenderer, the head being not quite one-fifth, or scarcely more than one-sixth, of the length of the body, while in the other species it is nearly one-fourth of the same.

The fore part of the body is, as in most of the species, beset with minute papillæ, the hinder portion being quite smooth. The total length is 201 millim.; length of the head 34, its breadth the same, and its greatest height 20 millim.; the greatest height of the body at the middle of the dorsal fin is 32 millim.; tail 27 millim. high and $11\frac{1}{2}$ millim. in thickness. Number of the fin-rays:—D. 1. 7; A. 11; C. 18–20; P. 1. 9; V. 6. The adipose is 26 millim. long and 7 millim. high. Coloration uniform grey, darker on the upper parts; the lower surface lighter.

Note.—All the species of *Arius* have in the axilla, above the pectoral fin, and immediately under the end of the os coracoideum, two apertures, one behind the other, the anterior one being the smaller.

8. *Trichomycterus areolatus*, Cuv. & Val.; Guich. in Gay, ii. p. 309.

Easily distinguished from the other species by the singular folded appearance of the skin on the under surface of the head.

9. *Trichomycterus maculatus*, Cuv. & Val. U. S. N. A. Exp. p. 243, tab. xxxiv. f. 1–3.

Guichenot has not given the number of the fin-rays; Cuv. and Val. give D. 15, A. 9; Girard, however, has D. 13, A. 8.

10. *Trichomycterus marmoratus*, Ph.

Blackish-grey, varied with numerous small black spots resembling those of *Tr. punctatus*; the ground-colour of the tail is more of a brownish yellow; belly white and spotless, as are also the pectoral, ventral, and anal fins; dorsal and caudal blackish. Its shape is slenderer than that of *Tr. punctatus*, Cuv. and Val., as the admeasurements will show: length of the largest of the four specimens at hand 119 millim.; length from tip of snout to commencement of dorsal 55 millim.; length of dorsal 10 millim.; distance between end of dorsal and end of caudal 36 millim.; height of dorsal $7\frac{1}{2}$ millim.; greatest height of body 11 millim. The lips are smooth, without papillæ; the maxillary barbels are as long as those of the nasal region, shorter than the head, and black. The under surface of the head shows no areolæ. I find the fin-formula to be as follows:—D. 10; A. 6; C. about 14; P. 8; V. 6. This species is therefore easily distinguished from *Tr. areolatus* by the condition of the skin of the inferior surface of the head, and the number of the rays in the dorsal and anal fins; from *Tr. maculatus* by the last-mentioned character and its blackish colouring.

11. *Trichomycterus tigrinus*, Ph.

This species is easily discerned at the first glance by its coloration. It shows on a white ground numerous reddish-

brown round dots, which, however, are absent from the fins; the lower surface of the head and the belly as far as the tail are white, as are also the ventrals and anal. The pectoral is remarkably broad, and blackish at the base. Both lips are thickly beset with tolerably large wart-like papillæ, very much as in *Arius carcharias*. All the lower barbels are of equal length, as long as the opening of the mouth, and whitish. Length of the fish 118 millim., of the head $18\frac{1}{2}$ millim.; greatest height 15 millim.; height of the tail 9 millim. Number of rays in the fins:—D. 10; A. 6; P. 8; V. 5.

12. *Trichomycterus pallens*, Ph.

This species also is easily distinguishable by its colouring: it is of a pale reddish white, after having been kept a long time in spirit, and the fins are quite colourless; what the colour may have been during lifetime I am unable to say. The sides of the body present, as in the foregoing species, and as, indeed, in so many fishes, an inconspicuous darker longitudinal streak. The lips are completely smooth; the maxillary barbels are longer than the nasal ones, and the longest reach quite to the opercular margin. The spines of the suboperculum are very strong as compared with the small size of the fish. The largest specimen measures only 72 millim., of which the head is 11 millim.; the breadth of the head is 14 millim., its height 8 millim.; greatest height of the body 12 millim., that of the tail 8 millim. Number of rays in the fins:—D. 9 or 10; A. 6; P. 8; V. 5.

13. *Nematogenys inermis*, Girard, U. S. N. A. Exp. p. 240, t. xxxii. f. 1-3.

Trichomycterus inermis, Guichenot in Gay, ii. p. 312, tab. 9. f. 2.

I possess several specimens, which correspond exactly in colour &c. with the figure given by Gay.

14. *Nematogenys nigricans*, Ph.

This fish is anteriorly almost entirely black above; the tail presents a rather bright yellowish ground, which is varied with black spots. The inferior surface is white anteriorly, varied with blackish spots on the sides, and with a short blackish stripe with white spots; the hinder half is entirely blackish. The dorsal and caudal are blackish, as also the upper surface of the pectoral; the ventrals and anal are white, with blackish spots; the entire body is thickly beset with papillæ, which are largest upon the lips. The barbels at the angle of the mouth do not reach to the root of the pectoral. The size and proportions of the body are the same as in *N. inermis*; I do not, however, believe this to be a mere colour variety.

15. *Nematogenys pallidus*, Ph.

This species also corresponds with *N. inermis* in size, form, and number of the fin-rays; but, whilst in the latter species the skin of the belly is quite smooth, in *N. pallidus* it is as thickly and conspicuously beset with papillæ as the back, lips, &c.; and the coloration is very different, viz. a bright brownish red, almost a flesh-colour: it is only on the head also that any darker spots are to be distinguished, and they are here, moreover, but ill defined. Scarcely any darker cross markings are to be seen on the dorsal and caudal fins; the other fins are perfectly white. The barbels do not reach to the origin of the pectoral.

LXIV.—Description of a new Species of Rissoa from Madeira.

By J. GWYN JEFFREYS, F.R.S.

THE Rev. R. B. Watson has kindly sent me specimens of a *Rissoa*, found by him at Madeira, which appears to be undescribed; and, at his request, I will now record the discovery.

Rissoa picta.

Shell conic-oval, rather solid, semitransparent, and glossy: *sculpture*, numerous (although not close-set) slight, equal-sized, spiral striæ, which cover the body-whorl, but are not discernible on the upper whorls; there is no labial rib: *colour* pale yellowish-white, variegated by equidistant rows of oblong reddish-brown spots; the body-whorl has three rows (the lower two being sometimes partially confluent), and each of the upper three whorls has two rows: *spire* rather short, bluntly pointed: *whorls* five and a half, somewhat compressed, encircled below the suture by a thickened rim, owing to the last-formed whorl overlapping the preceding one in that part; the body-whorl occupies about two-thirds of the shell: *suture* slight: *mouth* roundish oval, not expanded: *outer lip* sharp: *inner lip* reflected on the pillar and base, united above with the outer lip: *pillar* broad and flattened: *operculum* yellowish, rather thick, nearly smooth; *spire* or nucleus small, and placed on the inner side near the base. Length 0·075 in., breadth 0·05.

Habitat. Under stones at low-water mark, Madeira (Watson); not uncommon.

The nearest ally to this pretty little shell is *R. semistriata*, from which it differs not only in the smaller size, but in the whorls being flatter, the sculpture equal and not confined to the upper and lower portions of the body-whorl, and in having three (instead of two) rows of coloured spots on that whorl, and two on each of the preceding whorls.

MISCELLANEOUS.

*The Theory of the Vertebrate Skeleton.**To the Editors of the Annals of Natural History.*

GENTLEMEN,—Is it that Mr. Seeley, before writing his letter contained in your last Number, did not re-read my letter published by you in December last? This seems a very improbable supposition; and yet, without some other supposition which I should be reluctant to make, I cannot account for the fact that Mr. Seeley ignores absolutely the essential point of my letter.

The first indication of his views he dates back to a paper on "Homologies of the Bivalve Mollusca," made public on March 17, 1862. He says they were again propounded in a paper read on Nov. 10, 1862. And he winds up his historical statement by saying "it is known to certain of my friends that the paper 'A Theory of the Skeleton' was written nearly in the form in which it is printed before any part of the 'Principles of Biology' could have been issued."

This has the appearance of being a sufficient reply. Every reader will, as a matter of course, infer from it that the view to which I had drawn Mr. Seeley's attention as in great measure identical with his own was first published in the 'Principles of Biology;' and every reader will conclude that, having traced back his view to an earlier date than the 'Principles of Biology,' Mr. Seeley has proved his case. Any one, however, who takes the trouble of referring to my letter of December last, will find that what Mr. Seeley proves is wholly beside the question. In that letter I pointed out to Mr. Seeley that, in "the 'British and Foreign Medico-Chirurgical Review' for October 1858, he will find, at the close of a criticism on Prof. Owen's 'Archetype and Homologies of the Vertebrate Skeleton,' a brief outline of the theory that the vertebrate skeleton is a product of mechanical actions;" and I referred to the 'Principles of Biology' merely as containing this theory "more fully worked out."

Thus Mr. Seeley passes over in silence the date of 1858, as that at which an outline of this theory was given by me; and saying that an indication of this theory was given by him in 1862, dwells on the fact that this is earlier than the issue of the 'Principles of Biology,' in which I have elaborated the theory.

I am, Gentlemen,

37 Queen's Gardens, Bayswater.

May 4, 1867.

Yours, &c.,

HERBERT SPENCER.

On the Type of a new Family of the Order Rodentia.

By A. MILNE-EDWARDS.

The class Mammalia has been studied with so much care, and is now so well known, that zoologists rarely meet with species belonging to it new to science; and in general these readily find their place in the generic divisions already established.

The animal which constitutes the subject of this memoir must therefore, it seems to me, interest naturalists in a very particular manner; for it had hitherto escaped their researches, and it differs so much from all the great Linnean genera that, in order to bring it under the existing classifications, it is necessary to establish for it in the order Rodentia, not only a new genus, but even a special family. I propose to give it the name of *Lophiomys Imhausii* (L'Institut, tome xxxv. p. 46, Feb. 6, 1867; Annals, May 1867, p. 372).

This little mammal lived for nearly two years in the Garden of Acclimatization in the Bois de Boulogne. I am indebted to the kindness of M. Alb. Geoffroy Saint-Hilaire for being able to undertake this investigation, and I eagerly take this opportunity to thank him publicly for the numerous services of this kind which he is constantly rendering me.

Lophiomys Imhausii is of the size of a small rabbit; but its aspect is very different; for it is provided with a long tufted tail, and the hairs of its back are erected in such a manner as to form a sort of longitudinal mane. The hairs of the flanks are likewise very long, but pendent; hence they are separated from the mane by a furrow, the bottom of which is occupied by hairs of a very singular aspect: they are of a greyish-fulvous colour, lying down upon the skin, thick and flattened: microscopic examination shows that their structure is spongy, and that the epidermic sheath which surrounds them constitutes an actual network with irregular meshes, in the midst of which longitudinal fibres are arranged. The remainder of the fur is mixed black and white.

The inner digit of the hind feet is well detached from the others, and by opposing itself to these can form a true prehensile hand, of which the animal makes use to seize forcibly the objects upon which it climbs.

The most important characters of *Lophiomys Imhausii* are furnished by its osseous framework, and more particularly by its head. The upper surface of this is entirely covered with miliary granulations, arranged with perfect regularity and symmetry. No mammal presents an analogous arrangement. Behind the orbits the head is extremely wide; but this is not due to the development of the cranial case, which is in reality narrower than in most rodents: it results from the ossification of the aponeuroses of the crotaphital muscles, which extend over the temporal fossæ in such a manner as to unite with the bones of the cheek and complete the orbital frame behind. I know of no example in the Mammalia of a similar mode of organization; and we find nothing analogous to it except in certain reptiles, and especially in *Testudo caretta*.

The dentary system differs less from that seen in various rodents, and enables us to ascertain that it is to the *Muridæ* that *Lophiomys* presents the most resemblance. There are in each jaw a pair of incisors, and three pairs of radicated molars, of which the first consists of three ridges separated from each other by deep grooves. The genus *Cricetus* is the only one in which we find an arrangement of the folds of enamel similar to that in *Lophiomys*.

The study of the skeleton of our rodent offers a great number of interesting facts, upon which I shall not at present dwell, but confine myself to mentioning the state of extreme imperfection of its clavicles (which are suspended in the flesh as osseous styles), and the great number of the dorsal vertebræ (of which there are sixteen, whilst in most cases only thirteen exist).

The stomach of *Lophiomys* is very remarkable: it is unilocular, and presents in its interior two crest-like folds, festooned on their free margins, which extend parallel to each other from the orifice of the œsophagus to the commencement of the pyloric portion. These folds enclose a deep furrow, which, by the approximation of their margins, may be converted into a channel, by means of which liquid aliments may flow from the œsophagus into the neighbourhood of the pylorus without falling into the general cavity. This arrangement is very remarkable, and apparently can only be compared with the subœsophageal channel of the ruminants.

Upon the lower border of the stomach we observe, in the abdominal cavity, a large appendage, in the form of the finger of a glove, which opens near the pylorus by an orifice surrounded by a sort of sphincter. The walls of this diverticulum are thick, and appear as if villous; and their inner surface is riddled by a multitude of pores, which are the orifices of the same number of secretory tubes: these, under the microscope, appear cylindrical, long, and very narrow; their diameter is only about $\frac{1}{20}$ millim.; they are parallel, very close together, and present neither ramifications nor an initial inflation. The stomach of no mammal presents a similar arrangement. In its form the finger-like appendage somewhat resembles the pyloric cæca of fishes; but it appears to me to be due rather to the localization of the pepsic glands, which, instead of being, as usual, disseminated through the thickness of the walls of the stomach, are concentrated in a peculiar appendicular organ.

The small intestine presents nothing remarkable; but the arrangement of the pancreas deserves notice. The excretory canals of this gland, instead of opening directly into the intestine, pour their products into the choledochal canal, and it is by the intervention of this latter that the pancreatic juice reaches the duodenum.

The cæcum has the form of a subcylindrical sac; but it is far from being so much developed as in most of the Rodentia.

The male generative apparatus of *Lophiomys* resembles that of the Hamster more than that of any other species of the same order.

The preceding zoological and anatomical details suffice to show that *Lophiomys Imhausii* differs considerably from all the known types of Rodentia: and it appears to me indispensable to form of it not only a new genus, but a new family; for the peculiarities of structure which we meet with in it are superior in zoological value to those which have served as bases for the establishment of the other secondary groups of the order Rodentia, whether called tribes or families.

I can give no precise information as to the native country of *Lophiomys*. It was bought, in 1865, at Aden, by M. Imhaus,

Receiver-general of Finances. It is therefore probably derived either from Southern Arabia or from the opposite coast of Africa—that is to say, Nubia or Abyssinia. Unfortunately, M. Imhaus could not obtain from the owner of the animal any information that might serve to elucidate this question.—*Comptes Rendus*, April 22, 1867, pp. 812–814.

On the Spontaneous Movements of Colocasia esculenta.

By H. LECOQ.

There are few plants the organs of which do not spontaneously execute various movements: and here we distinguish these movements from those which are the result of some provocation, and which botanists designate under the name of *irritability*. Most of the spontaneous movements are due to the more or less rapid evolution of the organs, and the eye cannot follow them. We only know *Hedysarum gyrans* in which the leaves, or rather the two lateral leaflets, are endowed with regular movements visible at all times. I can add a new example of spontaneous oscillation, which was presented to me by *Colocasia esculenta*, Schott.

On the 13th January last, in passing through my stove, I thought I observed a slight movement in a leaf of *Colocasia*. I ascribed it at first to the displacement of the air by my passage; but a more careful examination proved to me that the movement occurred not only in the leaf which I had noticed, but also in four other leaves, the plant having only five in all. One leaf, smaller than the others, and at least one year old, was agitated like the younger ones. The movement was, in all, a sort of regular trembling, and was so sensible that the leaves of *Colocasia* communicated it to the neighbouring plants.

Every day after the 13th January, I carefully observed this plant of *Colocasia*, the only one in my stove, and noted the phases of its agitation. Sometimes this agitation persisted night and day; most frequently it occurred from 9 o'clock to noon, and then became weakened. The plant also had whole days, and even weeks of absolute repose. It then occurred to me, in order that I might be warned of the hours and periods of movement, to attach to my plant a certain number of little bells: these were not always sufficiently shaken to make them sound, but never failed to give me notice of the great crises.

Thus on the 18th January the agitation commenced at 2 o'clock A.M., and continued through a great part of the morning. The little bells rang, and the leaves of the *Colocasia* struck upon the neighbouring plants with sufficient force and distinctness to enable me, by means of a watch with a second-hand, to count the pulsations, which were from 100 to 120 per minute.

Several times I had the opportunity of witnessing violent fits of shaking,—among others, on the 20th January and 2nd March. On the latter day, in the morning, although the temperature of the stove was lowered to 7° C. (=45°·6 F.), the agitation was considerable

in all the leaves, both old and new, without exception: it is an actual febrile movement, a violent shivering. It is especially perceptible along the undulated margins of the leaves, and on the two raised auricles, which are merely prolongations of the limb beyond the petiole. The pulsations, still numbering from 100 to 120 per minute, had force enough to communicate the movement to the pot which contained the plant; and, although it weighed from ten to twelve kilogrammes, the hand and the strength of a man did not prevent it from shaking. This rhythmic agitation was also communicated to a fine leaf of *Strelitzia Nicolai* and to a large leaf of *Philodendrum pertusum*, which last passed the impulse to some fine flowering groups of *Begonia manicata*.

We have not yet been able to ascertain the circumstances which seem to determine the movement, nor those which appear to oppose it, although we have observed it every day for three months.

In the first place, we may almost deny the action of temperature, although its influence is considerable upon the development of the Aroïdæ, since they disappear geographically from the cold regions of the earth. We have not seen the movements of the *Colocasia* increased by a temperature of 30° C. (=86° F.), nor have we seen them slackened by a temperature of 7°.

Is it the development of the new leaf, which is always very rapid, that excites the agitation? This seemed to us to be the effect of the leaf produced in January. The movement, at all times not very regular and without fixed periods, ceased when the leaf had nearly attained its growth. But in the case of the leaf produced in February the agitation did not commence until after the nearly complete development of the limb. Why should there be this difference?

Eminent botanists have paid attention to various physiological phenomena presented by *Colocasia esculenta*. MM. Schmidt, Duchartre, and C. Musset have published very important memoirs upon this plant, and have all occupied themselves with the emission of sap by its leaves. M. C. Musset especially has determined with precision the various phases of this transpiration, and ascertained that during præfoliation the sap was projected to a distance of several centimetres, through two orifices, in the form of stomata, situated at the apex of the leaf. M. Musset was able to count eighty-five drops projected in one minute—a number which may have some relation to the 100–120 pulsations per minute of our plant of *Colocasia*.

M. Musset had the kindness to send me his memoir; and I greatly desired to see, as he had done, the fine drops shooting forth from the apex of the unexpanded leaf. I have never been able to observe them; moreover the stomata of the apex have never presented an orifice. At no period could I observe a single drop suspended from the leaf, or falling from the extremity of its limb; there was no trace of humidity or of transpiration. I had, in a cooler house, a tuft of *Calla æthiopica* placed in a basin; and each leaf every moment let fall upon the water the result of its transpiration.

In another stove, also situated at Clermont, I observed a *Colocasia*

precisely similar to my own, which allowed its pearl-like drops to escape from the extremities of its leaves.

Is the remarkable and sometimes violent movement of my *Colocasia* due to an exception—namely, the accidentally imperforate condition of the stomata, and the incessant shocks of an imprisoned sap?

On the other hand, M. Musset says that the leaves of his *Colocasia* present violet reflections on their upper surface; mine is throughout of a pale green. Can we have studied different varieties?

M. Musset carried on his cultivation in the open ground; I mine in a hot stove: the difference of the stations may have had some influence upon the results. Might there not be, also, in these energetic spontaneous movements some transformation of heat into motion, just as in the Arums there is a development of heat at the moment when fecundation is about to take place.—*Comptes Rendus*, April 22, 1867, pp. 805–808.

Characters of new Fishes. By Dr. F. STEINDACHNER.

Ctenotrypauchen, g. n.—Distinguished from *Trypauchen* by its large cycloid scales, an elevated dentated ridge on the occiput, and only three branchiostegal rays.

C. chinensis.—Length of head contained about $5\frac{2}{3}$ times, depth of head about $6\frac{1}{3}$ times in the total length. Eyes extremely small, scarcely visible externally; body elongated, ribbon-like. Dorsal, anal, and caudal fins united into a single fin. The dorsal contains 6 spines and 46 jointed rays, the anal 1 spine and 42 jointed rays. Along the lateral line 46 scales. Colour light yellowish brown, with a narrow reddish-violet band along the lateral line. China.

Heros Troschelii.—Distinguished from *H. urophthalmus* by the greater number of dorsal spines (16), and by the lower jaw overhanging the upper only on the sides. Mexico.

Ctenolabrus Brandaonis.—Dorsal spines 19; 5–6 rows of scales above the lateral line; depth of body contained $3\frac{2}{3}$ times, and length of head $4\frac{1}{4}$ times in the total length; 5 rows of scales beneath the cheeks; 37–38 scales along the lateral line. Brazil.

Batrachus liberiensis.—Body completely and distinctly scaled; second dorsal with 25, anal with 22 jointed rays; head one-third the length of the body (without the caudal); breadth of the head six-sevenths of its length. No tentacle over the eye. Liberia.

Caranx macrops.—Forms a transition towards *Vomer* by the small elevation of the first dorsal; the maxillary teeth lie in several rows one behind the other, and are exceedingly delicate and fine, with the exception of the larger cutting-teeth in the outer row. Depth of body contained $3\frac{1}{2}$ times, and length of head $4\frac{1}{2}$ times in the total length. Body finely scaled; 40 scutes along the lateral line; 8 transverse bands on the sides of the body. Liberia.

Arius Capellonis.—Nearly allied to *A. Heudelotii*, Val.; but the occipital region is much more strongly arched, the dorsal and anal fins are considerably higher, and the adipose fin much longer than

in that species. The greatest depth of body is contained $4\frac{1}{2}$ times, the length of the head nearly $3\frac{2}{3}$ times, and the breadth of the head almost 5 times in the total length. Liberia.

Balistes liberiensis exhibits a long, produced head; the profile of the head runs in a straight line to the muzzle. The length of the head is contained $3\frac{1}{2}$ times and the greatest depth of body twice and one-fifth in the total length, and the eye $4\frac{4}{5}$ times in that of the head. The body has large blue-black spots; the head is adorned with smaller bluish-green spots. 1st D. 3; 2nd D. 25; A. 27; P. 13. Liberia.—*Anzeiger der K. Akad. der Wiss. in Wien*, March 14, 1867, pp. 63–64.

On some points in the Anatomy of the Sipunculi.

By S. JOURDAIN.

The researches of which I here give the most prominent results relate to the following species:—*Sipunculus gigas*, *S. obscurus*, *S. vulgaris*, and *S. punctatissimus*.

The integuments are destitute of those calcareous corpuscles, sometimes so curious in their form, which are met with in great quantities in the *Holothuræ*. The spinules which roughen the anterior part of the body of *S. obscurus* and *S. punctatissimus* are dependent upon the epidermic envelope. Glandulæ exist in great numbers in the skin of *S. obscurus*, *vulgaris*, and *punctatissimus*, and cause it to appear finely punctate.

In *S. gigas* the general cavity communicates with the exterior by an orifice furnished with a sphincter, situated at the posterior extremity of the body. Two branches springing from the fusiform ganglion, which terminates the nervous chain, surround this orifice with a nearly complete ring. A similar orifice is wanting in the three other species.

The ova or spermatozoids (for the sexes are not distinct) float in the liquid which fills the general cavity. In the last three species, they can issue only by a bilabiate pore placed upon the neck of the two cæca which open upon the sides of the dorsal region at the level of the anus. In *S. gigas* there is a pore similarly situated; but it is possible that the products of generation may be expelled by the posterior orifice, a sort of peritoneal canal in these Annulata. This well-ascertained arrangement seems to me to be of sufficient importance to justify the creation of a new generic group, to which I propose to give the name of *Sipunculoporus*; this genus would at present include only a single species, *Sipunculoporus gigas*.

I shall now indicate an anatomical peculiarity which is perhaps connected with the presence of the posterior orifice—namely, the existence of tendinous fræna, or very slender threads, furnished with vibratile cilia, which connect the spiral convolutions of the digestive tube with the walls of the body, and seem to be intended to hold the former in their place.

The liquid of the general cavity contains two kinds of globules:—(1) colourless discoid corpuscles, very like the globules of human

blood, but of four times their diameter, and formed of a proteic substance, the ready alteration of which induces a rapid deformation of these corpuscles; (2) granular spherules furnished with singular processes, which, by interlacing, often agglomerate these bodies into masses of variable size: these bodies, which I propose to call *villous globules*, occur also in the cavitary liquid of many Invertebrata, and have been mistaken for portions of vibratile tissue. The vessel, forming a simple or double cæcum, which is attached to the first portion of the digestive tube and opens into the tentacular crown without furnishing ramifications to the integuments, contains discoid corpuscles very similar to those of the cavitary liquid, but of rather larger diameter. The corpuscles are set in motion by a ciliary epithelium, which likewise lines the interior of the tentacular crown. This tube, in my opinion, represents a very rudimentary circulatory system: whenever a portion of the nutritive fluid is vascularized, this vascularization is generally for the benefit of the function of respiration. The delicate structure of the tentacular membrane, and its relations to the vessel which I have just described, lead me to think that, as asserted by Dr. Williams, this region is the principal seat of hæmatisis. The thicker integuments, in contact only with the mud or muddy sand in which the *Sipunculus* lives enclosed, only play a secondary part, but, nevertheless, one which we cannot deny. The cavitary liquid, in fact, is subjected to a double movement of transport, perfectly recognized and described by M. Quatrefages. This movement is caused by vibratile cilia distributed over the surface of the digestive canal; and the fræna here and there bind together its convolutions: the inner wall of the tegumentary envelope is destitute of these appendages.

With regard to the cæcal tubes, in which certain anatomists have been inclined to recognize an organ of respiration, the following is the view which seems to be most plausible. They are formed essentially of a structureless membrane, strengthened by some smooth muscular fibres forming an irregular network, and by a layer of cells with brownish granular contents, such as occur in the gland destined, in many Invertebrata, to eliminate uric acid. The product of secretion, in the form of a clear greenish-brown liquid, often distends these cæca, which I regard as an organ of elimination analogous to the gland of Bojanus. These organs also serve for the emission of the ova and spermatozoids—a purpose which we also sometimes see fulfilled by the organ of Bojanus.

I was unable to make out with certainty where and how the ova and spermatozoids are formed. I did not succeed in detecting the generative organ, the development of which is perhaps temporary. I have, however, sometimes seen, on the terminal portion of the intestine, pedunculated vesicles, which might perhaps be very young ovigenous or spermatogenous cells. The question is still too obscure to allow me to hazard an assertion; and I propose to resume it by studying the nearly unknown embryology of these Gephyrea.—*Comptes Rendus*, April 29, 1867, pp. 871–873.

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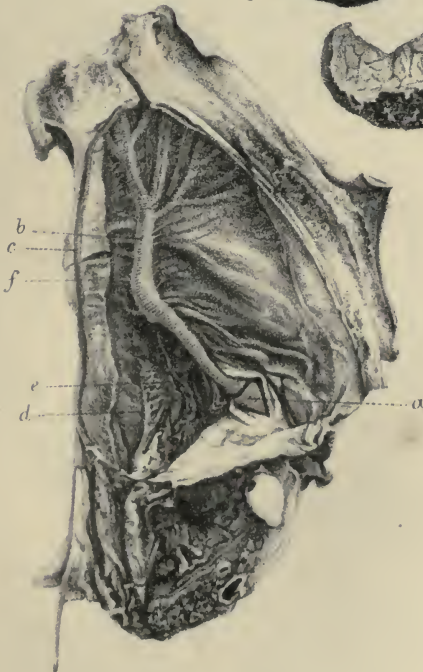
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END OF THE NINETEENTH VOLUME.

Fig. 1.



Fig. 2.







A. G. Butler del. et lith.

W. West imp.

1. *Anadebis Ifimachala*. Moore.

1^a neuration. 1^b palpus.

2. *Debis Diana*. Butler.

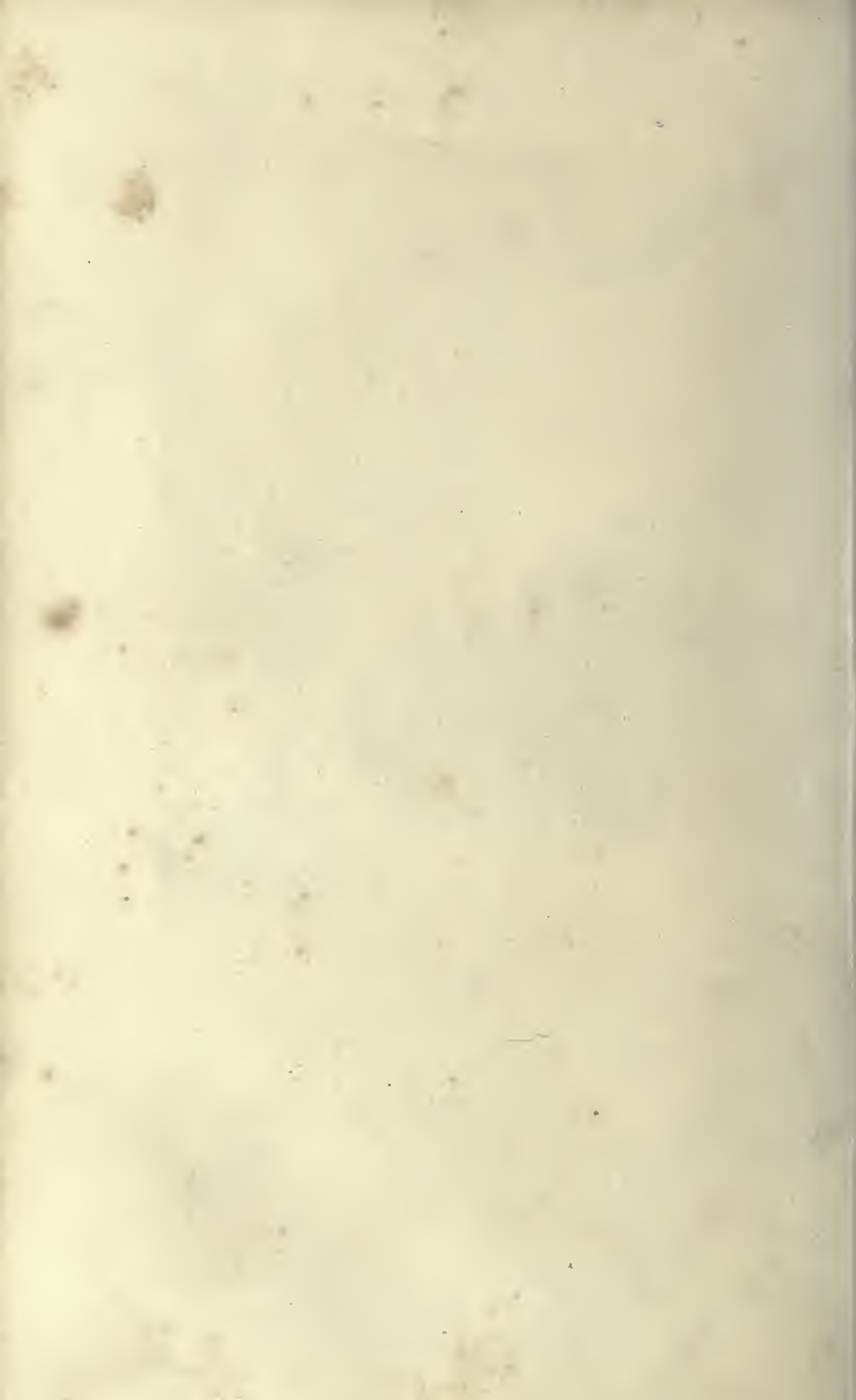
2^a neuration. 2^b palpus of *Debis*

3. *Mycalasis Gamaliba* Walker, Ms.

3^a neuration. 3^b palpus.

4. *Orinoma*, (neuration.)

4^a palpus.





A. G. Butler, del. et lith.

V. Westw. imp.

- | | | | | | |
|----|--|-----|---------------------------------|-----|------------------------------------|
| 1 | <i>Hipparchioides Mixticla</i> . Butler. | 6. | Head of <i>Hipparchioides</i> . | 11. | Club of <i>Satyrus</i> . |
| 2. | " <i>Philerope</i> Guerin † | 7. | Proleg of Male. | 12. | Plumule of <i>Hipparchioides</i> . |
| 3. | Neuration of <i>Hipparchioides</i> . | 8. | " Female. | 13. | " (<i>Lasiommata</i>) |
| 4. | " (<i>Lasiommata</i>) | 9. | Club of Antenna. | 14. | " <i>Satyrus</i> . |
| 5. | " <i>Satyrus</i> . | 10. | " of (<i>Lasiommata</i>) | 15. | " <i>Epinephete</i> . |

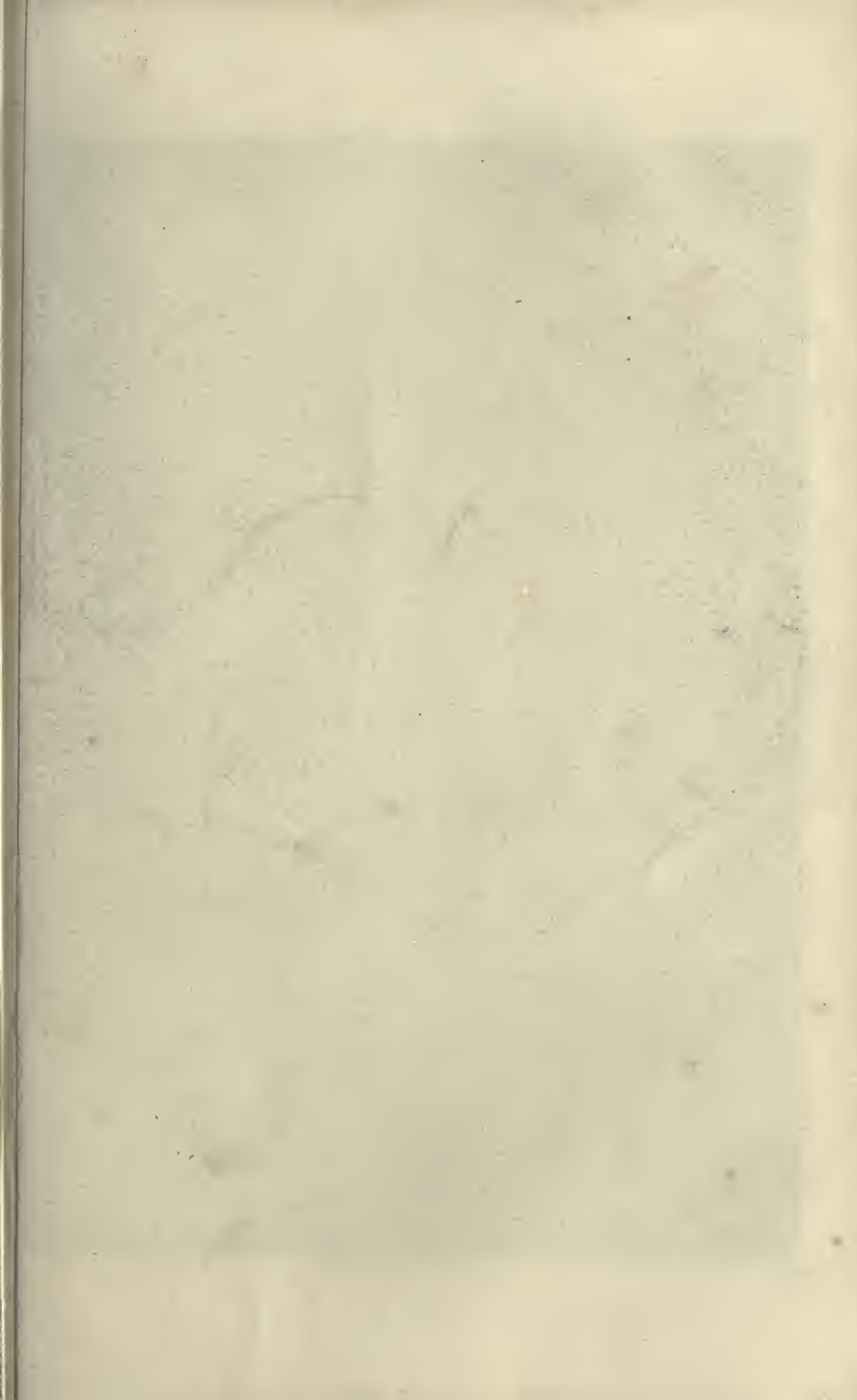




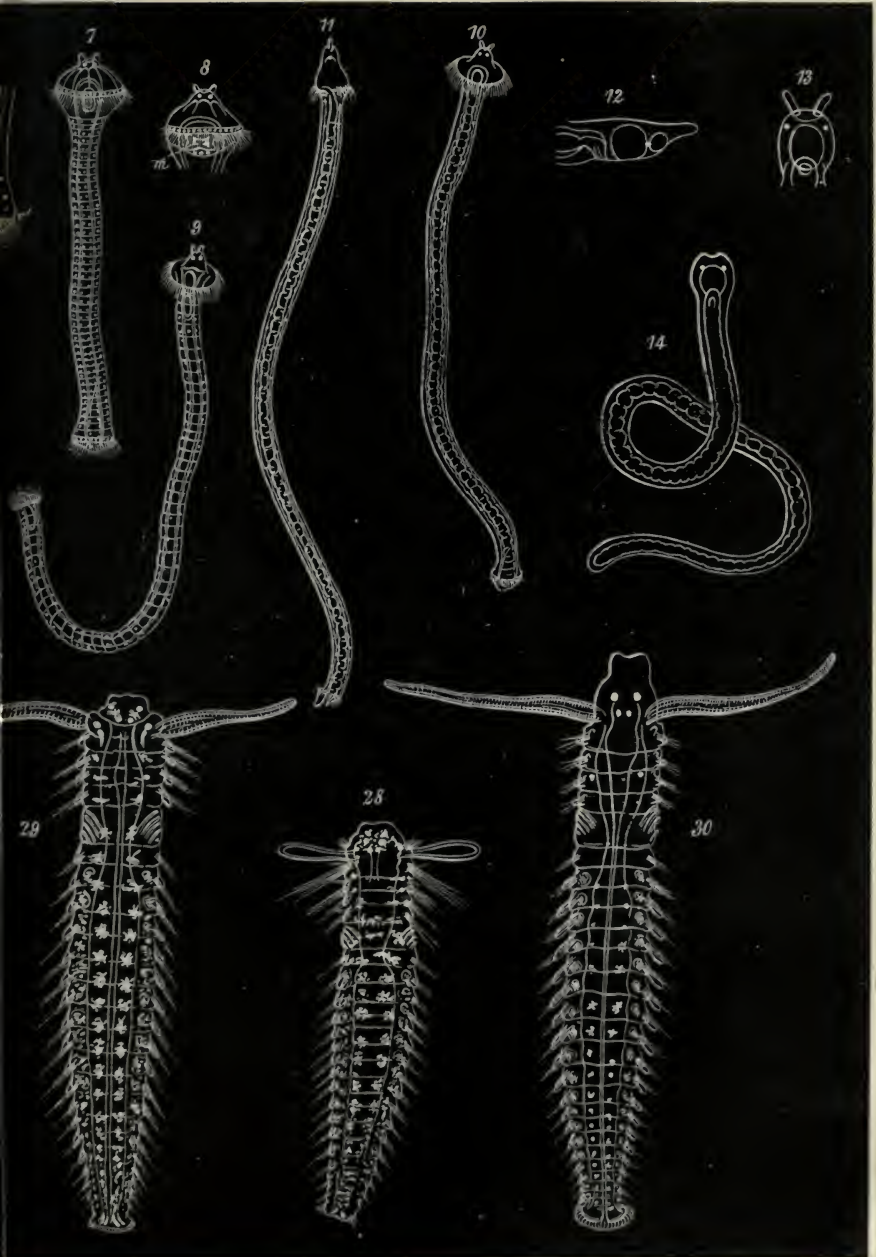
A G. Butler, del. et lith. Jan. 1867.

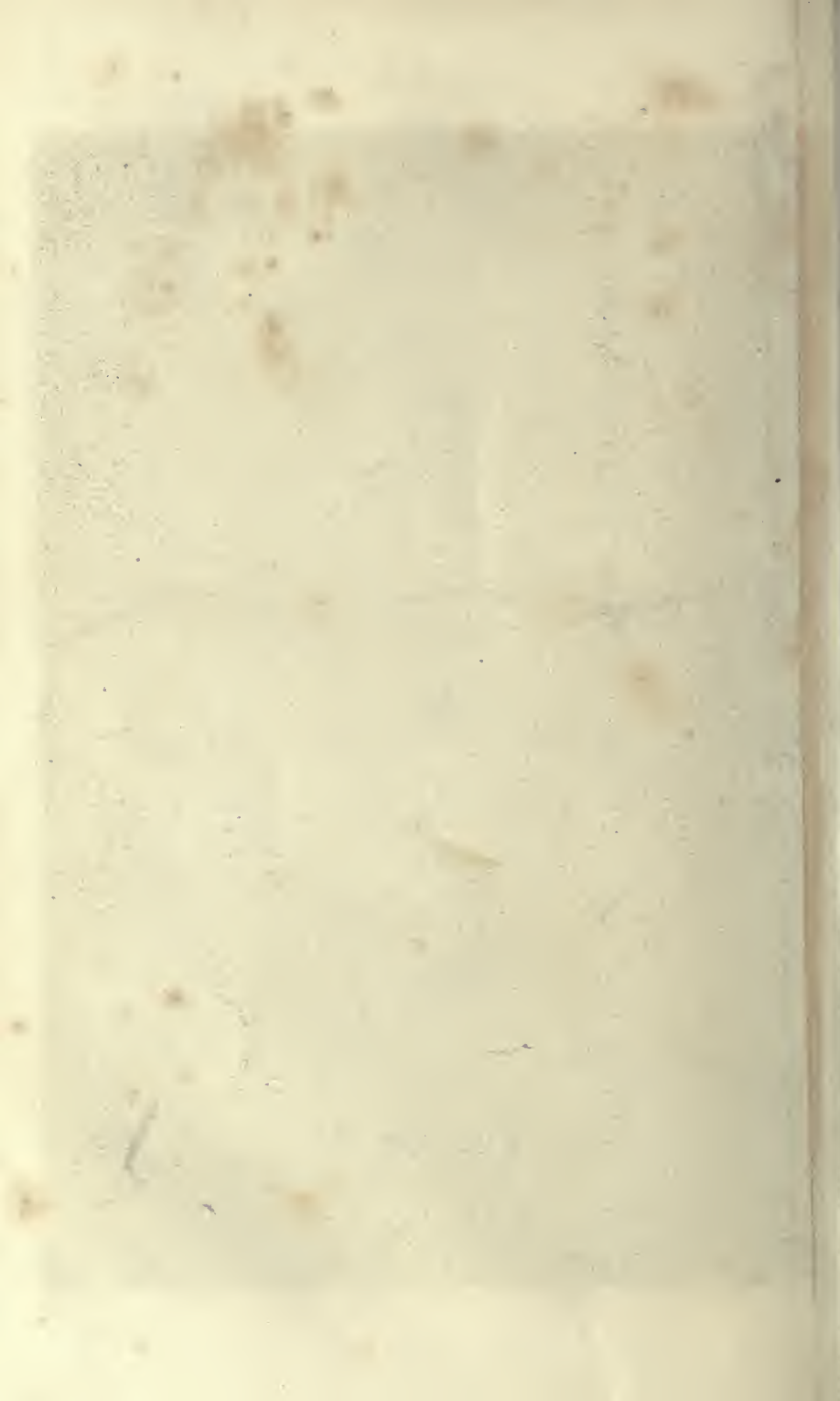
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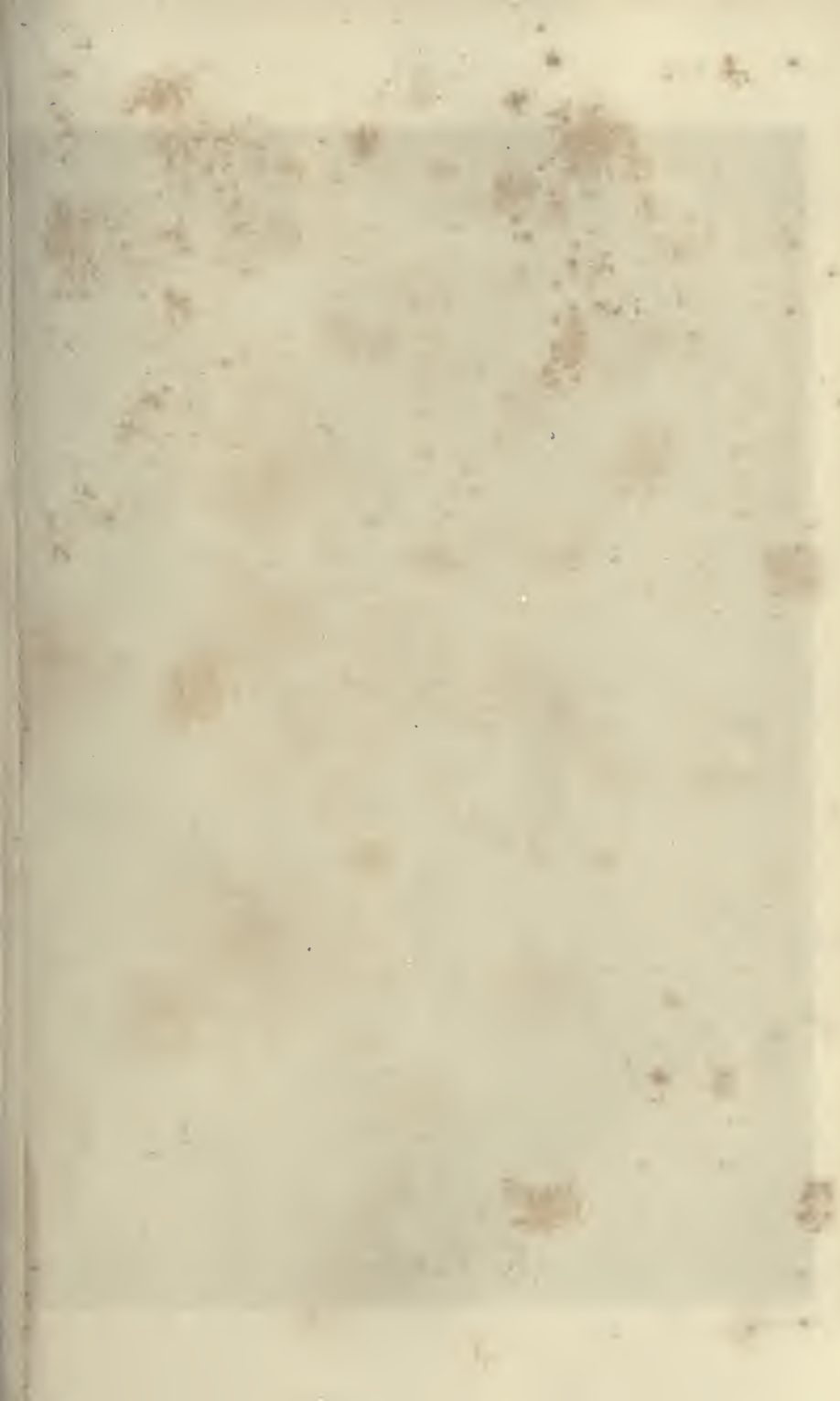
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|--|--------------------------------------|---|
| 1. <i>Amecera Megara</i> . Linn. (Head) | 3. <i>Raphicera Satricus</i> . Doubl | 5. ^a Club of Antenna. |
| 1. ^a Club of Antenna. | 4. " Moorei. Butl. | 6. Neuration of <i>Argynnis</i> . |
| 2. <i>Lasicnonta Ageria</i> . Linn. (Head) | 4. ^a Club of Antenna. | 6. ^a Club of Antenna. |
| 2. ^a Club of Antenna. | 5. Neuration of <i>Geitoneura</i> . | 7. <i>Neope Moorei</i> . Butl. |
| | 7. ^a Club of Antenna. | 8. (<i>Encodia</i>) <i>Journa</i> , Butler. |

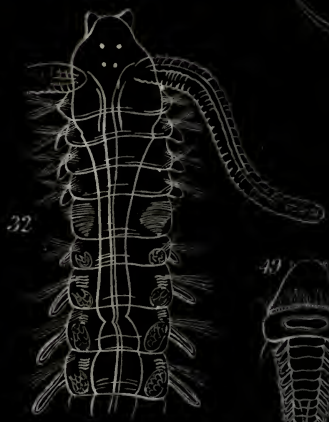


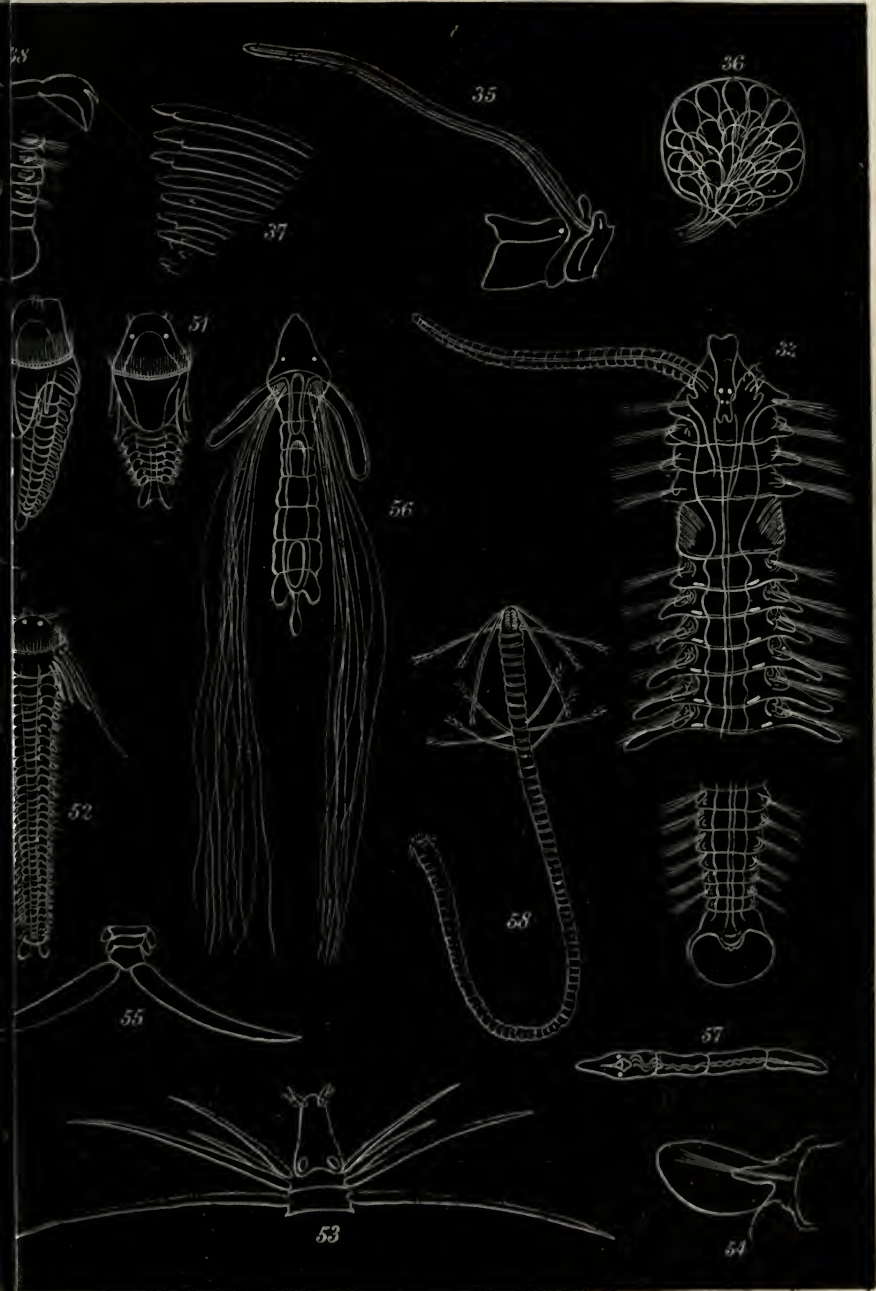










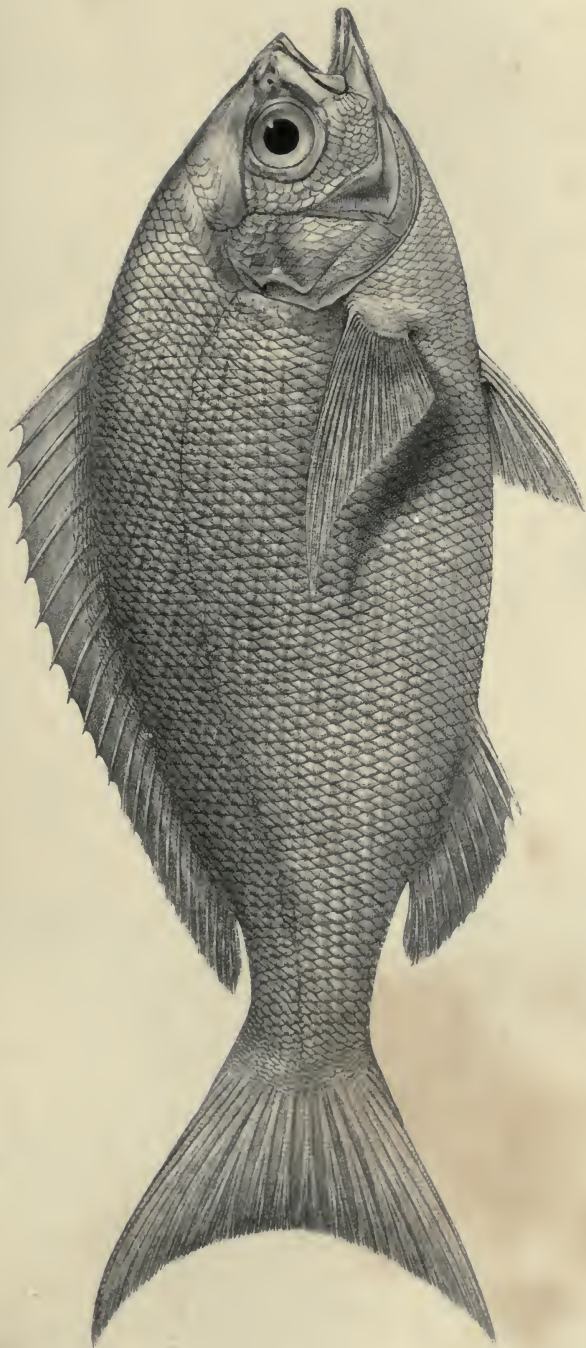












Mesoprion Mitchellii, Günth.

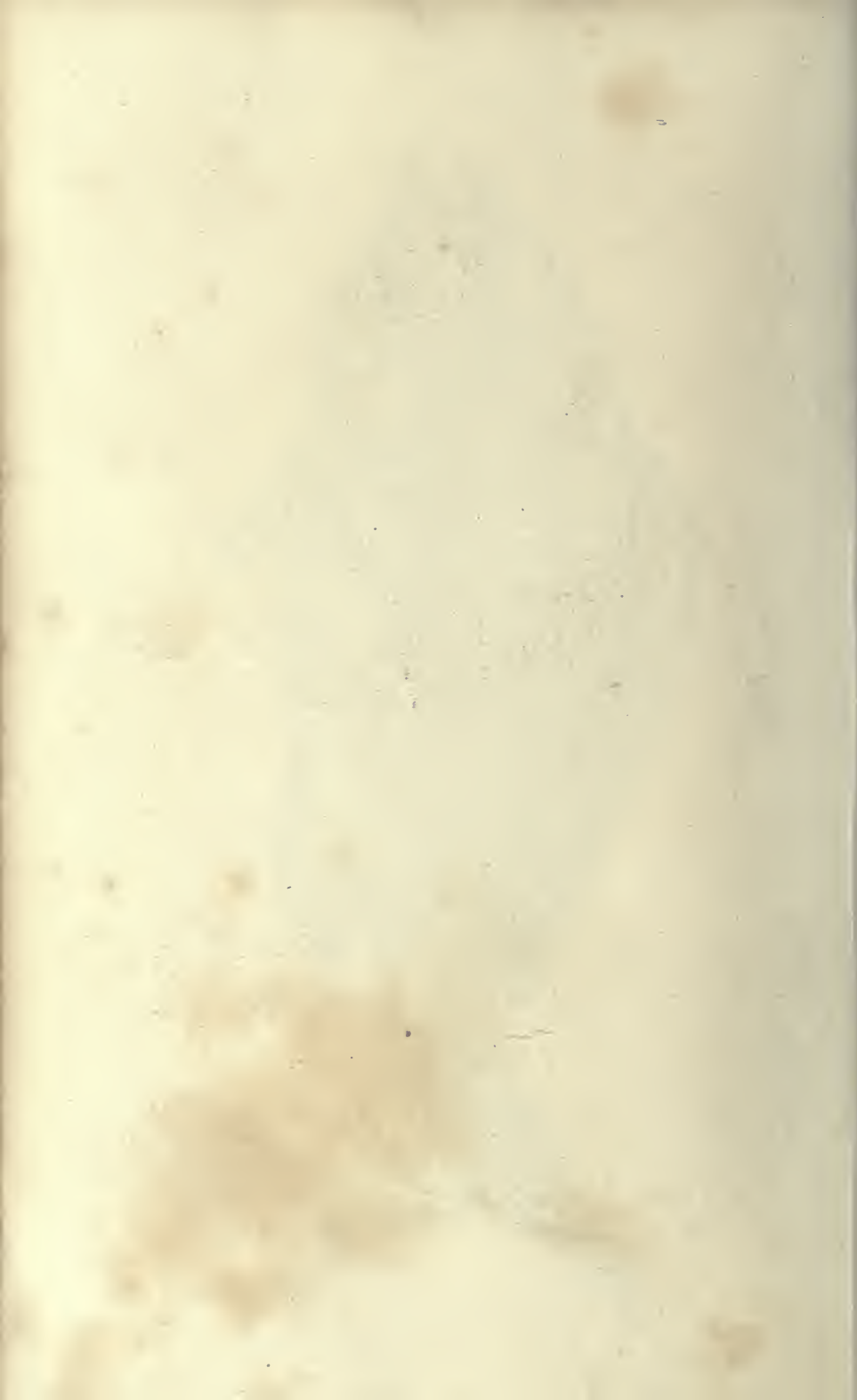


Fig.1.

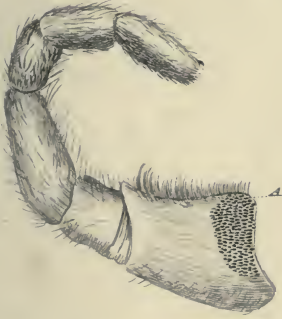


Fig. 2.

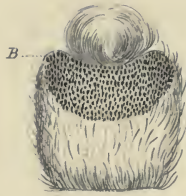
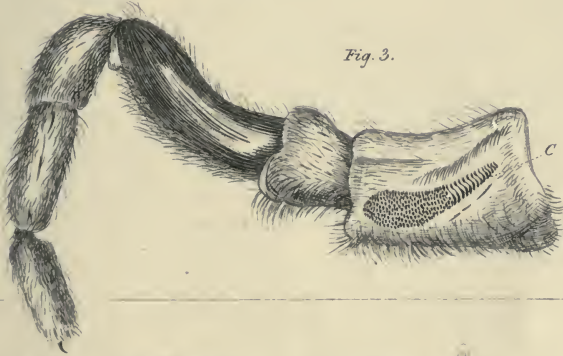


Fig.4.



Fig. 3.



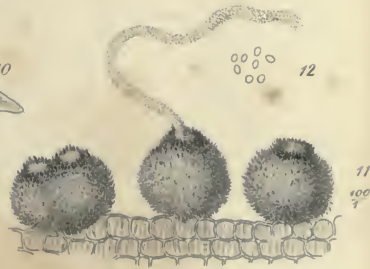
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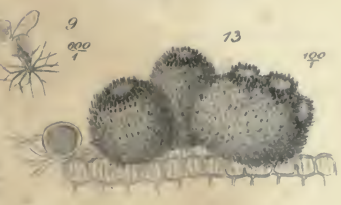


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Fig. 2

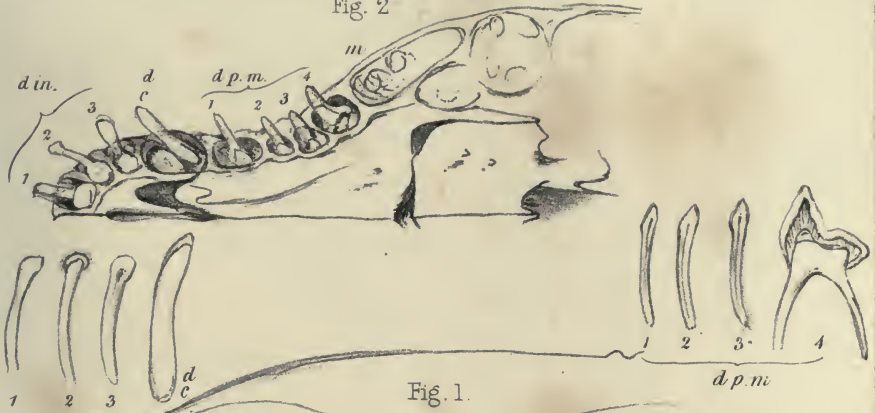


Fig. 1.

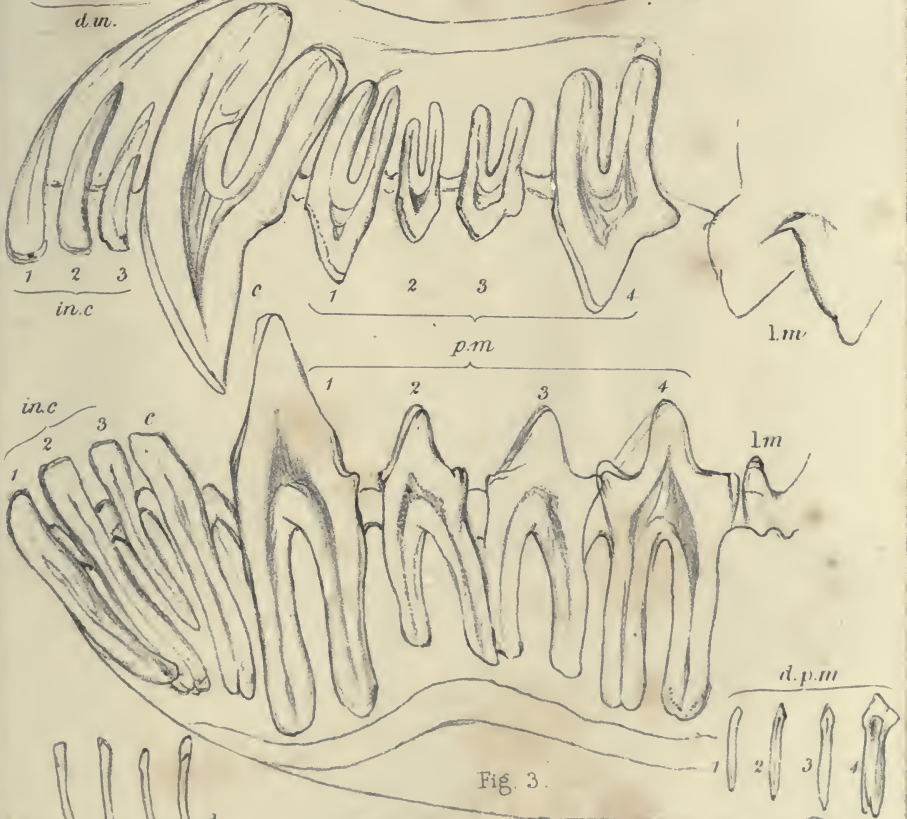


Fig. 3.

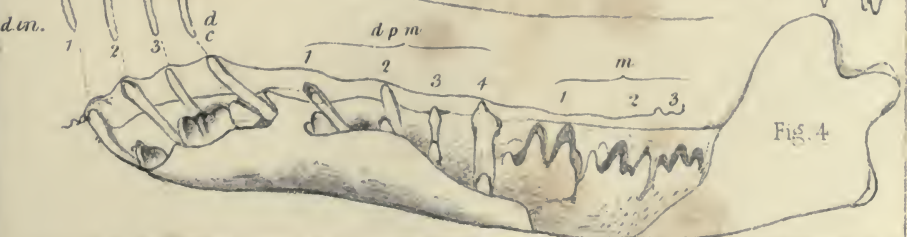


Fig. 4





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